THE TRANSPORT AND HEALTH STUDY GROUP

HEALTH on the **MOVE 2**

Policies for Health Promoting Transport

The Policy Statement of the
Transport and Health Study Group, 2011

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The Transport and Health Study Group (THSG) is an independent society of public health and transport practitioners and researchers committed to understanding and addressing the links between transport policies and health and promoting a healthy transport system. We were founded in the late 1980s by Dr. Stephen Morton. The publication *"Health on the Move"* authored by the Transport & Health Study Group was the first definitive account of the relationship between transport and health. THSG later contributed to *"Road Transport and Health"* by the British Medical Association. In 2009 THSG agreed to administer a Transport Special Interest Group for UKPHA.

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HEALTH on the MOVE 2

POLICIES FOR HEALTH PROMOTING TRANSPORT

The policy statement of The Transport and Health Study Group

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FOREWORD

Public health needs ideas, it needs inspiration, it needs champions. Such are the scale and complexity of the challenges that must be addressed.

The causes of ill health, the solutions to some of our major health problems and the sustainability of our environment are intricately interwoven with the way that we move from place to place both locally and across the globe. The scope of any analysis in this area of public health also needs to encompass the way that goods and services are accessed and the ways that groups of people gather. For example, what a family chooses to eat, where they buy their food, where the food is sourced and how they acquire it may seem simple and routine. A few minutes reflection though and it is clear that the implications of millions of families' choices and habits can have profound implications for the health of our country and the planet.

Health on the Move 2 is a clear and comprehensive account of what would constitute a healthy transport system.

The report is unusual in that it blends evidence, authoritative opinion from experts in their field as well as creativity. It is not only an educational tool and a series of recommendations for policy-makers, it is a powerful basis for advocacy. No-one should underestimate the scale of changes required to realise the vision for the future set out in this ground-breaking report.

If just a small number of towns and cities in the country would act on the ideas and evidence in it then we would begin to see the shape of a new future in which every move is a healthy move.

Sir Liam Donaldson

Chief Medical Officer for England (1998 – 2010)

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1 A Vision for a Healthy Transport System

S Watkins and J Mindell

1.1 Introduction

This report is intended primarily for transport and public health professionals and other policy- and decision-makers working at national, regional or local levels in the public, private or voluntary sectors.

The opening chapter presents the Transport and Health Study Group's vision for a healthy transport system – one that promotes the health of the population, reduces inequalities, and is sustainable for the environment. After a brief explanation of the nature of this report, this chapter gives a short cameo of what life might be like in a sustainable future with healthy transport the norm. It then considers the elements that constitute a healthy transport system. It concludes by mentioning various controversies that emerged and were discussed during the preparation of this report.

It is the nature of public health practice to examine scientific evidence, develop a vision that flows from that evidence, and put forward policy proposals that flow from that vision. That is what this book does. Section II of this report, chapters 2 to 10, presents the evidence on which our conclusions are based. Section III sets out implications for professional practice. Chapter 11 considers clinical aspects of transport-related disease while chapter 19 covers the role of the NHS as transport providers and users; chapter 12 is directed towards transport and planning professionals, providing information on why health and inequalities considerations are relevant to and should inform their thinking. Section IV, chapters 13 to 22, discusses the policy implications of these facts for various players. Chapter 21 sums up our recommendations, with chapter 22 concluding this report. For ease of reference, each chapter has been referenced separately.

Some of our academic members have suggested that it might be better if we concentrated on the science and missed out the visionary ideas. That might be appropriate, scientific, cautious epidemiology but it would not be public health. The purpose of scientific understanding is to make it possible to decide the direction of human advance. Where scientific understanding is incomplete, scientists set themselves far too simple a task if all they say is that more research is needed: it is certainly necessary to be clear of the uncertainties and the need for more research but it is also necessary to provide policy makers with a clear point of reference as to what can be learned from the data.

For practical professionals, the reverse problem exists. This book may seem far too full of complex analysis. For those who are uncomfortable with epidemiological analysis, it is possible to read a relatively analysis-free version of the book by concentrating on chapter 1, section 2.3, chapter 3, section 4.3, chapters 5 and 6, sections 7.2.5, 7.3 and 7.4.4, and chapters 10 to 22. If that was all that we had written, it could be treated as mere opinion. If that is all that you choose to read then you must forego the right to dismiss it in those terms and understand that these opinions are rooted in scientific evidence.

Transport of goods or people by ships or air cause air pollution and emission of greenhouse gases. Shipping generally uses high sulphur fuels, being permitted to use the cheapest, high sulphur residue remaining after all the lighter fuels that are legal for land use have been taken. The world's largest ships use as much fuel as small power stations, emitting to the atmosphere sulphurous smoke that can result in cardio-respiratory problems and cancer. Aeroplanes cause significant noise pollution as well. However, to keep this report within manageable limits, it is generally limited to land travel.

1.2 Living with healthy transport

Jean checked her diary for the day. It wouldn't be necessary to go into HQ. But there were some meetings which would need her to use the video facility at her local neighbourhood work station. She pondered whether to go to the work station for the whole day or whether to work at home in the large office that they had built in the garage when they gave up the cars. She'd rather like the company, she thought, and Angela was always there on a Tuesday so she'd be able to ask Angela for advice about storing her parents' motorised transport contraptions once they convert their garage into a downstairs bedroom. It had taken her so long to persuade them to do this but, of course, her parents' generation had grown up in the days of private transport and found it hard to abandon old attitudes. Angela always used the community transport bus door to door whenever she needed to go further than her self-propelled wheelchair could manage. Jean had only ever used this when she had heavy luggage but she wondered if it would answer all her parents' travel needs too now they had finally given up driving regularly.

Coming back to the present she settled down to eat her breakfast. Bacon from the pig farm in the next village. Eggs from her own hen. Toast and marmalade, made from good Sheffield oranges grown in the multi-storey farms of the Don Valley.

David had overslept. Not surprisingly after the late night he had had the previous evening. As she was finishing her breakfast he joined her, spent a few minutes bolting down some cereal (from the multi-storey farms at Ringway, built on the site of the old airport) and rushed out to get his bicycle.

"It's pouring down" she said *"Why don't you walk?"* *"Too late"* he said as he pedalled off to the station.

Jean followed him but she walked along the covered walkway to protect her from the rain. It was a nice street. Rose gardens and trees and children's play areas filled the gaps between the opposing houses. On a sunny day Jean would have wandered amongst them, chatting to neighbours and watching the children play in the street out of harm's way but today the weather called for being under cover. Half way to the work station there was the facility that Jean had pressed so hard for when the street was being designed – the open air swimming pool. As she passed the swimming pool, the delivery van bringing the shopping up to the local shop for people to collect was picking its way along the carriageway. Unlike the straight direct cycleway, motor vehicles had to negotiate the gaps between the obstacles rather than having a protected carriageway. Jean watched the van, its guidance devices, speed regulators and obstacle detectors all fully engaged, as it inched gingerly along the edge of the pool. It reminded her of the incident last winter when the council had only had had enough grit to do the pavements, cycleways and busways and the roads had been closed. The delivery van driver had foolishly ignored this and had ended up in the swimming pool and winner of You Tube's Idiot of the Week.

As Jean arrived at the work station, checked her booking of the videoconference for the meeting that afternoon, switched on her computer, and started to write a lecture for medical students setting out the evidence for the powerful health benefits of social networks, David was arriving at the Metro station.

He inserted his card and keyed adult single with cycle to Emmerdale into the journey planner. A recorded voice came over the intercom. *"Next but one service from Platform 3. Change at Angerfield, which is the fourth station, for a bus to Emmerdale from stand E."* Then a real human voice replaced it as the controller intervened. *"The Emmerdale bus is demand-responsive and you are the only person booked on it today. If you'd prefer we could let you have a car from the Car Club for the normal bus fare and without road charges."* They often made this offer when he was going to Emmerdale. Usually he took it but today he was feeling tired and he didn't think it would be safe so he declined, collected his tickets and made his way to the platform. The freight train to the shopping distributive warehouse at Angerfield was passing as he reached the platform, then the fast train to the city drew up into the platform making the wayside stop that it made here once an hour instead of running through non stop as it did the rest of the time. David knew this train stopped at Angerfield. They wanted him to wait for the tram because he would get no benefit from the train due to the connection and they liked to keep short distance passengers on the trams if they could. But he rather fancied the plusher seats of the train so he climbed aboard, stored his cycle in the cycle van and lounged back into a seat. The train flashed past the three intervening tram stops and overtook the freight train as it manoeuvred itself into the shopping sidings. Then the train drew up at Angerfield. He made his way to stand E and relaxed in an armchair watching the trolley buses come and go as he waited for his own bus. While he waited, he thought about their holiday. 15 days on a cruise train. They started with a day in Paris, then a slow daytime ride across the Alps with a break at Innsbruck. Full days spent, in Venice, Bled, Dubrovnic, Athens, Istanbul, Samarkand, St Petersburg, Narvik and Bergen, sometimes linked by high speed overnight travel, sometimes interspersed with slow, looking out of the window days. He thought Samarkand and Athens would be the highlights of the trip.

1.3 The elements of a healthy transport system

In this little cameo of the future we can see many features of a healthy transport lifestyle. There is powerful evidence that social support benefits health. The living streets that provide opportunities for social networking show how we can learn the lessons of Appleyard & Lintell[1] and Joshua Hart[2] that streets full of traffic isolate and separate us. In the future we should find that intolerable. Living streets can also create greener local environments, with the street becoming a shared garden. Evidence is emerging of the importance of pleasant green surroundings to health – even to the point that people recover faster from operations if they have plants in their hospital room[3] or can see the natural environment rather than a brick wall from their window.[4] Motor vehicles should not be banned from living streets but they should, like the delivery van in the cameo, be out of place, picking their way slowly round obstacles.

The guidance devices, speed regulator and obstacle detector on the van reflect the fact that the kind of technological controls that have long been a feature of the railway need to apply on the roads as well. A transport system which doesn't force people to drive is also safer – David had the choice of the car but chose the bus because he felt tired.

Climate change should be a major factor in transport policy. Reduced need to travel and reduced freight distances are achieved by the use of local produce and by local work stations. The use of local work stations rather than home-working is a way to provide facilities – like Jean's videoconference - that it may not be worth providing to every home. It also sustains the social support of being at work. For many types of employment, similar benefits can be obtained by mixed use in urban planning – close proximity of homes, workplaces, and services rather than siting these in discrete locations. Electric traction should be used as far as possible, although electricity is only clean if it is generated by renewable means. In the cameo, aviation has been curbed – we propose that it be limited to flights across oceans and polar ice and to islands, where such travel is unavoidable. International high speed trains would replace it, Although long distance business travel would have declined dramatically with many business meetings and conferences taking place in cyberspace, the world's ecosystem should be able to afford to provide a reasonable number of long distance holidays.. The car has also been curbed, limited to journeys where there is nobody to share a bus or a train. The combination of the cycle (for short journeys) with the train (for longer ones) has all the flexibility of the car. The cycle is healthier (and would be safer if it didn't have to mix with heavy traffic) and the train is safer and faster.

Active travel - walking and cycling - has an immense potential to enable people to get more daily exercise. Calculations based on American research[5] into the effect of pedestrian-permeability on mean body weight has shown that simply making it easy to walk can have an impact of one per 1,000 per year on death rate. Given the worldwide obesity epidemic,[6] these finding are of even greater importance.

The lifestyle described in the cameo is not an isolated travel-free lifestyle nor an unpleasant restricted one. It is a technologically feasible lifestyle. It is healthy. It protects our environment. It actually offers chances to improve our lives – the extra space in the house because the garage is no longer needed, the extra garden taken from the street, the extra personal time due to shorter journeys and less travel time. Why should it not come about?

In the middle of the last century, a comprehensive rail and bus network provided effective transport for most people Those who bought a car bought greater freedom and greater speed. But as car ownership grew, this freedom and speed became eroded. People buy a car in order to drive on an open road a typical advert might show a drive across a Scottish moor. However, and they use it to inch their way through city centre traffic jams searching for somewhere to park. The car owner today may travel further – and certainly spend more time doing so – but is much less mobile than the car user of the 1950s. Indeed within city traffic, the car owner of today is no faster than the public transport user of the 1950s, although it must be recognised that even in the 1950s rural public transport was often infrequent, so today's car-based system is more flexible.

If the car owner of today enjoys only slightly better mobility than the public transport user of the 1950s, what about today's public transport user? Over half of the route-mileage of the railway system has been closed. Rural buses and late night buses have been reduced. Non-radial public transport routes have diminished. Public transport is no longer a comprehensive network. In order to have access to a comprehensive network, it is necessary to buy a car. And so the vicious circle takes another twist. The vision of increasing car ownership points us towards the situation of Los Angeles, where two-thirds of the land area is occupied by roads and car parks,[7] and smog is a major hazard.

Yet there is another vision. Fast, modern, comfortable, frequent public transport systems can provide cities in which everybody can travel without encumbrance. In recent years, new stations and the Channel Tunnel high speed railway have been opened, with new high speed railway routes planned. New developments such as people movers (small personalised computer-controlled tracked vehicles) make it possible for public transport to meet even the unusual and individual transport needs for which the car has hitherto been the only possible system.

Trains can now travel at speeds of more than twice the motorway speed limit, light rapid transit offers the only hope of congestion-free city centres, and people movers can challenge the car even in the area of lightly trafficked distinctive journeys, so some people now argue that the car and lorry are in the situation that the horse was in between the opening of the Stockton and Darlington Railway in 1825 and the railway boom of the 1840s. Its dominance of the transport system was complete. The alternatives were scattered and the idea that they could be made comprehensive was visionary. Yet the end of the horse as the main mode of transport was as inevitable as its inevitability was, to many, imperceptible. Those towns and nations who were the first to see the future gained an economic advantage which lasted for many decades.

Is this political and economic argument one that has relevance for public health or are transport and public health separate spheres of human activity? The Transport and Health Study Group believes that transport is a public health issue. Public health must consider the socially unequal distribution of opportunities for access to such health promoting facilities as shops selling healthy food, sports centres and the countryside.

Opportunities for social networking and for children's independent travel and play are public health issues[8] and we cannot overlook the potential that traffic-calmed streets hold out for enhancing community life. Roads were made for cars, but streets were made for people.

Much of this policy statement consists of detailed analysis and proposals. Yet behind the detail there is a vision. It is a vision of a society where we no longer accept that children cannot play in the streets for fear of being killed, nor that disabled people should be confined to the home, nor that the poor cannot have access to healthy lifestyles because they cannot travel to their sources. It is a vision of a people who enjoy the beauty of their cities instead of scurrying along narrow pavements, who breathe unpolluted air and who read and chat as they travel rapidly and unimpeded about their business. It is a vision of a people who can choose to live in rural areas and know that they can readily access the goods, services, and people they need without needing a car for most journeys. It is a vision of a future where people will no more accept road crash deaths than we accept maternal mortality or diphtheria.

Public health has always been driven by such visions. The vision of clean water and sanitation in the 19th century; the development of housing standards and the eradication of infectious diseases in the 20th century; the virtual ending of maternal mortality in western countries; the idea of a clean atmosphere in which you could stand on top of a Pennine hill and see the industrial town below; the idea that people in workplaces and public places shouldn't poison their neighbour with cigarette smoke in the 21st century. These are the visions, dismissed as crackpot when first articulated, fought for against powerful economic interests, and yet, today, accepted without question as part of the inevitable onward flow of civilisation.

The health of the people is a fundamental social value. In comparison with the battles we have fought and won in the past, our vision of a healthy transport system does not seem at all ambitious.

1.4 Some areas of controversy

The members of THSG were consulted about each chapter of this book after the authors and editors had produced a version of the chapter with which they were almost happy. Many helpful suggestions were made and incorporated. It also became clear that some elements of the vision are to some extent controversial. Three areas in particular sparked controversy.

1.4.1 Can we afford high-speed international transport?

Our most controversial proposal was that aviation be replaced with high-speed international rail systems. Intercontinental travel across the Bering Straits, the Straits of Gibraltar, from Eritrea to Yemen, and from Russia to Japan via Sakhalin could be undertaken by high speed trains through tunnels. Perhaps there could even be a link from Singapore to Australia by a series of tunnels linking Indonesian islands, although the carbon cost/benefit of this is not as clear as for the other proposals and would need to be assessed, including the one-off costs of railway and tunnel construction as well as in use. Intercontinental railways – as a curb on air travel - is an essential part of our climate change strategy.

A number of our environmentalist members argued that we should not replace aviation at all – we should simply eliminate the concept of high-speed international transport. For business travel, cyberspace is an alternative venue for meetings and conferences whilst those who want to see the world should do it properly, taking the time out to travel by local train and ferry and mix with those whose culture they want to experience. Long distance tourism is ephemeral and unnecessary. High speed international travel is unnecessary. The vision of a Bering Straits Railway should be put in the same bin as the aeroplane it was intended to replace.

The words of one of the founding fathers of our field of study, Mayer Hillman, were quoted to us: *"in the absence of a miraculous technical fix, travel will have to become more local, less frequent, less energy-intensive and slower. Avoidance of transportation is at the heart of the transition required."*[9]

Mayer is right that avoidance of transportation is essential. Our own vision embodies that in our proposals for using cyberspace for business meetings and conferences; our proposals for a four day working week, one of which will be at home; cutting commuting by 40%; our proposals for an organised system of efficiently delivering routine shopping to local shops; and our proposal to revitalise local services wherever possible. None of those things in any way diminish human potential or step backwards in human development. Abandoning high-speed international travel would be a qualitatively different step. On the whole, public health does not work by constricting human growth and potential. Healthy food tastes nice, physical activity creates a glow of well being, social networks and empowerment are important public health issues. Puritanism is a different thing entirely. We do not believe that it is actually necessary to abandon high-speed international transport if enough is done in more mundane areas.

It is however important that the high speed international rail system replaces aviation instead of adding to the amount of long distance international travel. It may well be that some system of rationing of long distance international travel is necessary, not necessarily a rigid limit on how much usage is permitted but certainly in the sense of arrangements applying both to air and rail so that above a certain level of individual usage the price rises substantially. This could be achieved by a general system of individual carbon accounts extending more broadly than just transport, or alternatively by some special pricing/rationing system specific to high speed long distance international transport.

1.4.2 Compete with the car or provide for existing users

In two separate areas – cycling and public transport – we have been faced with a dilemma that the provision which is most likely to compete with the car is probably not the provision that will best serve existing users.

Our suggestion that there be investment in cycling networks separate from the main heavily-trafficked roads has been questioned as a departure from the Hierarchy of Provision favoured by cycling organisations as the most cost-effective way to make provision for cycling. We have no doubts that if the issue was simply how to provide for existing cyclists then the current Hierarchy of Provision is right. However our objective is also to attract large numbers of relatively sedentary people out of their cars and on to bicycles in order to save their lives and we are deeply impressed by the evidence which suggests that this will not happen unless quiet networks are provided because of these current non-cyclists' perceptions of risk.

Similarly, the planning of public transport has been dominated for several decades by finding the most cost-effective way to move a declining (or, recently, slowly growing) number of relatively captive users and the system is usually embarrassingly taken by surprise by any rapid growth in demand. Against this background, ideas have developed that the bus is much more important than the train because far more people use buses than local trains and trains tend to be used by the more affluent who do not matter because they could always use their car. Ideas have also developed that "we don't pay operators to haul fresh air" and that it is sensible to cut out lightly used services in order to make resources for "core" services. We do not dispute that this is right if the idea is to maintain a public transport system as a safety net for a captive group of non-car-users. If, however, the idea is to attract car users out of their cars then this will not work. European evidence shows that cities with rail-based public transport have higher levels of bus usage than cities with bus-based systems,[10] presumably because the whole public transport system competes more effectively with the car. This is borne out in the UK by the difference between London and other cities. Yes – there are lots of other things different about London, and they may be hypothesised to contribute to the difference, but the difference can be explained without reference to any such hypothetical effects simply by referring to the Europe-wide evidenced trend for one kind of system to outperform others so that is the scientifically-conservative explanation in the current state of the evidence. This finding may only be a single study but it is supported by the work of Mogridge[11] who correlated traffic congestion in London inversely with the quality of the rail system. It is plausible that it is the fixed network and speed of the train that creates this difference rather than the metal rails or a love of rail vehicles; we are supported in that view by Spanish evidence that investment in converting a bus route to a trolley bus route can reassure users enough to increase their reliance on it.[12] Against that evidential background we have come to our conclusion that a clearly defined comprehensive network of freely flowing train, tram, motorway bus and coach and limited stop/high frequency bus services with bus priority is necessary to attract people out of cars.

In both these areas it is not enough to be satisfied with increases in usage that seem substantial when the existing usage is taken as the denominator. We need shifts that seem substantial when the total number of journeys by any mode is used as the denominator. For example, to reduce car usage by 30% (measured by passenger-mile) with the train, the bus or coach and the bicycle each taking up one-third of the shift, we would need to double bus and train usage and increase cycling seven-fold. This requires very different thinking from the marginal change we are accustomed to celebrate.

1.4.3 Is it realistic to plan for such changes?

Almost everybody who now works as a transport planner or transport system manager has spent their entire career in an atmosphere of retrenchment where the emphasis is on squeezing more and more through the existing system and where it has been assumed that the trend towards the car is unstoppable. It is not surprising therefore that many of them have expressed unease at the scope of the measures which we describe as the minimum necessary. And yet, the wider societal costs of transport in urban areas in England has recently been estimated as costing £38 – 48billion.[13]

As we have already said, public health is used to being described as “unrealistic” - even “crackpot” - when it advocates the inevitable. The transport system that we advocate is no more unrealistic than the building of the sewers or the removal of industrial and domestic smoke from the air was in the 19th and 20th centuries, respectively. What is totally unrealistic is to believe that as a species we will allow ourselves to become extinct because we refuse to use available technologies to stop carbon emissions destroying us, or that we can tolerate a situation where it becomes normal to be obese, or even that we will allow our large cities to grind to a halt in gridlock. We are the realists. It is those who pretend that we can avoid these measures who lack an understanding of reality.

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Section II The effects of transport on health – the evidence

How does transport affect health?

Transport is the movement of people (or objects) from one place to another. It can both promote and damage health (Table 1). It should be noted that some impacts (severe injury, air pollution levels) are more easily measured than others (stress, community severance, fear).

Table A. Ways in which transport influences health

Health Promoting	Health Damaging
Enables access to:	Injuries
employment	Pollution:
education	particulates
shops	carbon monoxide
recreation	nitrogen oxides
social (support) networks	hydrocarbons
health and other services	ozone
countryside	carbon dioxide
recreation	lead
physical activity	benzene
	Noise and vibration
	Odour
Active travel	Climate change
	Stress and anxiety
	Danger
	Loss of land and planning blight
	Severance of communities by traffic

A 2009 report from the Cabinet Office stated that congestion, air pollution, injuries[i], physical inactivity each cost the country around £10billion each year. Further costs are caused through greenhouse gas emissions and annoyance from noise.[1] This section of the report describes these but also other important impacts of transport on health and inequalities.

[i] The report uses the term ‘accidents’. In this book, we follow current practice among transport and health professionals of using the term ‘crash’ or ‘collision’ to describe the event and ‘injury’ to describe the resultant harm to health, because although ‘accidental’ means ‘unintentional’it has often been taken – wrongly – to mean ‘unavoidable’.

Outline of Section II

Section II provides the underpinning evidence for each of these effects.

Chapter 2 examines the benefits for health of physical activity and the harms of inactivity. It relates these to walking and cycling, also covering trends in these forms of transport and the obesity epidemic.

Chapter 3 describes the health effects of air pollution and of climate change and how these are related to transport.

Chapter 4 presents information on injuries related to transport.

Chapter 5, Social support and stress, includes discussion of stress and anxiety, stress-related disease, perceived danger, and community severance.

Chapter 6, Other impacts of transport on health, covers access, recreation, noise pollution, spatial planning, loss of land and planning blight, and parking.

Chapter 7 examines the safety of cycling.

Chapter 8 presents data on transport trends in the UK, including the economic costs of travel.

Chapter 9, Inequalities, includes sections on social inequalities in both the use and effects of transport and social exclusion caused by current transport policies.

Chapter 10 then presents the case for a National Integrated Transport Web, with benefits for sustainability and social inclusion.

Reference

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2 Physical Activity, Trends in Walking and Cycling and the Obesity Epidemic

A Davis, N Cavill, M Wardlaw, J Mindell

2.1 Introduction: 'Walking is transport'[1] – and so is cycling

Walking is the most fundamental form of transport: for 99% of human history, walking has been the only means by which people have been able to travel. In modern society, walking still forms an essential part of most journeys, ranging from just a few metres between home/office and car park or public transport stop, to several miles. It can form our whole journey from origin to destination, or just a small part at either end or along the way, such as changing from a bus to train.

Walking and cycling are forms of transport that also provide physical activity. They are therefore very important in terms of reducing ill-health and the disease burden arising from a sedentary society. They are often referred to as 'active travel'.

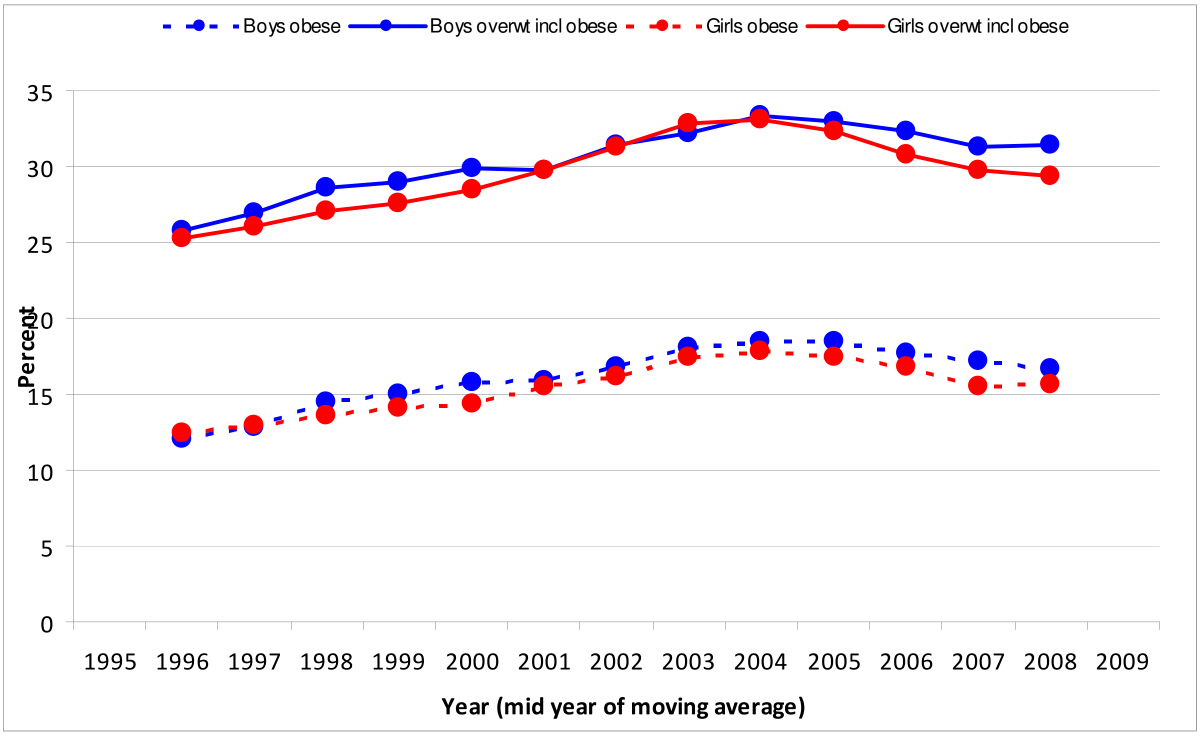
2.2 Physical activity and prevention of disease

2.2.1 The obesity epidemic

The UK is currently experiencing an epidemic of obesity (Figures 2-1 and 2-2). In England, nearly a quarter of adults are classified as obese,[2] and two-thirds are obese or overweight.[3] The Foresight Report of 2007 predicted that by 2050, 60% of men, 50% of women and 25% of children would be obese, costing society £50 billion per year (in 2050, at 2007 prices).[4] This epidemic is paralleled across much of the developed world, a world in which the built environment has increasingly been designed to accommodate travel by car at the expense of walking and cycling. In China, men who acquired a motor vehicle increased their weight by

1.8kg more on average than those who did not acquire a car, and were 70% more likely to become obese.[5]

Figure 2-1 Trends in childhood obesity and overweight in England, 1995 – 2009 (children aged 2-15, three year moving averages)



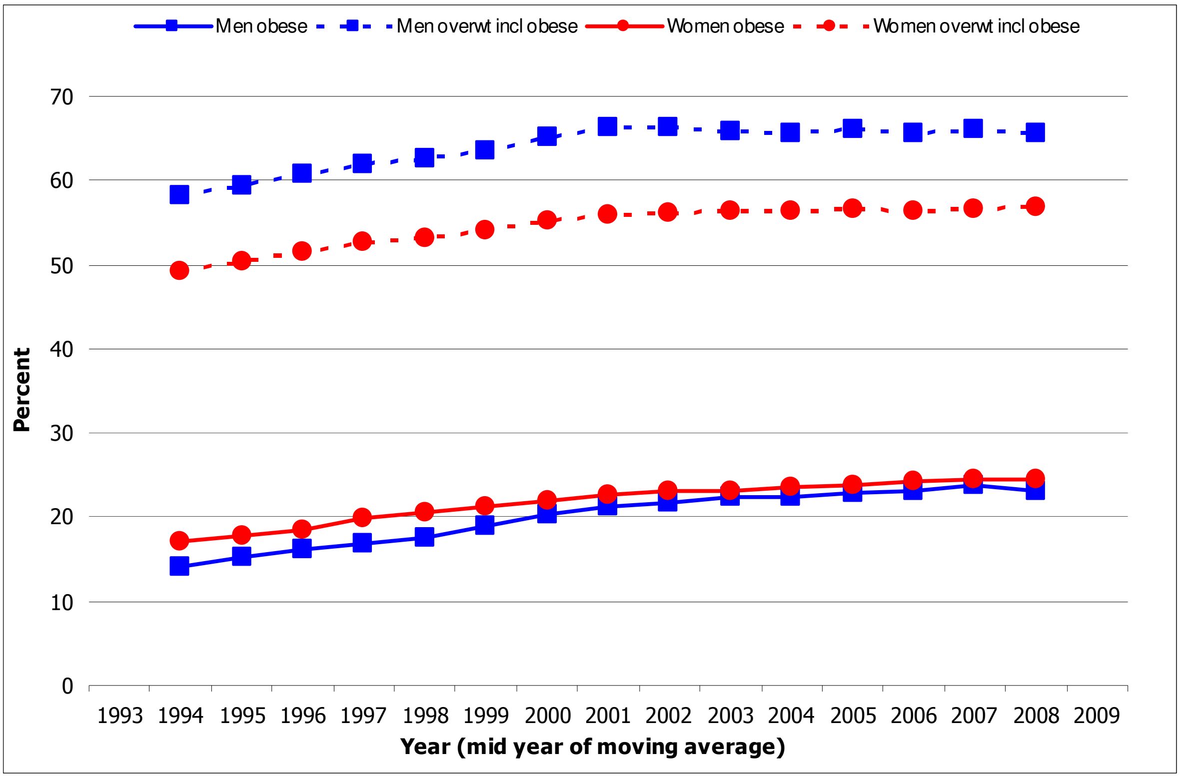
Source: Health Survey for England 2009[6]

Since 2000, an association between the built environment and obesity has been reported through a number of studies in both the US and Australia.[4 7 8 9] The amount of time spent in cars appears to be a key factor. This is likely to be a function of land use as well as occupational exposure which affects adults within lower socio-economic groups to a greater extent than those in higher socio-economic groups. Both land use and transport infrastructure that facilitate walking and cycling as practical travel modes are associated with higher levels of physical activity.[10] Reductions in walking and cycling and in children's independent play have made major contributions to a decline in physical activity. Both reduced physical activity overall and falling active travel specifically have played a large part in the obesity epidemic, though the relative contributions of increased intake (particularly of energy-dense foods and sugary drinks) and decreased energy expenditure to rising obesity it is still being debated.

Obesity occurs when calories consumed exceeds those expended.[11] The extent to which rising obesity over the past 30 plus years is due to a significant decline in energy expenditure rather than an increase in energy intake is still debated.[11 12] Average calorie intake increased by 12% in the USA from 1985 to 2000[13] but it fell by 20% in the UK from 1974 to 2004,[14] although the quality of some of the UK studies and therefore this conclusion have been questioned. There is also some emerging evidence that dieting (restricted energy intake) can reduce the basal metabolic rate, resulting in less weight loss than predicted.[15 16] Restricting energy intake is also sometimes accompanied by compensatory reductions in exercise, reducing but not necessarily abolishing the consequent weight loss.[15 16] However, physical activity can increase the resting metabolic rate, thus enhancing weight loss. Except for athletes, energy expenditure is determined primarily by light and moderate activity rather than by vigorous activity as vigorous activity tends to be infrequent and of short duration.[17]

Physical inactivity is one of the ten leading causes of death in developed countries.[18] It is associated with increased risks of developing many of chronic diseases such as type II diabetes, obesity, cardiovascular diseases, certain cancers, depression, osteoporosis and anxiety. It also has a positive effect on a range of health determinants such as body weight, blood pressure, cholesterol levels, sense of well being.[19] The benefits of physical activity for health is undisputed. The recommendations for adults have been to undertake at least 30 minutes of moderate intensity activity at least five times a week; this activity can be accrued in bouts of at least 10 minutes.[19] This guidance also noted that 45 to 60 minutes' activity on most days may be required for weight management, however only 5% of adults in England in a recent study met the general guidance, when objective measurements of activity were used.[3]

Figure 2-2 Trends in adult obesity and overweight in England, 1993 – 2009 (aged 16+, three year moving averages)



Source: Health Survey for England 2009[6]

Note: Data from 1993 to 2002 are unweighted. Data from 2003 onwards are weighted for non-response. In these moving averages, some points combine weighted and unweighted estimates

New recommendations have been published by the British Association of Sport and Exercise Science for adults aged 18-65y (Table 1).[20] They are expected to be endorsed by the English Chief Medical Officer's 2010 report. Aerobic activity should be undertaken in bouts of at least 10minutes duration, preferably on at least five days per week. During moderate-intensity activity, the heart rate and breathing are raised, but it is possible to speak comfortably; during vigorous-intensity activity, heart rate is higher, breathing is heavier, and conversation is harder. Muscle-strengthening activities, such as weight training, circuit classes, or yoga, provide further health benefits and are recommended for healthy adults at least two days per week. For weight loss, reducing time spent being sedentary is also recommended. Separate recommendations are being produced for older people.

It is recommended that children aged five to 16 years should be at least moderately active for at least 60 minutes every day,[19] including vigorous-intensity aerobic activities that improve bone density and muscle strength.[20]

Table 2-1. ABC physical activity recommendations for adults, 2010

	Applies to:	**Aerobic activity**
A	All healthy adults aged 18-65y	≥ 150 minutes pw moderate intensity activity or ≥ 75 minutes pw vigorous activity or an equivalent combination of the two
B	Beginners	Work towards meeting the recommendations for healthy adults, such as walking an extra 10 minutes every other day.
C	Conditioned individuals (who have met the recommendations for healthy adults for at least six months)	Additional health benefit obtrained from ≥ 300 minutes pw moderate intensity activity or ≥ 150 minutes pw vigorous activity or an equivalent combination of the two
	Obese adults and those with type 2 diabetes	Gradually work towards meeting the recommendations for conditioned adults

Studies have demonstrated that people are more likely to be heavier, overweight, or obese if they live in less walkable areas[21 22] By "walkable" is meant areas which have safe, secure, pleasant walking routes undisrupted by traffic in a network. Crime, severance by busy roads with inadequate crossings, or circuitous walking routes due to closure of direct links each reduces walkability. Pleasant surroundings, greenspace, and signposted links improve walkability. Each additional kilometre walked per day is associated with a 4.8% reduction in the likelihood of obesity, whereas each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity.[23] Pedestrian-permeable street designs are associated with 6lb lower mean population weight than pedestrian-impermeable environments.[24]

Analysis of national travel survey data from countries in North America, Europe and Australasia found that countries with the highest levels of active transportation had the lowest obesity rates.[25 26] Specifically, commuting by car to work has been associated with overweight and obesity compared with active travel modes and use of public transport. A significant association between car use and physical inactivity has also been reported. This may contribute to our understanding of the relationship between car use and overweight and obesity.[27]

In contrast, however, the 'natural experiment' of the economic difficulties in Cuba in the early 1990s following the collapse of the former Soviet Union show that population level measures that result in reduced calorie intake and increased physical activity (walking and cycling increased as cheap forms of travel) can have substantial effects on obesity. Mean weight fell by 4-5kg, BMI by 1.5 units, obesity halved (from 14% to 7%); deaths in the later 1990s from cardiovascular disease and diabetes fell.[28] A recent American study found that variation in the proportion of commuting by foot or bicycle accounted for almost one-third of the variation in adult obesity rates between states and over one-quarter of the variation between cities.[26]

2.2.2 Physical activity and health

Introduction

Physical inactivity, rated by the World Health Organisation (WHO) as one of the leading causes of death in developed countries, was estimated in 2002 to cost £8.2 billion a year in England.[29] The risk of developing major chronic diseases is almost halved in physically active adults.[19] The WHO estimated that physical inactivity is responsible for 22-23% of coronary heart disease, 16-17% of colon cancers, 15% of diabetes, 12-13% of strokes, and 11% of breast cancers.[30] Regular physical activity also helps promote the health of communities.[31]

All-cause mortality

The strongest and clearest evidence exists for the association between physical inactivity and an increased risk of death, which has been shown in numerous studies.[19 32 33] Physically active adults have a 20-30% reduced risk of premature death.[19] A Swedish 35 year follow-up cohort study[34] concluded that:

> *"Increased physical activity in middle age is eventually followed by a reduction in mortality to the same level as seen amongst men with constantly high physical activity. The reduction is comparable with smoking cessation."*

Cardiovascular disease

Strong evidence exists for the relationship between physical activity and a reduction of risk of mortality and morbidity from cardiovascular disease.[33 35 36] There is an inverse relation between physical activity and cardiovascular disease incidence and mortality. The evidence is strongest for coronary (ischaemic) heart disease, for which the risk of both developing the disease and of dying from it are halved by regular physical activity.[37 38]

The evidence for an association between physical activity and ischemic stroke has been deemed equivocal[37] but evidence from case-control and prospective studies has suggested that physical activity reduces the incidence of stroke independent of other stroke risk factors in men[39]; this was confirmed in a recent review.[40] People who were highly active were found to have a 27% lower risk of stroke incidence or mortality than less active people.[41] Similar results were seen in moderately active people compared with inactive people[19] and for habitual activity,[42] especially if lifelong.[43]

Cancer

Physical activity is associated with a reduction in the overall risk of cancer.[35 44] A review of 41 studies observed a crude graded inverse dose-response association between physical activity and colon cancer and an inverse association with a dose-response relationship between physical activity and breast cancer.[45] Evidence for other types of cancer such as rectal or prostate cancer is less conclusive.

Type 2 diabetes

There is strong evidence for the role of physical activity in the prevention of type 2 diabetes.[33 35 46] Regular physical activity is also an important component for the treatment of type 2 diabetes.

Obesity

As noted in section 2.2.1 above, the rise in obesity is associated with a significant decline in energy expenditure over the past 30 years or so.[12] Obesity itself contributes to many of the disease also associated with physical inactivity.[19]

Mental health

Mental well-being is improved by physical activity:, with regular activity being associated with raised self-esteem[47] and with less depression, tension, fatigue and aggression and sleeping better. Well-being can be associated with a sense of achievement and improved physical appearance.[48] Participating in exercise programmes leads to reduced stress, improved productivity, enhanced problem-solving ability, and increased concentration. Physically active employees have improved work performance, decreased absenteeism and reduced turnover, although these effects can be small.[49]

Mental illness

Physical activity is as effective an anti-depressant as psychotherapy and is more effective than relaxation and enjoyable activities. Exercise, including walking and/or jogging can reduce depression by half, whether clinical or not, reactive, situational or unipolar depression.[50]

Dementia

In older people, physical activity is associated with faster psychomotor speed, less anxiety, and self-reported enhanced mental alertness and energy levels.[51] Long-term physical activity can improve performance of some cognitive tasks[47]; reduced memory loss has been reported in the elderly who are physically active.[52]

Musculo-skeletal health

Physical activity has a positive influence on bone health, reducing the risk of osteoporosis,[53] muscular health, and quality of life, particularly maintaining independence in older age.[54] Physical activity improves balance, co-ordination, mobility, strength and endurance and the control of chronic disease.[18] Muscle bulk and strength can be increased by 10-20% by appropriate exercise in men in their early seventies.[58] Aerobic activity, including walking, jogging or cycling, can improve stamina.[55]

Reducing disability

Physical activity contributes to compression of morbidity as well as to reduced age-specific mortality.[56 57] Those who are physically active in middle age and continue to be active have less deterioration with age than control groups[58]: lifetime disability in exercisers is only one-third to one-half that of sedentary individuals.[56] Activity leading to even slight increases in physical fitness can improve self-esteem[59], confidence[59], and function to perform the activities of daily living and can therefore avoid institutionalisation.[58] Benefits in the very elderly can also occur from starting a new programme of physical activity, for example walking.[52] Indoor walking can improve walking pace in elderly people with osteoarthritis, improving their daily activity score, their perception of ability and disability and their use of drugs.[60]

2.2.3 Health benefits of active travel

Both cycling[61] and walking[38] are good exercise.[62] Men who walk or cycle to work have a lower rate of death from ischaemic heart disease than men who travel to work by car - even in men from households with cars - with public transport users having in-between rates.[63] Walking or cycling to school or work is as effective as a training programme[57] and can fulfil the recommendations for physical activity. There is increasing evidence that walking or cycling (including for travel not leisure purposes) results in the same health benefits as sports or other exercise.

Walking is the easiest and most accessible form of physical activity. Walking is classified as a moderate intensity activity, as is cycling at 10mph. Walking two one-mile journeys or cycling two three-mile journeys daily satisfies the ‘Half an Hour a Day’ physical activity recommendation for adults.[64] There is a strong and growing body of evidence that walking or cycling confers multiple health benefits.[65] In addition to the specific conditions listed below, walking also protects against some cancers, respiratory disease, and type 2 diabetes. Over half the variation between American states in rates of self-reported doctor-diagnosed diabetes is accounted for by differences in the rates of active commuting.[26] Shephard calculated that cycling at 10mph uses 29kJ/min on average, adequate for health benefits.[66] More extensive information is also available on-line from Sustrans[67] and Cycling England.[68]

All-cause mortality

Expending ≥ 2,000 kcal/wk (equivalent to daily cycling for 30-40 minutes[69]) compared with <500 kcal/wk adds 2.15 years of life up to age 80.[70] The Copenhagen Centre for Prospective Population studies found a substantial decrease in the risk of death among those who spent three hours per week commuting to work by bicycle compared to those who did not commute by bicycle.[71] This is supported by a recent Chinese study reporting similar results in women.[72] These studies confirm earlier work in the UK, showing that the life-extending health benefits of cycling were about ten times greater than the life years lost in road crashes.[69] In summary, cyclists live longer. Similar results have been found for regular walking.

Coronary heart disease

Regular walking reduces the risk of cardiovascular disease.[60] “Vigorous” cycling, defined as at least one hour per week commuting or at least 25 miles of other cycling in the previous week, halved the rate of coronary (ischaemic) heart disease in the Whitehall study.[69] Benefits of walking include major health risk reductions as a result of increasing cardio-respiratory fitness.[60 73] Walking also increases beneficial high density lipoprotein levels.[48]

Obesity

Walking uses 4kJ/kg bodyweight, almost independent of pace, so walking more slowly than needed to increase fitness still aids weight control. For example, one mile on the level requires 272kJ for a 75kg man and more in heavier individuals.[60] Walking a mile in 20 minutes (slower than the 3.5 – 4.5mph most often recommended for health benefits to accrue to the middle-aged[74]) expends the same amount of energy as cycling at 9.4mph for 16 minutes, running a mile in 10 minutes, swimming breast stroke for 10 minutes, medium-intensity aerobic dancing for

16 minutes, or playing football for 12 minutes.[75] Cycling is a more vigorous activity than walking. 2,000 kcalories is roughly equivalent to half a pound of fat. As a regular habit, sustained over the years, cycling has significant potential to control weight.

Mental health

Walking reduces anxiety and depression[76] and can maintain mental wellbeing.[47] Other benefits to well-being occur from companionship and pleasant physical surroundings.[55] With prolonged activity, runners and cyclists become more self-sufficient, serious and relaxed.[77]

Bone density

This is higher in the legs and trunk of postmenopausal women who habitually walked >12km/week compared with those who walked <1.6km/week.[60] In healthy sedentary adults, walking led to reductions in mood disturbance in women and increased positive affect in men. Different intensities of walking all improved quality of well-being in people with chronic pulmonary disease in proportion to improvement in exercise tolerance in comparison with controls. Walking improved pain in people with osteoarthritis.[47]

Fitness

A series of Finnish studies explored the feasibility and effectiveness of physically active commuting. Most physically active commuters reported their journey caused slight sweating and shortness of breath. A 10-week randomised trial of volunteers who had previously commuted by car or bus found increases in both mean walking speed (from 5.8km/h to 6.2km/h) and fitness; the mean distance travelled was 3.4km. Cyclists' speed and fitness also increased, with a mean distance cycled of 9.7km. The volunteers walked or cycled for more than three-quarters of their commuter journeys in the 10 weeks.[73] Active commuting is also positively associated with aerobic fitness in young men and women.78

Hillman reported that regular cyclists have a level of fitness equivalent to that of people 10 years younger[79] but a Finnish study found that while physically active men and women (including cyclists) had the explosive muscle power of someone 10 years younger, the 55-year-olds had the aerobic fitness of people of the same sex 30 years younger.[80]

Twenty years ago, a report for the British Medical Association found that the benefits of cycling outweighed the risks.[69] Hillman calculated that among regular cyclists, 20 years of life are gained through the benefits of activity for each year of life lost through injury.[79] Recently, a new report has shown that even when air pollution exposure and other hazards are considered, the benefits of cycling outweigh the risks. Individuals to change from commuting by car to bicycle gain about 3-14months from the increased physical activity, while increased dose of air pollution would potentially result in 0.8-40days lost and increased risk of traffic injury 5-9days lost. Gains to society are greater, because these shifts also reduce the number of cars that cause air pollution and injuries, and increasing the number of cyclists reduces the injury risk for all of them (see chapter 7).[81]

2.3 Transport Policy Context

2.3.1 Sustainability

The benefits of encouraging walking and cycling journeys tie directly into the five goals of the Department for Transport (DfT) consultation document *Delivering a Sustainable Transport System*.[82] Although active travel can contribute to all of them, some benefits are more direct than others. This is discussed in more detail in chapter 10.

2.3.2 Benefits of active travel to society and individuals

Cycling and walking are highly relevant in the 21st century to address major burdens and threats, including obesity and a range of diseases; ecological threats from a high carbon culture; economic problems of oil dependency; and congested roads. These are discussed in more detail in chapter 10. At the individual level, active travel confers additional benefits:

a) Cycling or walking readily incorporates physical activity into daily life.

b) Cycling and walking can be undertaken by virtually all age groups, of many different abilities.

c) Cycling is affordable once a bike is owned, and bicycles can be inexpensive to purchase; walking requires no equipment at all, for most individuals.

d) Cycling and walking are means of reaching employment, training and other opportunities to those without car access.

e) Replacing motorised transport by walking or cycling for a proportion of trips reduces pollution, benefits local air quality, and reduces cardio-respiratory illness.

f) A widespread cycling culture increases the safety of cycling and walking.

g) Cycling or walking can improve mental health and feelings of well-being.

h) Cycling or walking enhances local environments and sense of community.

i) Cyclists generally live longer than non-cyclists.[83]

j) Those who cycle to work report fewer days sickness leave compared with those who do not cycle.[84]

k) The combination of the cycle with public transport creates the only transport mode that can currently (pending further technological development of the people-mover) compete with the car for flexibility (see chapter 14, section 14.9).

Considering the need to address the disease burden due to physical inactivity, the Chief Medical Officer noted in his 2004 report on physical activity that:

> *"For most people, the easiest and most acceptable forms of physical activity are those that can be incorporated into everyday life. Examples include walking or cycling instead of driving..."*[19]

Moreover, Cycling England have noted that:

> *"It's vital for the health of the nation – and the health of the planet – that health and transport professionals focus on positive actions to encourage cycling, especially where a cycle journey will replace a car journey. Local transport and health authorities need to recognise the potential of cycling to improve many aspects of public health, and place it at*

the heart of a healthy transport strategy, devising safe cycling policies and promoting the use of cycling – by children and adults alike – on a daily basis." [85]

2.3.3 Population Health

The wider objectives that will be met through increasing walking participation contribute to a range of non-transport policies and targets, not least those of public health, as set out in the Public Health White Paper *Choosing Health*.[86] The direct population health benefits of increased walking and cycling are given in sections 2.2.2 and 2.2.3 above. There is some evidence that people taking part in exercise programmes reduce physical activity at other times of the day or even increase dietary intake, both among adults[87] and children.[88] It is claimed that this compensatory increase in intake is less likely when moderate not vigorous activity is undertaken, for example active travel, but we have been unable to find evidence for this statement.

Importantly, walking is available to nearly all. However, a 2008 survey of the general population in England found that only 41% of men and 33% of women reported walking at a fairly brisk or fast pace at least once in the previous four weeks for at least 10 minutes.[3] As Morris and Hardman note in the most authoritative paper on the health benefits of walking:

> *"unlike so much physical activity, there is little, if any, decline in middle age. It is a year-round, readily repeatable, self-reinforcing, habit-forming activity and the main option for increasing physical activity in sedentary populations. Thus, walking is ideal as a gentle start up for the sedentary, including the inactive, immobile elderly, bringing a bonus of independence and social well-being. As a general policy, a gradual progression is indicated from slow, to regular pace and on to 30 minutes or more of brisk (ie 6.4 km/h) walking on most days. These levels should achieve the major gains of activity and health-related fitness without adverse effects… 'I have two doctors, my left leg and my right…'."* [60]

Broader health benefits, attributable to walkable neighbourhoods, include higher levels of social capital among people living in walkable, mixed-use neighbourhoods compared with those living in car-oriented suburbs. Those living in walkable neighbourhoods are more likely to know their neighbours, participate politically, trust others, and be socially engaged.[89]

Other benefits of an increase in walking is that it can help improve local air quality by changing travel behaviour with reduced motor vehicle use and congestion. The reductions in congestion delivered through increasing the number of people walking can improve the conditions on the transport network meaning more efficient on-time journeys. Improved health through regular walking can also improve economic competitiveness through reductions in sickness absenteeism. The Foresight report pointed out that policies to reduce obesity, particularly those aimed at reducing 'passive obesity' from living in an obesogenic environment, also mitigate climate change.[4]

2.4 Levels of active transport

2.4.1 Levels of walking for transport

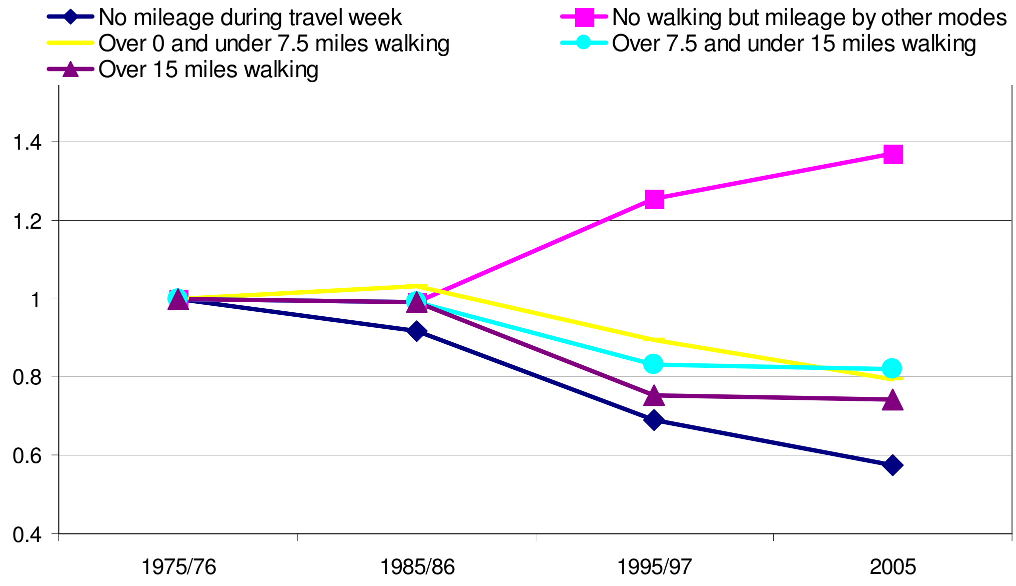
There have always been issues about measuring walking – it is notoriously under-reported in transport surveys. One of the main problems is that journeys tend to be done in parts: if you get the bus you have to walk to and from the bus stop, or if you get the train you walk to and from the station, so the walking element is not usually reported. *"How do you travel to work?" "By* *bus",* not "*bus and walking".*

In 2008, walking for transport comprised 22% of trips by main mode. Over three-quarters of all trips of less than one mile were carried out on foot[90] although it has fallen from 86% in 1975/76. Nationally, 11% of commuters walk to work[91] and 46% of children walk to school.[92] There has been a reported decline in walking journeys according to the National Travel Survey (NTS) across all age groups since 1975/76 when NTS first provided data on walking.[90] A more major decline in walking is noted from 1985/86 (see Figure 2-3). It is of note that it was in 1986 that the 1985 Transport Act came into operation, deregulating bus services outside of London. Whether as a result of this, or whether through a growth in income, the result was to accelerate the decline in this mode of travel and thus the walk opportunities as more adults turned to car ownership.

A USA study found that Americans who use public transport ('transit') spend a median of 19minutes daily walking to and from public transport, with 29% spending at least 30 minutes; this latter group were more likely to be rail users, or people from minority groups, low income households, or high density urban areas.[93] Another American study found that inclusion of non-leisure time walking and cycling reduced differences in physical activity levels by race/ethnicity, education, and income.[94]

The NTS 2008 reported that between 1995/97 and 2008 average walking trips per person fell 24% from 292 to 221 per year.[90] The current monitoring of walking is however limited and development of adopted walking strategies should provide more monitoring with resulting data used to report improvements in walking and walking levels. Walking in general is reported on via the Health Survey for England which also included accelerometry data in 2008 to provide objective assessments of activity levels (see chapter 14).[3]

Figure 2-3. Distance walked during the travel week by people aged 17 and over 1975/76-2005 (1975/76 = 1.0)



Source: NTS 2007[95]

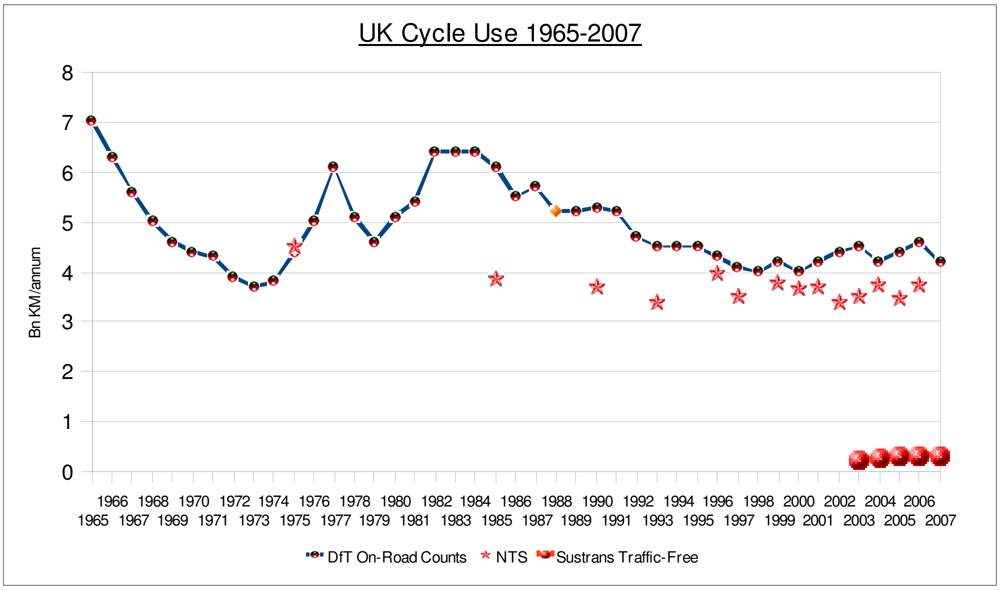
2.4.2 Trends in cycling 1965-2007

Data are presented extending back more than 40 years into the mid 1960s. Such long term trends inform us of the general drift of change that influences the current situation (Figure 2-4).

Having declined through the 1950s and 1960s, cycling became more popular after the first Oil Crisis in 1973. The trend peaked in the mid 1980s. There followed about fifteen years of steady decline. In the last decade, the distance cycled nationally per year has been fairly constant. Against a background of rising population, this suggests continued slow decline in miles cycled per person. This is in fact reflected in the NTS data for 1996-2005, showing annual miles cycled per person falling by about 10% in that decade. The use of traffic-free routes of the National Cycling Network is growing, as the route is developed and marketed. Cycling on NCN traffic-free routes amounted to about 7.5% of all cycle trips by 2008.

Conclusion: There has been a continuing trend of declining cycle use per person. The trend is long-established, although it is slower now than in the period 1985-2000.

Figure 2-4. UK Cycle use 1965 – 2007



Sources of data:

[96] The Department for Transport (DfT) carries out traffic monitoring by on-road traffic counts. Automatic Traffic Counters (ATCs, >10,000 in number) distributed in the national road network add to knowledge of all classes of traffic. Cyclist movements are less reliably recorded than for other vehicle types. Cyclists are more likely to use quiet roads, where less monitoring takes place. Because of this, the data are likely to be under-estimates. The methodology of counts has been fairly consistent in the survey period above.

[95] The DfT also carries out the National Travel Survey. This involves distributing travel diaries to a random sample of approx. 8,000 households per year. There have always been difficulties with obtaining a high rate of completion of travel diaries. This has been especially so with cycling, which is mostly done by boys and young men. Since 1995, data have been weighted to account for incomplete responses. Previous data cannot be reliably compared to post 1995 data, although they have been included in the

chart above. The NTS was carried out only intermittently prior to 1988. The 1978/79 NTS was withdrawn due to poor response rate.

[97] *Sustrans collects its own data on use of the National Cycle Network. The Sustrans data presented here are for the traffic-free routes only of the National Cycling Network because in theory, use of On-Road sections of the National Cycling Network will duplicate data from the DfT above. Thus they complement the on-road data of the DfT. Sustrans and the DfT are developing the merging of their data, so the above data may be subject to revision (probably upwards relative to on-road cycle use).*

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Chapter 3. Transport, Air Pollution, and Climate Change

A Watson, J Mindell

3.1 Air pollution

3.1.1 Emissions from road transport

Road traffic is an important cause of both urban and global air pollution (Table 3.1). The main urban pollutants directly emitted by vehicles include carbon monoxide, particulate matter, oxides of nitrogen, and volatile organic compounds (VOCs, a collective term which includes toxic compounds such as benzene,1,3-butadiene and polycyclic aromatic hydrocarbons (PAHs)). In addition, sunlight causes a photochemical reaction to occur between nitrogen oxides and volatile organic compounds to form ozone, a secondary 'long distance' pollutant. Since 1990, despite an increase in the number of vehicles on the road, most emissions from road transport sources have declined steadily due to the development of more efficient engine combustion technology, the use of catalytic converters, the growth in diesel engine use, and stricter regulations on HGV emissions. Despite this, there has been a steady growth in carbon dioxide transport emissions worldwide which has significant implications for climate change. It is important that the beneficial impacts of reductions in many harmful emissions are not allowed to obscure the worsening of this particular harmful problem.

3.1.2 Health effects of air pollution

The well known health hazards of air pollutants have resulted in significant research efforts, to understand the associations between air pollutants and ill health; and many environmental legislative acts to reduce air pollution levels have been passed. In the first edition of Health on the Move, lead was a major pollutant mentioned in this chapter. The virtual eradication of leaded petrol has dramatically reduced its significance such that it is now mentioned only for historical reasons.

The health effects of the main traffic-related pollutants are outlined in Table 3.2. They are especially likely to be experienced by young children, elderly people, pregnant women and people suffering from illnesses such as asthma, bronchitis, emphysema and angina. Approximately one in five of the population is in one or more of these sensitive groups.

Table 3-1. Emissions of pollutants from road transport, United Kingdom 1990 to 2006, and percent of emissions from all sources in 2006

	Thousands tonnes emitted		Percent change	Percent of total emissions
Pollutant	**1990**	**2006**	**1990-2006**	**in 2006**
Carbon monoxide	5,479.8	984.1	minus 82%	44
Nitrogen oxides [a]	1,323.6	515	minus 61%	33
Airborne particulates [b]	60.1	32.2	minus 46%	21
Volatile organic compounds [3]	2,291.8	857.4	minus 88%	12
Carbon dioxide (as C)	2,9838	3,2806	10% increase	28
All road users (billion vehicle kilometres travelled)	410.8	507.5	24% increase	

a. Figures for nitrogen dioxide equivalent
b. Figures for particulate matter 10 µm
c. Figures exclude methane
Sources: National Atmospheric Emissions Inventory, 2008, Department of Transport 2008.

The EU Air Quality Targets are compulsory for the UK to attain.[1] The UK Government strategies to control road traffic related air pollution combine the requirements for an appropriate transport infrastructure with a need for cleaner, quieter and less environmentally harmful vehicles. Alongside the transport strategy, UK National Air Quality standards have been set, based on assessment of the effects of each pollutant on human health.[4] Nitrogen dioxide and particulate matter often exceed these concentrations in urban areas. Ozone can exceed these standards in urban areas but more commonly do so in rural areas. As part of the UK Air Quality Strategy, an Air Pollution Information Service provides public information on the level of pollution based upon the highest concentration or forecasts of five pollutants: nitrogen dioxide, ozone, carbon monoxide, particles (PM_{10}) and sulphur dioxide (originating from power generation and industrial sources). At ‘high’ levels (air pollution index 7-9), significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their 'reliever' inhaler is likely to reverse the effects on the lung. These effects can be worse at ‘very high’ levels (index 10).[2] Across the urban and rural pollution monitoring sites in 2007, air pollution was recorded as moderate or higher on 24 days on average per site.[3]

Table 3-2. Health hazards of urban air pollutants from motor vehicles (adapted from Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007[4])

Pollutant	Health Hazard
Carbon Monoxide (CO)	CO prevents the normal transport of oxygen in the blood which can lead to a significant reduction in the supply of oxygen to the heart or brain. People with existing diseases which affect oxygen delivery, such as angina, are at particular risk. CO also slows thought processes and reflexes, causing drowsiness and headaches. Long term exposure may aggravate arteriosclerosis causing cardiovascular disease.
Nitrogen oxides (NOx)	Nitrogen dioxide is associated with adverse effects on human health. At high levels it causes inflammation and irritation of lung tissue, increasing susceptibility to viral infection, bronchitis and pneumonia. At high levels it also increases sensitivity to allergens, e.g. pollen, in sensitive individuals.
Particulate Matter (known as PM_{10} or $PM_{2.5}$ the number indicative of the particulate diameter in μm)	Fine particles can be inhaled deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases. Exposure to particulate matter is consistently associated with respiratory and cardiovascular illness and mortality.
Ozone (secondary pollutant indirectly formed from vehicle pollutants)	At high concentrations ozone irritates the eyes, nose, throat and lungs causing coughing, headaches and reducing resistance to respiratory infections. Ozone also reduces lung function: very high levels increase the symptoms of those suffering from lung diseases such as asthma and bronchitis, leading to increased incidence of respiratory hospital admissions and mortality.
Carbon Dioxide (CO_2)	No direct local health effects in urban environments, but it is the most important 'greenhouse gas' contributing to global climate change with widespread impacts on infectious diseases, famine, weather-related harmful events, flooding, heat-related conditions etc.
<u>Volatile Organic Compounds</u>	
Benzene	A recognised human carcinogen, particularly associated with leukaemia.
1,3-Butadiene	A recognised human carcinogen. The health effect of most concern is the induction of cancer of the lymphoid system and blood–forming tissues, lymphoma and leukaemia.
Polycyclic aromatic hydrocarbons (PAHs)	Lung cancer is most obviously linked to exposure to PAHs through inhaled air. Individual PAHs vary in their ability to induce tumours in animals or humans, and in many cases their carcinogenic potency remains unknown or uncertain.

3.2 Climate change

3.2.1 Transport's contribution to carbon emissions

Within the UK, road transport emissions of carbon dioxide are responsible for approximately a quarter of the UK greenhouse gas emissions. Since 1990, despite the introduction and greater use of more fuel efficient vehicles, this proportion has grown because of the increased number of vehicles on the roads (Table 3-3). International governments, business, public sector and environmental bodies are all now advocating moves toward more sustainable forms of transport such as walking, cycling and public transport to address these transport related emissions. This has the additional bonus of promoting a healthier approach to transport and individual mobility.

Table 3-3. Carbon dioxide emission by mode[5]

Mode	CO_2 emission by mode (g/passenger km)
Coach	30
Electric train	54
Overall train	61
Diesel train	74
Bus	98
New car (average occupancy)	99
Modern short haul aviation	120

Research by Natural England concluded that the private car is the dominant mode of travel used for leisure trips to the natural environment in England, and listed many of the same adverse consequences that are dealt with elsewhere in this report. Leisure travel in all its forms accounts for 6.7% of the total CO2 transport emissions.[6]

A study modelling carbon emissions in two rural communities concluded that even with technological innovations, the main reduction in carbon must come from reduced travel.[7]

UK domestic transport greenhouse gas emissions in 2008 were 131.9 $MtCO_2$, 3% lower than in 2007; this was the largest reduction in transport emissions since 1990. Road transport emissions in 2008 had fallen by 4% compared with 2007.[8]

3.2.2 Health effects of climate change[9 10]

Evidence now exists to demonstrate that climate change is a significant and emerging threat to public health. However these threats are not distributed equally across the world, and the most vulnerable populations are often to be found in the most economically undeveloped nations.

In the UK it is believed that the majority of expected health effects can be managed through existing public health programmes and interventions. Cold winter periods will probably become less common, bringing health benefits amongst the elderly, (although this may not be so if changes in the sea lead to the loss of the Gulf Stream) and summers will become warmer. It is felt that the people will be capable of adapting to warmer summers, however heatwaves present a serious risk.[11] In August 2003, the summer heatwave accounted for over 2,000 excess deaths in the UK[12] and 70,000 across Europe[11]; it is believed that this type of climatic extreme will become more commonplace with climate change. Children, elderly people and the frail, particularly those with pre-existing conditions such as cardiovascular and respiratory diseases, are most susceptible to extreme temperatures. (If 'global warming' affected all seasons in the same way, there could be fewer winter deaths from hypothermia but it is more likely that 'global climate change' will lead to more extreme weather, with hotter summers not necessarily accompanied by warmer winters. In the worse case scenario for Great Britain, the Gulf Stream could cease and winter temperatures in Britain could fall dramatically.[11]) Other impacts of warmer summers will be increased incidence of food poisoning, eg salmonella, and waterborne bacterial diseases. Also, although incidents will be rare, the potential for outbreaks of vector-borne disease such as malaria and tick-borne diseases mean that health authorities will need to be alert to the possibility of such outbreaks.[11]

The impacts of other more complex climate events such as flooding, droughts or other extreme weather are more difficult to quantify, as their secondary impacts are more poorly reported, but it is clear that an increasing frequency of such events will lead to more casualties.[11]

The extent of sea level changes is also open to variable predictions, but it is clear that coastal areas and low lying areas like East Anglia will be affected. Most predictions would add London to this list and some predictions would add areas like the Cheshire Plain.

Although the UK may seem to be lucky to experience less by way of climate problems than most parts of the world, it is important to remember the UK's dependence on imported food which would render us vulnerable to changes in food production in other parts of the world, the security implications of large scale human displacement and the significant family ties between the UK and other parts of the world as a result both of an Anglo-Saxon diaspora and of immigration from the Indian subcontinent, Africa and the Caribbean (all of these legacies of an imperial past).

Finally, although the main urban air pollutant concentrations are expected to continue to fall from their present levels, ozone levels are expected to increase, leading to more cases of hospital admissions and mortality during ozone episodes.[13]

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4 Injuries

R Mackett, J Mindell, M Wardlaw, V Feypell

4.1 Injuries

The World Health Organisation has published an assessment of road traffic injuries in 178 countries.[1] They are an important public health problem, particularly in low- and middle-income countries, which account for 48% of the world's motor vehicles but 90% of road traffic injuries. Road traffic injuries are predicted to become the fifth leading cause of death worldwide by 2030, resulting in 2.4 million deaths a year. This is due to a combination of rising road traffic injuries and falling deaths from other causes.[1]

In Great Britain in 2009, there were 222,100 road traffic casualties, including 24,690 serious injuries and 2,222 fatalities. These deaths included 1,059 car users, 500 pedestrians, 472 motorcyclists, and 104 cyclists.[2] These figures represent a reduction in each category even since 2008. However, almost two-thirds of all road deaths are on rural roads, with the proportion increasing as overall figures fall, suggesting that policies that have reduced urban road deaths have not had a similar effect in rural roads.[3]

Road deaths are of particular concern because young people have the highest death rate per million capita (Table 4-2). Despite this, road deaths are not a major cause of life years lost, and the percentage is falling. While in 1986, road deaths were responsible for 5.8% of years of life lost before the age of 70 (YOLL <70), by the period 2005-2007, this percentage had dropped to 4.2% (Table 4-1).[4]

Table 4-1 Years of Life Lost 2005-07

Cause of Death	Total Years of Life Lost (YOLL) <75	Percent of All YOLL (%)
All Causes	6,896,930.5	100
All Cancers	2,363,798.5	34.3
All Circulatory Disease	1,504,191.0	21.8
CHD	824,407.0	12.0
Land Transport Injuries	290,772.0	4.2
Stroke	272,436.5	4.0

Source: Clinical and Health Outcomes Knowledge Base 2005-07[4]

The risk of dying in a road collision in any year in the UK is about one in 20,000, and the lifetime risk is one in 240.[5] To put this into perspective, one in two smokers dies prematurely because of their smoking.[6] The risk of death in a road accident is thus low at the individual level, except for motorcyclists, who face risks more than10 times greater than other classes of road user (see Section 7.2).

Death rates from road traffic injuries are higher in men than in women (Table 4-3). Almost one-third (31%) of road traffic deaths occur in males aged 15-34years (Table 4-2). In 1987, almost a quarter (23%) of all motor vehicle drivers involved in collisions were males aged 17-24 years.[7]

Death rates by age and mode of travel are shown in Table 4-3. Children and elderly people dying from road injuries are most likely to be pedestrians, while other adults are most likely to be car occupants. Pedestrian death rates are highest for children and elderly people, while car occupant and motor-cyclist death rates are particularly high for young adults. There are very few deaths of bus and coach occupants. Inequalities in road traffic injuries are presented in section 9.2.

For each age group and mode of travel, the death rate depends upon the amount of travel, and the risk of travel, by that mode at that age. The number of injuries among children aged four to 10y increases with age, regardless of road user type. Those aged 11y and older have a great increase in pedestrian injuries, peaking at age 12y, then decreasing to adulthood. A lesser increase in cycle injuries levels off aged 13y then decreases. In-car injuries remain flat until the age of 14y, then increase rapidly, as do motorbike injuries, peaking at age 16y for motorbikes and 18y for cars.8 This is discussed further in Section 7.2.

Table 4-2. Deaths from land traffic injuries (V01-V89), number, percentage of deaths from all causes and rates by age and sex, England and Wales, 2007

Value	Sex	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	All Ages
Number of deaths from all causes	M	2,228	182	226	797	1,218	3,138	6,264	11,893	27,508	47,830	80,573	58,930	240,787
	F	1,691	121	192	357	453	1,360	3,787	8,072	18,166	33,903	79,411	115,752	263,265
	M+F	3,919	303	418	1,154	1,671	4,498	10,051	19,965	45,674	81,733	159,984	174,682	504,052
Number of deaths from road traffic injuries	M	17	17	41	315	205	382	172	206	147	140	126	17	1,785
	F	13	11	17	66	36	50	58	72	67	103	116	14	623
	M+F	30	28	58	381	241	432	230	278	214	243	242	31	2,919
Percent of deaths from road traffic injuries	M (%)	0.8	9.3	18.1	39.5	16.8	12.2	2.7	1.7	0.5	0.3	0.2	0.0	0.7
	F (%)	0.8	9.1	8.9	18.5	7.9	3.7	1.5	0.9	0.4	0.3	0.1	0.0	0.2
	M+F (%)	0.8	9.2	13.9	33.0	14.4	9.6	2.3	1.4	0.5	0.3	0.2	0.0	0.6
Population ('000s)	M	1,641	1,552	1,680	1,834	1,881	3,509	4,077	3,475	3,146	2,127	1,283	366	26,569
	F	1,562	1,484	1,598	1,724	1,780	3,490	4,132	3,551	3,267	2,342	1,767	806	27,503
	M+F	3,202	3,036	3,278	3,558	3,661	6,999	8,209	7,026	6,413	4,468	3,050	1,172	54,072
Number of deaths from road traffic injuries per million people	M	10.4	11.0	24.4	171.8	109.0	108.9	42.2	59.3	46.7	65.8	98.2	46.4	67.2
	F	8.3	7.4	10.6	38.3	20.2	14.3	14.0	20.3	20.5	44.0	65.7	17.4	22.7
	M+F	9.4	9.2	17.7	107.1	65.8	61.7	28.0	39.6	33.4	54.4	79.4	26.4	

Source: Derived from National Statistics Mortality Statistics DR series[9] Tables 1 and 5.19

Table 4-3 Deaths from land traffic injuries, number and rates by age and mode of travel, England & Wales, 2007[9]

Mode of travel	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	All Ages
Number of deaths													
Pedestrian (V01-V09)	13	12	22	50	43	60	41	64	60	69	126	63	645
Pedal Cycle (V10-V19)	2	5	13	7	5	22	29	12	20	12	9	-	136
Motor-cycle (V20-V29)	-	2	3	64	63	128	141	65	33	13	5	-	517
Car and taxi (V40-V59)	12	6	16	224	238	209	153	116	107	82	99	61	1,323
Bus and coach (V70-V79)	-	-	-	1	2	1	-	-	1	4	6	8	23
Goods vehicle (V60-V69)	-	-	-	2	1	-	12	10	10	6	1	-	42
All road fatalities (V01-V89)	30	28	58	368	381	452	429	294	270	201	272	136	2,919
All transport fatalities (V01-V99)	*31*	*28*	*58*	*370*	*383*	*458*	*441*	*305*	*278*	*207*	*273*	*136*	*2,968*
Population (000's)	3,202	3,036	3,278	3,558	3,661	6,999	8,209	7,026	6,413	4,468	3,050	1,172	54,072
Deaths per million persons per year													
Pedestrian	4.1	4.0	6.7	14.1	11.7	8.6	5.0	9.1	9.4	15.4	41.3	53.7	11.9
Pedal Cycle	0.6	1.6	4.0	2.0	1.4	3.1	3.5	1.7	3.1	2.7	3.0	-	2.5
Motor-cycle	-	0.7	0.9	18.0	17.2	18.3	17.2	9.3	5.1	2.9	1.6	-	9.6
Car and taxi	3.7	2.0	4.9	63.0	65.0	29.9	18.6	16.5	16.7	18.4	32.5	52.0	24.5
Bus and coach	-	-	-	0.3	0.5	0.1	-	-	0.2	0.9	2.0	6.8	0.4
Goods vehicle	-	-	-	0.6	0.3	-	1.5	1.4	1.6	1.3	0.3	-	0.8
All road users	9.4	9.2	17.7	103.4	104.1	64.6	52.3	41.8	42.1	45.0	89.2	116.0	54.0
All transport-related fatalities	*9.7*	*9.2*	*17.7*	*104.0*	*104.6*	*65.4*	*53.7*	*43.4*	*43.4*	*46.3*	*89.5*	*116.0*	*54.9*

Source: Derived from National Statistics Mortality Statistics DR series[9] Tables 1 and 5.19

4.1.1 Trends over time in road collision deaths by mode

In comparison with other countries of Europe, Great Britain has one of the lowest mortality rates for all road injuries. However, this generality hides some important exceptions. The best figures for child pedestrian mortality were from Sweden (0.3 deaths per 100,000 children), compared with the UK figure of 0.9 per 100,000 children.[10] In 2007, 3,090 children were killed or seriously injured, of whom 1,899 were pedestrians; the 121 deaths were the fewest recorded.[11]

Between 1980 and 2007, road traffic increased by 87% but there was a 24% reduction in total casualties. The number of fatal and serious road casualties (KSI, killed or seriously injured) fell by considerably more; 64%.[11] Car occupants' fatality rate more than halved from 6.2 deaths per billion passenger km in 1980 to 3.0 in 1993, since when the fatality rate has continued to fall but more slowly, reaching 2.6 deaths per billion passenger km in 2006.[11] It is this paradox of increasing motor traffic running with declining injuries, especially serious and fatal injuries, that is cited as vindication of transport policies favouring car use.

However, it is less well recognised that the safety of active travel has also improved. In 2006, the fatality rate for pedestrians was 54% lower than the 1980 level and for pedal cyclists it was 46% lower. The trends in cyclists' safety is studied in greater depth in Section 4.2. The perceived safety when walking and cycling has not improved. Rather, concern over perceived danger from rising traffic levels has increased.

4.2 Long term trends in cycle casualties

4.2.1 The Use of Hospital Statistics on Road Casualties

It is accepted that fatalities in road accidents are accurately reported. Concerning serious injuries, however, there is long-standing confusion in the medical world. This has major relevance in the misperception of risk in cycling.

In the UK there are two datasets for recording fatalities and injuries in road traffic accidents: STATS19 and Hospital Episode Statistics (HES). The STATS19 dataset is maintained by the Department for Transport (DfT). It is based on reports by police attending road accidents. The police are mainly interested in crashes involving motor vehicles, as these are most likely to result in charges. The STATS19 database is the basis of the annual report *Road Casualties Great Britain*, the record of deaths, serious injuries and slight injuries in road accidents and a prime element of road safety policy. The HES dataset is maintained by the NHS Information Centre. It is based on hospital records of those admitted as in-patients.

One might expect the HES to be the more accurate record of road traffic injuries. However, a serious complication arises, because the definition of 'transport accident[i]' in HES is defined differently for cyclists compared with pedestrians. This has long caused confusion. It has also given rise to the view that the police under-report cycling injuries; this view is not correct, as shown below.

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[i] In common with many other organisations, we recommend avoiding the term 'accident' when dealing with traffic collisions and casualties, as it is often taken to mean 'unavoidable' instead of its actual meaning of 'unintended'. However, 'Transport accident' is the term used in the International Classification of Disease; we therefore use it in this report when referring to data sources based on specific definitions but otherwise avoid the term.

Serious injuries in collisions with motor vehicles are accurately reported by the police for cyclists, but are under-reported for pedestrians. Table 4-4 shows data are taken from the 2006 and 2007 editions of *Road Casualties Great Britain*.[11] [12]

Table 4-4. Serious injuries after collision with motor vehicle: STATS19 and HES compared

	Cyclists	**Pedestrians**
HES	2,186	7688
STATS19	2,092	5525
(difference)	4%	28%
Source	RCGB 2006[12] Chap 6 Table 6a	RCGB 2007[11]**Error! Bookmark not defined.** Chapter 6 Table 6e and p75

The under-reporting of pedestrian serious injuries is not appreciated in the road safety debate. The accurate reporting of cyclist injuries in STATS19 is likewise not recognised.

The major differences between STATS19 and HES arise for injuries not involving a motor vehicle. The definition of 'transport accident' in HES is not consistent. This is summarised in Table 4-5.

Table 4-5. Comparison of inclusion / exclusion criteria for 'transport accident' in Stats 19 and HES

	Cyclists		**Pedestrians**	
	STATS19	HES	STATS19	HES
Collision with M.V.	yes	yes	yes	yes
Fall in highway	some	yes	no	no
Fall in unspecified place	no	yes	no	no

(see Chapter 6 of *RCGB* 2006 Edition[12] for detailed comparison of HES and STATS19)

Needless to say, the HES figure for cycling serious 'transport accidents' is greatly inflated by the inclusion of falls that are excluded from the pedestrian definition. The inflation factor is about 3.25. The situation is of course exacerbated by the HES cycling definition being a 'dustbin code' to catch incomplete data that do not fit anywhere else. Children playing off-road will be classed as transport accidents if the place of injury is unspecified at admission.

If we are to be informed, we must compare like with like. Table 4-6 presents the data for cyclists and pedestrians compared directly: collision with a vehicle, fall in the highway and fall in an unspecified place. The data for pedestrians are for casualties ≤ 65 years. only, as there are very few cyclist casualties older than 65 years.

Table 4-6. Serious injuries in fair comparison 2004/5 (C) and 2005/6 (P), HES data

	Cyclists	**Pedestrians (<=65y.o)**
Collision with motor vehicle	2,186	7,688
Fall (in highway or unspecified place)	4,880	63,500
Source	RCGB 2006 Chapter 6 Table 6a	RCGB 2007 Chapter 6 Table 6f

It may be observed that the inclusion of pedestrian falls (in the highway and in unspecified places) has inflated the original traffic injury figure by a factor of nearly ten. For cyclists, the comparable factor is approx. 3.2. It is in fact pedestrian falls that are the 'great unreported' and unrecognised as a serious injury issue.

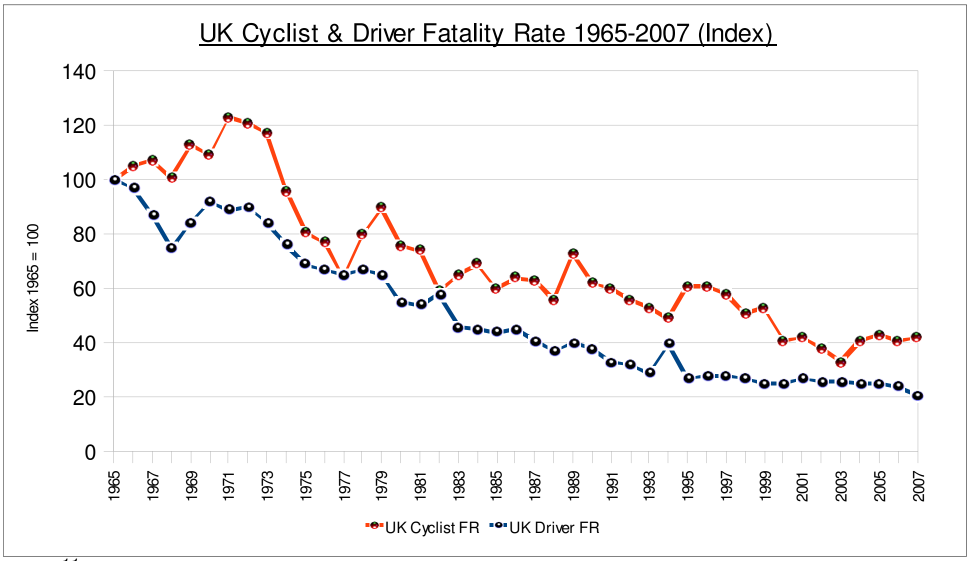
If HES were being used in a manner that respected the varying definition of 'transport accident', there would be no problem. However, the raw HES data are being misinterpreted by the DfT and some researchers to build a case that cyclist casualties are under-reported by the police, by a large factor, and hence that cycling incurs much higher risks than previously thought. This argument is false, as we have seen, but it has appeared in some apparently authoritative places. For instance, the most recent report on risk factors for cycling[13] issued by the DfT in December 2009 presents precisely this argument. A paper[14] that appeared in the peer reviewed journal *Injury Prevention* also presents this argument, to build a flawed case that cycling is more dangerous than police records show. This latter paper attracted considerable media interest. The argument is also applied in a recent textbook[15] on road safety, to conclude that the risk to cyclists is "50 times higher than for drivers". In contrast, more careful risk assessments[16 17] have appeared in the past and been ignored by the media. Competent analysis is not news in cycling.

One would naturally expect that the extensive improvement in protection for car occupants would be reflected in a relative advantage to drivers' safety. This happened briefly in the late 1960s when cycling fatality rates rose as driver fatality rates fell. However since 1970, cycling fatality rates have fallen by slightly more than driver fatality rates (Figure 4-1).

It is impressive that cyclist safety could have improved as much as driver safety over such a long period. It is beyond the scope of this review to analyse what underlies this result. Clearly there are consistent, powerful influences that have reduced driver and cyclist deaths almost equally over a 40 year period. A reduction in children cycling is probably not a factor here. The fatality rate for children and adults is very similar at around 35 deaths per billion kilometres in recent years (based on data from the *National Travel Survey*.[18] and Table 4.1 of ref[13]).

There has been some suggestion in recent years that cyclist deaths are rising as a percentage of all road deaths. In fact, review of the record back to 1965 shows that the current percentage is close to the long-term average of about 5%, although it is reverting to mean from a deep low (Figure 4.2).

Figure 4-1. UK Driver and Cyclist Fatality Rates 1965-2007

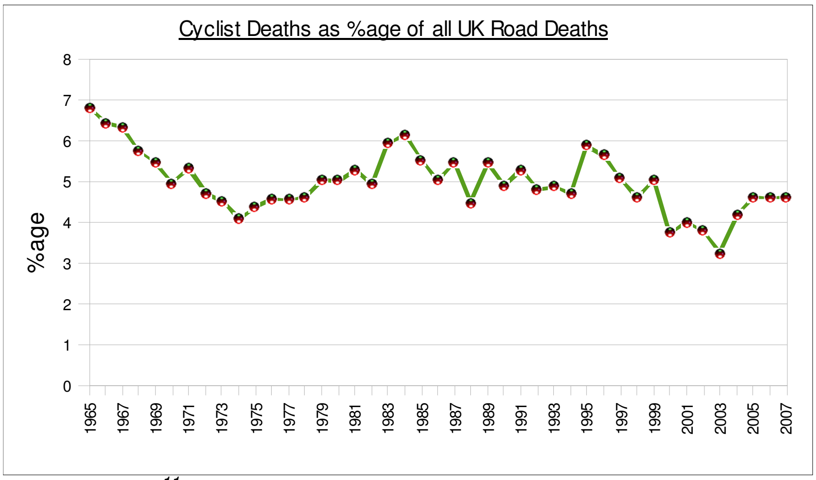


Sources of data[11]:

These trends are developed from fatality data as presented in Road Casualties Great Britain. This same source presents data on national mileage driven or cycled based on on-road monitoring.

Note: Fatality rates (deaths per billion km), have been indexed to 1965 values of 100. This does not mean that fatality rates for drivers and cyclists were equal in 1965. The fatality rates in that year for drivers and cyclists were respectively 11 and 78 deaths per billion km. The purpose of indexing is to allow easy comparison of long term trends.

Figure 4-2. Cyclist Deaths as percentage of all UK road deaths 1965 - 2007



Data source: DfT[11]

4.2.2 Children and cycling

An overview of injuries to children when cycling is useful. Data presented in the National Travel Survey show that ownership of bicycles by British children is high, at around 80%.[19] This amounts to almost 10 million potential child cyclists. However, the vast majority of these children own either mountain bikes or BMX bikes. These are not designed as vehicles for transport: the NTS reports that the number of trips cycled per UK child is only 18 per year. The figure for a Dutch child is 530 trips annually.[20] The Dutch figure includes some off-highway trips which are excluded from the NTS. Even so, the contrast is a factor of around 25. The National Travel Survey 2006 (Table 4.5) shows that the proportion of trips to school by bicycle in Britain in recent years was only 1-2%.[18]

In short, most British children own bicycles but they do not use them as a means of transport. In considering risk to children, the only data available concern on-road use from the NTS. By combining this with road casualty data, it may be shown that the risk per km travelled is higher for child cyclists than child pedestrians, although the risk turns out to be about equal once the dominance of boys in cycling is accounted for.[21] In recent years there have been 12 to 15 child cyclist deaths per year and 500 serious injuries in collision with motor vehicles. These figures represent 11% of fatalities and 17% of serious injuries of children in road accidents. These figures appear comparatively high but it must be recognised than 90% of child cyclist fatalities are male. This domination of male children in cycling inflates the overall casualty figures. Cycling road injuries account for only 6% of the annual total of 90-95,000 admissions of children for all causes of injury (taken from HES). Note that child cyclists and pedestrians together account for almost 80% of serious injuries to children from motor traffic. This reflects the relatively poor safety of children on the British road network.

4.3 Pedestrian injuries

4.3.1 The effect of speed

Speed has three effects on injury risk. It reduces the available reaction time, it increases the stopping distance so reduces the chance of avoiding a collision, and it increases the severity of injuries if a collision occurs.

A 5% increase in average speed increases the risk of crashes that result in injury by 10% and of fatal crashes by 20%. The kinetic energy involved in a crash is proportionate to the square of the velocity and stopping distance also increases exponentially so that an increase in speed of a few mph can leave a car travelling at a significant speed at the end of the distance in which it would otherwise have stopped. While most car occupants survive a collision at 30mph (50kph) if they are appropriately restrained in a well-designed vehicle, 80% of pedestrians will be killed at that speed.[22]

4.3.2 Measurement and assessment

As discussed above in section 4-5 above, pedestrian injuries are under-recorded by both Hospital Episode Statistics and the police Stats 19 data. A forthcoming report from the OECD discusses the use of standardized data collection across countries to obtain comparative information but also describes the need for detailed investigations of individual road collisions to increase understanding of the mechanisms to increase safety.[23] One such study in France by Brenac and colleagues produced a typology of situations resulting in pedestrian injury. These 20 ‘typical accident scenarios’ fall into four main categories and are estimated to account for 85% of pedestrian injuries reported to the French police.[24]

Collision[ii] during crossing

Detection problems

Poor visibility caused by parked vehicles, a stationary vehicle in another lane, night time, or the weather is often a contributing factor. The problem is drivers not perceiving pedestrians and pedestrians not perceiving cars, plus a lack of available reaction time to avoid collision once perception occurs.

Collisions can be reduced by measures that reduce vehicle speed, to increase the time available for both perception and reaction. City planning, to ensure that junctions, marked crossings, and bus stops, for example, are free of parked vehicles provide clear zones and improve reciprocal visibility. Reducing the width to be crossed, such as by build-outs or central islands, also reduces pedestrian risk.[25] This is probably both by reducing the area for pedestrians to assess and by slowing traffic. Education and experience, both of drivers and pedestrians, can also reduce risk.

Anticipation problems

This occurs when a driver sees the pedestrian but does not realize s/he is about to cross the road. It is particularly common with child pedestrians, who are more likely to run into the road without checking for traffic, but can also occur when pedestrians are using marked crossings, especially at a junction if the drive is turning.

Speed reduction measures, and increasing drivers' and pedestrians' understanding can again reduce the risk for these problems. City planning requires high visibility for pedestrian crossings and the use of the street by non-motorized travelers, together with avoiding measures that imply motor vehicle precedence and rephasing traffic lights to protect pedestrians from turning vehicles.

Collision[ii] on or near the pavement, not at a crossing

These are collisions with pedestrians on the pavement or leaving a vehicle. It is particularly common at night, and in areas where pedestrians are less common. Alcohol (driver or pedestrian) is often a contributing factor. It can also occur when a pedestrian crosses the road while a driver is reversing to park the car.

'Collateral' damage

In these cases, there is, and can be, no interaction between the driver and the pedestrian until the collision occurs. It generally results from an emergency manouevre by the vehicle or could occur if the driver loses control of the vehicle.

Other

These include pedestrians hit by motor or pedal cycles, or hit by a driver after a verbal altercation.

4.4 Economic costs

In New Zealand, road crashes involving pedestrians were estimated to cost society about 300,000 NZD each year, according to a 1993 report. Pedestrians admitted to hospital were more severely injured and their treatment costs twice as much as motor vehicle drivers and passengers.[26]

[ii] The report uses the term 'accident' to describe the categories

Department for Transport[27] figures from 2001 put the following medical costs on the following type of injury:

- Fatal £ 14,240
- Serious £ 14,610
- Slight £ 3,120

These figures do not take into account total cost to society, loss of earnings, cost to other emergency service, courts etc. The Scottish Government put the total cost of a road fatality in 2007 at £1.65 million.[28]

4.5 Role of alcohol, other drugs, and fatigue

4.5.1 Introduction

Driving a vehicle is a complex task requiring a high level of concentration and alertness. Driver impairment does have an effect on crashes but anyone that uses the roads or pavements can be involved in a road traffic crash. It is important that drivers and riders do not use their vehicles when impaired through alcohol, drugs or fatigue. The cost to society and the health service of dealing with casualties from road crashes is many millions of pounds a year in monetary terms but also has the emotional effects left on people of being involved in a crash or the loss of a loved one. Driving while impaired greatly increases the chance of the driver being involved in a crash; this can not only effect the driver but also other road users, driver and passengers in other vehicles, cyclists and pedestrians.

A brief review of the evidence on alcohol limits and driving impairment, findings of a 2010 NICE review, and the 2010North Report on drink driving and drug driving are discussed in chapter 17, section 17.6.2.

4.5.2 Alcohol

Drink driving tends to have more media coverage than drug driving: for a number of years the UK Government has been running high profile hard-hitting campaigns to reduce the number of people drinking and driving, this has been backed up by police enforcement and the courts handing out tough punishments for offenders. The Department for Transport figures for 2008 estimated 430people were killed in drink-drive crashes, [29] a 5% increase on the 2007 figure so shows that some drivers are still not getting the message. This represents 17% of all personal injury road crash deaths on British roads.[29]

Even though specific drink or drug laws do not apply to pedestrians, drink and drugs are a factor in a number of pedestrians that are killed or seriously injured each year. The Department for Transport puts the figure at 15% of recorded fatalities in pedestrians as being 'impaired by alcohol'.[31] Given that 500 pedestrians were killed in 2009,[31] this would mean that 75 pedestrians killed were 'impaired by alcohol'. If the 15% figure is applied to the figure for serious injuries it gives over 800 casualties that were 'impaired by alcohol.'

4.5.3 Drugs

Department for Transport research published in 2001 found that 18% of people killed in road crashes in Great Britain had traces of illegal drugs in their bodies**.**[30] Given that 2,222 people dies on Great Britain's roads in 2009,[31] on that basis it is estimated that around 400 adults killed in road crashes in the UK in 2009 had illegal drugs in their system and in the UK. Compared with the Drink Drive figures for 2009 and if the 18% figure is taken as still correct, even though the research was done nearly 10 years ago, then drug driving is as big a problem as drink driving. If we make the same assumption that 18% of victims of serious injuries, that figure is 4,444 people seriously injured have an illegal drug in their system. Certain Over-the-counter drugs or prescription drugs are known to make people drowsy and many drugs do give warnings not to drive but a Department for Transport report found they have the potential to be a road safety hazard.[32]

4.5.4 Fatigue

According to the Department for Transport, Driver tiredness is one of the biggest killers on UK roads, particularly on motorways and other monotonous roads. In the UK, tiredness causes one in five deaths on trunk roads.[29] Crashes caused by drivers falling asleep at the wheel typically involve vehicles running off the road or into the back of another vehicle. They tend to be high-speed crashes, because drivers do not brake before crashing, so the risk of death or serious injury occurring is greater than in other types of crashes.[29] It can be very difficult to put laws in place to tackle this area due to the number of factors that effect an individuals sleep pattern.

4.6 Government road safety strategies and targets

The 2000 Road Safety Strategy targets for 2010 were a 40% reduction in the number of people killed or seriously injured on the road and a 50% reduction for children, compared with the 1994-98 average.[33] The 1994-98 baseline figures were: 47,656 people and 6,860 children killed or seriously injured. By 2007 there were in fact 36% fewer people and 55% fewer children killed or seriously injured relative to the baseline.[11]

The UK Government is currently working on a new road strategy *A Safer Way: Consultation on Making Britain's Roads the Safest in the World*.[34] This strategy went out for consultation in April 2009. In the draft document, new targets for casualty reduction were set for 2010 till 2020. These are shown below.

> *"We believe that our key national target should be to reduce deaths, since we have been less successful in reducing deaths than serious injuries over the last decade. At the local level, as road deaths are much rarer occurrences, it is more reliable to address the combined number of deaths and serious injuries. We will monitor local progress against this benchmark.*
>
> *"We are therefore proposing the following targets:*
>
> - *to reduce road deaths by at least 33 per cent by 2020 compared to the baseline of the 2004–08 average;*
> - *to reduce the annual total of serious injuries on our roads by 2020 by at least 33 per cent compared to the baseline.*
>
> *"We also consider it important to maintain our progress on child road safety and to tackle the pressing problem of young people's safety, and therefore propose a more challenging target for children and young people:*
>
> - *to reduce the annual total of road deaths and serious injuries to children and young people (aged 0–17) by at least 50 per cent against a baseline of the 2004–08 average by 2020.*

"To improve health, the environment and congestion, we are keen to encourage more walking and cycling. We wish to reduce the risk to the individual walker or cyclist, and to take into account expected growth in activity. We are therefore proposing a target based on the rate of casualties:

- *to reduce by at least 50 per cent by 2020 the rate of KSI per km travelled by pedestrians and cyclists, compared with the 2004–08 average.*

The draft strategy identified the following topics as some of the priority areas that need to be addressed over the coming years:

- **reducing the number of road deaths**, which have fallen at a slower rate than serious injuries;
- **reducing pedestrian and cyclist casualties in our towns and cities** – particularly in deprived communities;
- **protecting children**, particularly in deprived areas, **and young people**, who are greatly over-represented in the casualty statistics;
- **protecting motorcyclists**, who represent 20% of road fatalities but just 1% of traffic;
- **safety on rural roads**: 62% of all road fatalities in 2007 occurred on rural roads, which carry only 42% of traffic;
- **variations** in safety from area to area and road to road;
- **poor road user behaviour** amongst a minority, where drink-driving and failure to wear a seatbelt remain a problem
- **illegal and inappropriate speed**: excessive speed was recorded as a contributory factor in 26 per cent of road fatalities in 2007.[34]

Wider factors, notably the environmental, economic and social context, will influence what we will be able to achieve over the period of the strategy. The further ahead we look, the harder it is to predict the impact of these factors. It is, however, likely that we will be living in a more carbon-constrained world, but with a continued increase in demand for travel over the longer term.[34]

Although most road safety legislation is reserved to the UK Government, the recent Calman Commission Report[35] on devolution recommended more power be devolved to the Scottish Parliament. This included setting drink drive limits and setting speed limits. In June 2009, the Scottish Government published the Scotland Road Safety Framework called *Go Safe on Scotland's Roads it's Everyone's Responsibility*,[36] which also included targets for the reduction of fatalities and injuries that are lower the UK targets in *A Safer Way.*[34]

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5 Stress, Social Support and Community Severance

J Mindell, S Watkins

5.1 Stress and poor health

Mental illness and its associations with transport and in particular, the effects that mental health may have on the need or ability to travel, are dealt with in chapter 11, section 11.2. This section considers the impacts of transport on stress.

5.1.1 Stress and anxiety

It is a common experience that travel can be stressful. For example, busy roads are intimidating to pedestrians, especially children, disabled people, elderly people, and people with impaired mobility. Drivers find traffic jams stressful. There appears to be little research on this subject, possibly because stress is difficult to define and measure. Studies of bus drivers found that they experience more stress under one person operation than when a conductor is present.[1 2] Measurements of heart rate and blood pressure whilst driving have shown that they rise in traffic jams.[3]

5.1.2 Stress and mental and physical health

The first scientific evidence that mental well being may be a risk factor for physical ill health emerged in the 1950s with the demonstration that American accountants showed higher rates of heart disease in the busy period of the year when they were preparing accounts for filing with the Internal Revenue Service than in the quieter periods.[4] From this study emerged a significant volume of material around so-called type A and type B behaviour patterns which essentially showed that working under pressure to deadlines evoked in many people a particular behaviour pattern which was associated with increased coronary risk.[5]

Shortly after this, a considerable literature began to be created, and to accumulate over several decades, associated with various permutations of the names Kasl, Cobb and Gore.[6 7 8] This literature, of which the references given are merely a small sample, studied the effects of significant life changes on rates of self reported health and various measurements of physiological and biochemical parameters. A wide range of life changes were studied, including losing a job, divorce, imprisonment, bereavement, going into an old people's home, moving house, promotion, and getting married. A consistent picture emerged that life changes which strike at the root of a person's identity cause damage to health from the time that they first begin to be anticipated until the individual has fully adjusted to the change. This applies whether the change is beneficial or negative, and the impact on health is negative in either case, but beneficial changes have less impact and are adjusted to more rapidly. The effects were minor gastrointestinal upsets, increased rates of infection, and increases in cardiovascular risk factors such as cholesterol and blood pressure.

Alongside this, evidence emerged of an impact of social support on health (see 5.3.5 below) and later, of health benefits from the aesthetic conditions of the environment (see 5.1.5 below).

Various studies of occupational mortality, including Marmot's study of civil servants[9] have shown that social status is a positive factor in maintaining health and so is autonomous control of one's own work.[10] More recent and more controversial is the work of Wilkinson which suggests that the perception of inequality may be as important as its material consequences and that people may suffer health consequences from feeling that they do not share the lifestyles and opportunities of other groups of society.[11]

Various studies of stress at work have shown that responsibility is good for health if it is linked to the training, ability and resources to discharge it, but that responsibility without training, ability and resources is bad for health. There has also been research showing an adverse effect of threats hanging over people, a beneficial effect of striving for a challenging and meaningful goal, and a beneficial effect of a strong personal identity.

These studies provide us with a clear scientific position that various aspects of well being affect our susceptibility to disease and influence death rates.

The most plausible biological mechanism for these relationships is the stress reaction – the fight or flight reaction that occurs when an organism experiences a threat. This reaction makes the organism stronger and faster and increases the rate of its mental functioning (which explains why time seems to slow during a threatening situation). On the other hand it does this through physiological changes harmful to health including depressed gut motility, raised cholesterol and raised blood pressure and depressed immune system. The stress reaction is therefore a poisoned lifeblood, essential to life but harmful. If it became inappropriately persistent, or occurred very frequently, it could be predicted that the reduced gastrointestinal function would cause gastric conditions, that the depressed immune system would predispose to cancer and infection and that the raised cholesterol and blood pressure would cause heart disease. These are exactly the conditions that have been observed to be associated with health damage due to the various aspects of lack of well being. It is very likely therefore that this is the biological link in this chain of causation although this has not yet been clearly proven. Hence the description of these links as "stress related disease".

5.1.3 Transport and the stress reaction

Transport is of relevance to the treatment of stress related disorders, of whatever origin, because of its potential use as a mechanism for physical activity. Physical activity is an effective treatment for stress. The stress reaction is itself a preparation for physical activity, so it may be that physical activity beneficially mops up the physiological changes. The statement that physical activity burns off stress may therefore be true at a physiological as well as at a metaphorical level.

Transport can also be a cause of stress. The term "stress" is widely used in an imprecise way to describe a wide range of forms of difficulty to which human beings react in a variety of ways. Some levels of difficulty form healthy challenges which are enjoyable to surmount, and seem to be good for health. This variation in reaction to difficulties often leads to the whole concept of "stress" and "stress-related diseases" being rejected as imprecise and unscientific. This arises however only when the terms are used imprecisely.

In the biological model advanced above, "stress" is appropriately used only for those conditions which lead to the stress reaction arising with inappropriate frequency or persistence. We know what these are – rapidly recurring deadlines, threats to personal identity which lie outside the individual's control, threats which hang over people (the Damocles effect), life changes and anticipation of life changes, responsibility which the individual does not have the competence, training and resources to discharge, and being trapped in deeply unsatisfactory situations with no means of escape and nothing that the individual can do to address their problem. "Stress related diseases" are the diseases caused by inappropriate persistence or frequency of the physiological consequences of the stress reaction and we know what these are – heart disease, cancer, infections, and gastrointestinal conditions.

Transport creates these in a number of ways. The noise of traffic or aircraft, or the disturbance of normal life by heavy traffic in a street can be a chronically unsatisfactory situation that causes stress. Threats to a public transport service which the individual uses for an important part of their life can be a Damocles situation and can then grow into a life change. Air traffic control is a stressful occupation because of the recurring deadlines. Driving is a responsible activity which is likely to be enjoyable to those who do it well but stressful to those who are less skilled (casting doubt on a transport strategy which requires everybody to drive). Lack of transport may be a chronically unsatisfactory situation. Being deprived of personal transport, for example by becoming unfit to drive, can be a major lifechange.

5.1.4 Diseases of poor social support

Around the same time as the early evidence of stress related disease, a study of outcomes of pregnancy in wives of US soldiers showed that the strength of social support networks was a factor that influenced the rate of complications of pregnancy.[12] On the same topic, the study of the Granville Train Disaster in Australia showed that weak levels of social support were a strong predictor of serious mental illness in survivors of this horrific accident where a train left the tracks and collided with the supports of a bridge bringing the bridge crashing down on the train.[13] This led to further studies of the impact of social support on health culminating in the Alameda County Study which showed that strength of social support was associated with a four fold difference in all-cause mortality.[14] This difference, comparable to the effect of poverty, was so great that the researchers at first refused to believe it. They said that it must be an association due to reverse causality (illness causing deterioration in social networks) and they predicted that it would therefore decline as the cohort was followed for longer periods. It did not. It strengthened, as would be expected from a directly causal relationship and ultimately the researchers were convinced and presented it as a causal relationship. It is now clear that strength of social support is a major contributor to keeping up good health.

This adds to the concern at the finding by Appleyard & Lintell in San Francisco,[15] now repeated in Bristol by Joshua Hart,[16] that traffic levels in streets diminish the strength of social support networks in those who live in them, by diminishing neighbour interaction.

The biological nature of the relationship between social support and health is not documented. It may be that inadequate social support is itself a category of stress. It is however also widely believed that lack of social support is not a direct risk factor but that social support is a factor which makes it easier for people to cope with stress. On either of these explanations the diseases of inadequate social support would be simply another category of stress-related diseases and would consist of the same diseases as other categories of stress-related disorders (ie gastric conditions, cardiovascular disease, cancer, infection etc). However this has not been clearly demonstrated.

Transport has important contributions to social support in a number of ways. Lack of access to transport will diminish access to social networks. In those who have previously had better access to transport and have built their social networks around it the withdrawal of access will disrupt those networks. A street scene which encourages social interaction and consequential neighbourliness, as in a Home Zone will strengthen social support. The Appleyard/Lintell/Hart studies show that heavy traffic in a street will disrupt it.[15 16]

Potentially public transport offers opportunities for social interaction amongst fellow passengers but this opportunity is not widely embraced.

5.1.5 Health effects of poor aesthetics and lack of tranquillity

Aesthetically attractive settings are good for health.[17] The pioneering study for this work was the demonstration that patients recovered quicker from a surgical operation if they could see trees from their window.[18] Some other studies have since confirmed this association between views of greenery and physical ill health, including research which suggests that greenspace may diminish inequalities.[19]

The explanation usually assumed is that ugly and untranquil surroundings are a stress and that attractive surroundings enhance feelings of tranquillity and hence ease stress. On this explanation the link between aesthetics and health is another category of stress-related disorder. However this has not been demonstrated to be the explanation.

Congestion, heavy traffic and aircraft noise can shatter tranquillity. Many people find railways aesthetically attractive, especially those that are redolent of bygone days, probably because of their nostalgic impact. Canals bring the same aesthetic benefits as other water features. The streetscapes that we advocate to promote walking, cycling and social interaction will also create aesthetic surroundings.

5.2 Perceived Danger

5.2.1 Fear of injury

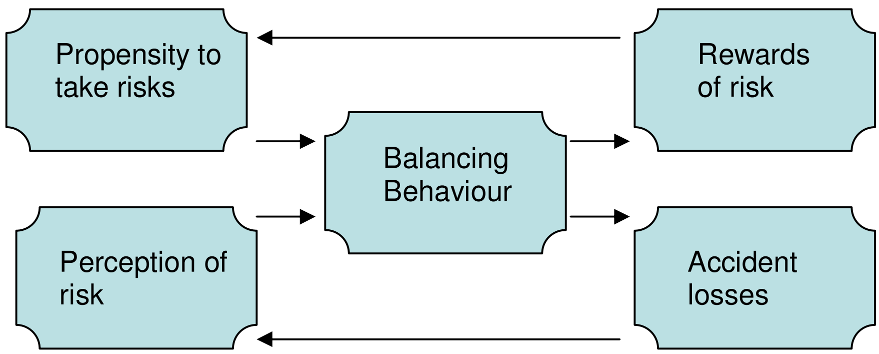
The perceived danger of travel may contribute to stress and / or cause people to restrict their travel with a consequent loss of any health benefits that they might otherwise have gained.[20]

For example, elderly people may become socially isolated. Danger may also restrict use of the environment around roads for functions other than travelling. For example, social interaction on streets may be limited (see 5.3.7 below) and children's outdoor play may be restricted. In 1999, 65% of survey respondents reported feeling threatened some or all of the time when walking, cycling or riding on country lanes.[21]

Despite the overall similarity of safety of cycling compared with other modes of transport (see chapter 4, section 4.2 and chapter 7, section 7.2), children in Britain who walk or cycle had twice the average European risk of death from a traffic collision at the turn of the millennium.[22] Parents also restrict their children's movements or escort them because of fear of attack by strangers.[23] Thus perceived danger from traffic leads to restrictions on children's independent mobility, with consequent increases in motor vehicle traffic to transport children (travel to school by car increased from 16% in 1985/87 to 30% in 1997/99[9] and 32% in 2006[24]) and concomitant decreases in fitness in children who no longer walk and cycle at will.

Danger, and its converse, safety, are particularly difficult to measure. They certainly cannot be reliably measured by numbers of injuries or crashes because behaviour is influenced by perceived danger.[25] For example, a busy main road in an urban area may have very few pedestrian injuries because pedestrians perceive it, correctly, to be so dangerous that they avoid crossing it as much as possible and take great care when doing so. The influence of perceived danger on behaviour is known as risk compensation (see Figure 5.1).

Figure 5-1 Diagrammatic Representation of Risk Compensation



If safety is the only factor being considered, then the impact of danger may be less than would intuitively be thought. It is unperceived danger which has the greatest impact on safety. However, safety is not the only consideration: the danger–aversion behaviour may be stressful or may be restricting (e.g. keeping children indoors instead of allowing them to play). Moreover, human beings are never perfect in their danger aversion: effective safety precautions are 'fail safe' and this principle needs to be applied to the human element of the system as well as the technical elements.

Changes in adults' concerns leading to accompanying children to school are shown in Table 5.1.

5.2.2 Fear of crime

Perceptions of danger are not limited to the perceived risk of collisions with traffic. Concerns about crime and attack are not uncommon. More than 11% of the population say they would travel more if they felt safer on the transport system.[26] In 2008, although 65% of all adults said they felt fairly safe when using public transport, only 20% of users and 15% of non-users felt very safe. In 2007/08, 54% of regular bus users aged 50-69 and 62% of those aged 70 or over felt very safe when travelling by bus, compared with only 40% of those aged 16-29. Men were slightly more likely than women to feel very safe at the bus stop or station (42% vs 38%) and to feel very safe when walking to or from the bus (43% vs 38%).27 27% of bus users had seen someone being insulted, pestered, harassed, threatened or spat at in the last 12 months; 10% had seen someone assaulted, mugged or robbed.[28]

Table 5-1 Whether children are accompanied to school by an adult and why, 2002 and 2008

	7-10 years		11-13 years	
	2002 (%)	2008 (%)	2002 (%)	2008 (%)
Usually accompanied by an adult	78	86	27	31
Usually unaccompanied by an adult	15	10	64	61
Sometimes accompanied by an adult	6	3	6	6
Accompanied part of the way	1	1	3	2
Why accompanied by an adult (all reasons)[a]				
Traffic danger	57	58	27	34
Fear of assault/molestation	47	29	29	23
Convenient to accompany child [b]	-	21	-	30
School too far away	25	22	34	29
Child might not arrive on time	12	18	14	15
Child might get lost	11	19	6	7
Fear of bullying	7	6	9	6
Other	22	12	32	15

a More than one reason may be given
b Not an option for participants in 2002
Source: National Travel Survey 2008[29]

Fear of crime is an important contributor to social exclusion, as it inhibits walking along streets that are perceived as threatening, and therefore limit access to services, people, or activities. A Street environment Index has been developed, based on the concept of ‘New urbanism’ and ‘Broken windows’. Broken Windows Theory suggests that the presence of a broken window that has not been repaired leads to a perception of neglect and danger, resulting in a gradual withdrawal of people from the street, thereby increasing the opportunity for further disorder, such as graffiti, with further withdrawal by pedestrians. The broken windows therefore become an indicator of a ‘fearful’ location. New Urbanism, on the other hand, encourages an open network of streets that are not only accessible but also friendly to pedestrians. The presence of pedestrians then reduces the opportunity for crime.[26] This resembles the ‘safety in numbers’ seen for injuries to pedestrians and cyclists, discussed in chapter 7, section 7.4. Although only 4% of the population in 2002/03 were victims of crime, 13% of people reported feeling unsafe and 21% a bit unsafe when walking in their local area after dark. The levels of fear felt by pedestrians depends on the openness of the space around them (the prospect) and the number of hiding places for potential assailants (refuges). Fear ranges from the most safe locations (open prospect, low number of refuges) to the most unsafe (blocked prospect with many hiding places).[30]

5.3 Severance of communities by roads

5.3.1 Introduction

Community severance arises when roads bearing high levels of traffic cut through communities. The physical presence of the traffic, particularly heavy goods vehicles, as well as the risk of collisions and injuries presents a barrier to the community, dividing it into two. This limits or disrupts access to goods, services, and people.[15 31] A recent review of community severance noted that the effects were broader than merely division of people from services, and included psychological effects of traffic and effects on quality of life and social cohesiveness, as well as implications for accessibility planning, mobility, and social exclusion.[32] However, health was not mentioned. The literature on health aspects of community severance has recently been reviewed.[31]

Similar effects can be caused by presence of fixed obstructions such as railway lines or rivers.

5.3.2 Definitions

The term "severance" was used by Liepmann in 1944, when she discussed the "severance of dwelling and work-place" and the effects of this on community life,[33] a factor raised in 1924 by Pigou.[34] In 1969, the UK government Urban Motorways Committee recommendation regarding the inclusion of indirect social costs when planning main urban mentioned 'severance', by which it meant the physical separation, visual effects, noise, and disruption of neighbourhood lifestyles that heavy traffic could cause.[35] Severance was defined in the late 1970s as

"the sum of the divisive effects a major urban road has on the inhabitants on either side of it."[36]

In 1983, the Department of Transport defined 'community severance' for trunk roads as:

> *"the separation of residents from facilities and services they use within their community, from friends and relations and, perhaps, from place of work as a result of changes in road patterns and traffic levels."Department of Transport. Manual of Environmental Appraisal. London: DoT, 1983, quoted by the TRRL*[35]

This was amended following a 1991 Transport and Road Research Laboratory review which suggested that 'community severance' could occur without traffic changes. Consequently, severance was considered more broadly as being:

> *"perceived by the public as a number of effects including pedestrian delay, trip diversion and suppression, , pollution, perceived danger and overall unpleasantness".*[35]

That review therefore proposed a definition of community severance as:

"the sum of the divisive effects a road has on those in the locality".[35]

James and colleagues, in their 2005 review,[37] listed 12 definitions of community severance from 1924 to 2001, many but not all of which were confined to travel behaviour.

5.3.3 Measurement of community severance

A major problem with conducting research into the health effects of community severance and how to prevent or lessen it is that it cannot currently be quantified effectively,. Berkman's Social Network Index predicted an increase in all-cause age-adjusted mortality in middle-aged men (RR 2.3 for those with most connections compared with those with least) and women (RR 2.8) with relative risks 1.8 to 4.6 for different age and sex groups.[14] However, this index can be applied only by individual questionnaire and cannot be derived from routine data. Interventions on a housing estate that included traffic management improved mental health but these effects are also not yet quantifiable.[38]

One approach is to try to quantify community severance itself. Pedestrian delay can be measured eitheras delays prior to leaving the kerb or as the total crossing time. It was proposed in 1969 as the most important indicator of severance by major urban roads by the Urban Motorways Committee.[39] Pedestrian delay was used in the willingness to pay study by Garrod and colleagues of traffic calming.[40] Appleyard and colleagues found that median delay before being able to cross the road ranged from nil on the street with light traffic to one to two minutes with very heavy traffic (Table 5.2).[41]

Table 5-2. Pedestrian delay in San Francisco[41]

Traffic level		Proportion of pedestrians waiting no time or only a few seconds	Median delay before crossing the road
Category	Traffic flow /d		
Light	0-2,000	94%	Nil
Medium	2,000-10,000	49%	30 seconds
Heavy	10,000-20,000	25%	30 seconds
Very heavy	>20,000	19%	1 – 2 minutes

A 1966 report proposed a peak figure of 300 vehicles/hr as an appropriate environmental standard, because of the adverse impacts from noise, fumes, vibration and the limitation of free pedestrian movement at traffic levels above this. For example, , at least 50% of pedestrians would be delayed by hourly traffic flows of 500 or more.[42] The 1963 Buchanan report showed that as road widths increased, so the volume of traffic required to cause the same pedestrian delay fell.[45] More recent studies have measured then modelled pedestrian delay on shopping streets. Two assessed delay prior to leaving the pavement and a third assessed total crossing time.[36] The latter measure is obviously more affected by the road width more than the former measures, although it is likely that pedestrians consider road width and their ability to cross to the other side when making their (subconscious) decisions regarding when it is safe to step into the road.

It has also been suggested that a proxy for pedestrian delay could be obtained by categorising streets using the proportion of street-dependent and vulnerable pedestrians (who walk more slowly[43 44])Error! Bookmark not defined. and thus require a longer gap in traffic for safety.[35] More sophisticated form of this approach was proposed by the Standing Advisory Committee on Trunk Road Assessment (SACTRA)[35] and the Transport and Road Research Laboratory[35] (TRRL). TRRL proposed identifying vulnerable groups, such as those with reduced physical mobility) or greater safety needs (such as children of various ages, the elderly or disabled, other vulnerable adults) or those dependent on the particular locality, such as certain ethnic and religious or low income groups). The TRRL approach then defined:

- the facilities to which access is potentially impaired (eg healthcare; education; services such as post office, day centre, launderette; social; leisure; shops; and transport); and
- the catchment areas from which users may be drawn).

Their proposed severance index, incorporating the above information combined with traffic density and allowing for the presence and acceptability of crossing facilities, if relevant, has a number of disadvantages, including the assumption that everyone would choose to go to the nearest facility. It also does not account specifically for acquaintanceships in the street and the ability to form weak ties with neighbours, i.e. the diminution in social contacts that may be the most subtle and yet an important issue for health.

A second approach is to measure health outcomes, health-related behaviours, and environmental factors, that may be affected by community severance, or indeed changes in these that may be attributable to community severance or attempts to mitigate it. Examples include access to specific goods, services, or people;, walking and cycling rates; injury and deaths from road traffic collisions; noise levels; traffic volume; and pedestrian delay in crossing roads.[45 46 47]

Both sets of approaches can provide only very limited information on the changes in inequalities that community severance and its sequelae may entail. Although it is possible to model expected injuries and fatalities from predicted changes in traffic flows, and the potential impact on inequalities relating to type of road user,, those relating to age, ethnicity or social class are difficult to quantify.

5.3.4 Impacts on travel behaviour

Reports from transport professionals have tended to focus on major roads, with rural motorways[35] and urban through routes[36 48 49] being barriers particularly to journeys on foot; construction of by-passes reduce the barrier effects of traffic in the bypassed towns or villages.[50]

The divisive effects of major roads result in reduced journeys made because of increased journey time or because of poorer environmental quality. The first was formerly referred to as 'real severance' and the latter as 'perceived or psychological severance'. Although the impacts on households is similar for both,[36] the distinction was important to transport planners: the impact of increased journey time could be modelled, whereas travel behaviour changes due to perceptions could not be.

Guo and Black divided the severance effects of roads into two components: static and dynamic. The former is due to the barrier effect of the road; the latter is due to the effect of vehicles moving along the road. Static severance itself comprises both the 'real' and 'perceived' severance referred to above. Dynamic severance is defined as the time-dependent barrier effect caused by conflicting streams of traffic movements (i.e. pedestrians and vehicles).[48]

Tate, cited by Bradbury and colleagues, notes that the physical barriers may result in 'trip delay' – a more time-consuming journey, due to added delay, or in 'trip diversion', due to added distance to reach a crossing point[32] or travelling to a different destination. Busy streets with heavy, fast traffic deter pedestrians from attempting to cross it, even among those who are fully mobile,[23] and particularly among those who walk more slowly.[51] Mitigation measures, are often unhelpful because of requiring a diversion, adding to the journey length and time[48]; are – or are perceived as – dangerous or unpleasant, such as bridges or subways[36 49] or pedestrian crossings may not allow sufficient time for older pedestrians to cross in the allotted time.[43 52] Some people, particularly young adults and children, will often prefer to run across trunk roads, risking injury, than make a diversion to use a crossing point.[32] Others avoid crossing points because of fear of crime on footbridges or in subways or because of difficulties using these, for example if a wheelchair user or pushing a buggy.[32] Major transport routes can also increase conflicts between vehicles and pedestrians.[53] Thus busy roads lead to journeys not being made[54] - 'trip avoidance'. Alternatively, it can lead to journeys that would have been made by bicycle or on foot being made by car.[32]

5.3.5 Access to people and impacts on social networks

Community severance limits or disrupts interpersonal networks and reduces social contact, as was originally shown by Appleyard and Lintell. Their pioneering study of three parallel streets in San Francisco bearing light, moderate and heavy traffic found that the number of friends and acquaintances residents reported was inversely proportional to the volume of traffic on their street.[15 41] The street with heavy traffic was used solely as a 'corridor' to use as a route to elsewhere but the street with little traffic allowed social interaction and a strong sense of community.[41] Hart has recently replicated these findings in Bristol, though residents of the light street (140 vehicles per day) had on average 5.4 friends on the street, higher than the 3.0 friends on the San Francisco quiet street (2,000 vehicles per day), suggesting more community severance on the quiet San Francisco street than had been appreciated.[16] Thus, residents living on busy streets are likely to have smaller social networks which, as discussed in 5.1 above, are health promoting. Reduction in social contacts is associated with higher mortality and morbidity in the elderly,[14] more unhealthy behaviours,[55] and possibly with worse mental health more generally,[56 57] even among those who were healthy at baseline.[14]

It has also been reported that the presence of a major road contributes to a reduction in the sense of community.[32]

5.3.6 Access to goods and services

The difficulty of crossing the road may separate housing from, and diminish access to, health promoting facilities, such as schools, parks, recreation facilities, shops and health services.[49 54] Community severance has also therefore been linked with social exclusion.[32 49] Major roads form boundaries delimiting neighbourhoods. This effect increases with the age of the road, as new generations limit themselves – or are limited – to considering only the area on their side of the road as part of their neighbourhood.[36]

5.3.7 Other impacts

Increasing volume or speed of traffic also affects the livability of streets, in other ways, especially road traffic collisions, perceived risk[58], and subsequent curtailment of healthy behaviours, such as walking, cycling, and the use of residential streets as places to meet and play.[15 23 64] More recently, children have not been playing outside as much even where adult supervision would be available, also resulting in less socializing by adults.[16] Reduced social interaction can also adversely affect children's development, due to reduced opportunity for exploration and social and motor skill development.[64] In parallel with the increase in traffic on local streets, there has been a reduction in the provision of play spaces.[59]

Children's independent mobility has been curtailed, with an increase in the average age at which they are allowed to travel unescorted by foot, bicycle or bus;[60] a high proportion are insufficiently active, partly through reduced walking and cycling, leading to high obesity levels.[61] Parents' concern over the risk to children's safety from traffic, particularly where they need to cross busy roads, are major barriers to children walking or cycling to school.[62 63] Lack of independence also impacts on physical health, self-esteem and mental well-being. Traffic, whether moving, stationary or parked, reduces the visual amenity of streets.[56] Traffic noise, discussed in more detail in chapter 6, section 6.4, is also intrusive. In Appleyard and Lintell's study, those living on the light traffic street included all their building and even the entire street as their 'home territory'.

However, because of the intrusion of traffic noise, those living on the heavy traffic street restricted their usable living space: in some cases, even parts of their own flat was not 'home'.[15] Some people cope with the problems of traffic by changing their work shift patterns.[32]

However, despite the associations described above, no prospective study of community severance and health has been undertaken.[31] It should be noted that this is no direct evidence of longterm effects on health from community severance, not evidence of no effect.

5.3.8 Effects on inequalities

These effects are likely to be greatest on people who are very young, very old, or have a disability[49] – the very people who are in greatest need of such facilities and who are most likely to lack social support networks. The transport literature identifies these groups that are affected more as those who are more dependent on walking for transport.[36] However, this ignores the social use of the street when not travelling, which recent research shows by Hart suggests could be important.. There is also an effect on carers: those living on almost traffic-free streets have more social contacts locally and know more adults willing to help look after their children than those living on streets with more traffic.[64]

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6 Other health impacts of transport

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6.1 Introduction

Transport is the movement of people (or objects) from one place to another. It can both promote and damage health (Table II-1, Introduction to Section II). Each of these effects is discussed in Section II. Major effects are covered in separate chapters; the remainder are covered below. It should be noted that some impacts (severe injury, air pollution levels) are more easily measured than others (stress, community severance, fear).

6.2 Access to places

The most important travel destinations include employment, education, shops, recreation, social support networks, health services, and the countryside. All of these may be beneficial to health. For example, access to shops selling healthy food at affordable prices is necessary in order to have a healthy diet. Exercise may be obtained in the countryside and at recreational facilities such as sports centres and swimming pools.

Social support is difficult to measure, but studies which have used measures such as marriage, having close friends and relatives, and being a member of groups such as church, have found lack of these things to be correlated with measures of psychiatric[1] and physical morbidity[2] and with mortality from all causes.[3] This is a substantial effect; for example, the four fold difference found in the Alameda County Study is equivalent to the impact of differences in wealth, so much so that the authors were reluctant to accept it until they had gathered further data to exclude reverse causality as the explanation for the association (see chapter 5, section 5.3).

Thus, the function of a transport system is to enable access to people and places. Mobility is the means by which this is achieved; it is not necessarily an end in itself. The greater distance that people travel today compared with half a century ago is often presented as if it were in itself a good thing. Visiting a good friend with whom you would once have lost contact is a powerful addition to human happiness. Visiting a part of the world you would once have had no chance to visit is an addition to human choice and experience, albeit one that in future will need to be restricted. Travelling 10 miles to the supermarket because there is no longer a local shop is an inconvenience balanced with the benefit of wider choice. Travelling 10 miles to the hospital because the one closer to you has closed is an inconvenience with no countervailing benefit, unless the resources saved have been used to enhance the quality and range of care you receive. Commuting 50 miles each day because geographical mobility of labour has led to you and your partner finding their jobs moved 100 miles apart is a hardship.

To speak of mobility as a good thing is to conceal the fact that it is an amalgam of benefits and disbenefits ranging over the whole gamut from major additions to happiness through to real hardships.

6.3 Recreation

On the whole travel takes place for the purpose of getting somewhere. Its significance is the benefit derived from being able to visit the end destination. However some travel takes place in order to see something en route – to traverse a particularly beautiful path, road or railway for example - and some for the joy of the journey – a cycle ride or horse ride in the country on a sunny day, or a trip on a steam train.

Transport is, therefore, relevant to recreation in two ways – as a means of access to recreation and as a form of recreation in its own right.

Recreation is good for people. Active recreation is especially good for them. Recreation which involves social contact or the tranquillity of appreciating beauty is also particularly beneficial. A cycle ride with a partner through beautiful countryside might score on all three counts. It would be unfortunate if its value were neglected just because its destination is the same as its origin and therefore it is seen as purposeless.

Sometimes travel which has arriving somewhere as its main purpose can be given the added recreational character of a pleasure trip, for example when somebody who has to travel from Central London to Greenwich chooses to do the journey by boat not because it is faster or cheaper but because it is different or more interesting, or when somebody is able to walk to work along an attractive route through a park, or when somebody travelling from Manchester to Middlesbrough chooses a route through the Yorkshire Dales rather than one along the M62. This potential for transport to offer incidental benefits is often neglected. It can be a motivator for people to choose a particular mode. People will walk further if the walk is pleasant. Somebody who wants to take in the Yorkshire Dales on their journey may choose to take the car if there is no public transport that follows that route, or if it is too infrequent or inflexibly ticketed to allow breaks of journey to admire the view, explore a village or try a particular pub.

6.4 Noise Pollution

Noise is another type of pollutant. Its effects on health are difficult to estimate. A 24-hour survey in England and Wales in 1990 recorded noise from roads outside 92% of the dwellings sampled.[4] A 2006 survey found that half a million Britons move house each year because of noise,[5] although of course, it is not clear to what extent traffic was the main source of noise. Defra produced noise maps, covering conurbations of 250,000 people or more plus the busiest roads, airports and railways. Under EU legislation, the government must develop action plans for the noisiest areas. However, many reasons, including excessive cost, can decrease the requirement for implementation.

Noise is also a problem in rural areas[6] disturbance from traffic noise is a problem and can be severe even in lightly populated rural areas. Traffic noise causes disturbance at a distance as well as alongside roads but current approaches to assessing road noise nuisance are inadequate for rural areas. Noise adversely affects both local residents and those visiting countryside locations for leisure.

Vehicle noise is created by the tyres interacting with the road as well as the noise from engines, exhaust systems, transmissions and brakes. In general, tyre-road interaction is the main cause of noise above 55kph for most cars, with engine noise predominating at lower speeds. Although individual vehicles have become quieter in the past two decades, this is almost entirely due to reduced engine noise, with little effect on tyre noise.

The EU is currently revising its Tyre Noise Directive: more stringent standards for tyres could reduce average car noise by up to 5.5 decibels.[7] Quieter road surfaces (notably porous asphalt) can reduce noise by 4-8 decibels – the equivalent of almost halving the volume of traffic. Stone mastic asphalt, a surface more commonly used where roads may be dug up for utilities, can cut noise by 2-3 decibels. Good acoustic barriers can reduce average noise levels by 5-15 decibels, although the number of locations where these can be used is limited. Vegetation, if high, wide and dense enough, can cut traffic noise. A 200ft width of dense vegetation can reduce noise by 10 decibels, as well as absorbing air pollutants, but this is feasible in a limited number of locations.

In England and Wales in 1986, 11,422 offences relating to noise from motor vehicles were recorded, 90% of which involved faulty silencers; in 2001 there were 3781 similar offences recorded representing a fall of 67% (Table 6-1).[8]

The most common problem associated with traffic noise is annoyance.[6 9] Noise can also lead to avoidance of the street for social use and constriction of living space even within the home to avoid interference by traffic noise with conversation, watching television, working or even eating.[10]

Table 6-1. Noise offences[a] relating to motor vehicles

	1986[b]	1991	1996	2001
England	10,496	7,104	5,328	3,552
Wales	926	572	381	229

a Includes written warnings issued for alleged offences, findings of guilt at Magistrates Courts and Fixed Penalty Notices.

b Fixed Penalties not introduced until October 1986.

Source: Home Office[8]

Noise from traffic is unlikely to lead to hearing loss but contributes to stress-related health problems such as hypertension,[11] including raising blood pressure in children,[12] and minor psychiatric illness.[13] Traffic noise can also impair health by causing loss of sleep[10 14 15 16] and can interfere with performance.[17] People with existing mental or physical health problems are the most likely to be sensitive to traffic noise.[17]

6.5 Spatial Planning

Urban sprawl not only interferes with amenity by building into the countryside, negating the Green Belt principle,[18] but also generally leads to lengthier journeys to work, school and other facilities, adding additional commuting time to residents' lives and reducing the proportion of journeys that can be walked or cycled. Planned mixed use has the opposite effect. Spatial planning may contribute in a number of ways to promoting – or hindering - walking and cycling.

Spatial planners should be aware of the American evidence on the marked, beneficial effect of pedestrian-permeability on mean population weight,[19] (see chapter 2, section 2.2.1).

The Appleyard & Lintell[10 20] and Hart[21] studies have demonstrated that society should regard it as seriously unsatisfactory to have a steady flow of traffic in a residential street (see chapter 5, section 5.3).

Parks and greenspace are important contributors to walking[22] and so is the retention of city farms or country parks within the city. Living walls (walls with plants climbing up them), green roofs, green security (thorny hedges rather than metal fences), gardens and street trees should all be encouraged by spatial planners for a number of reasons. They contribute to overcoming the urban heat island effect, there is increasing scientific evidence that they improve health directly by promoting tranquillity,[22] but they also make pedestrian routes more attractive and therefore more likely to be used.

6.6 Loss of land and planning blight

When it is known that an area is going to be extensively redeveloped with demolition of many of the existing buildings and impacts on others, the uncertainty is itself an important source of stress – the series of studies by Beale and Nethercott shows that when a major life change is anticipated health deteriorates, with increased levels of infection, gastrointestinal diseases and cardiovascular risk from the time the change is first feared up until the point at which people are settled into the new situation and adjusted to it.[23 24] These effects probably arise from stress (see chapter 5, section 5.1). If prolonged they are certainly sufficient to cause increased death rates.[25] In the case of planning blight, these stress-related effects are aggravated by a short termism in which people are unwilling to invest in buildings whose future is uncertain so that the area generally becomes run down. Planning blight can arise for many reasons but transport schemes such as new roads are an important source of it.

Considerable amounts of land may be used up by transport infrastructure, particularly roads for motor vehicles (which take more land than railways, tramways, cycle paths or pedestrian paths). For example, in Los Angeles, a city which has developed relatively recently and where most travel is done by car, two-thirds of the land is devoted to travel: one-third for roads and one-third for parking.[26] As well as land actually used by roads and the planning blight on land earmarked for building roads, the land taken by any other development will be increased. Motorways use large swathes of land in rural areas, needing far more land than railways. Some of the land lost was previously used for agriculture, particularly food production; some was countryside of leisure or amenity benefit to people - and native flora and fauna. The World Bank has drawn attention to the way that changes of land use as a result of extending or 'improving' transport infrastructure may modify the outcomes.[27]

All of these effects diminish land available for health promoting uses such as parks and play areas. Evidence is increasingly emerging that greenspace has a valuable health effect,[22 28 2922] so the replacement of gardens and local greenspace with roads and parking will be damaging to health. If tarmac replaces open ground, drainage is affected and flood risk is increased. The effects on greenspace can to some extent be mitigated by green roofs and living walls, but this does not diminish the use of usable recreational space.

6.7 Parking

Public health literature tends to focus on the *use* and the *ownership* of private transport. A third, and neglected, dimension is the *accommodation* of private transport, i.e. parking.

'*We have expensive housing for people while cars live rent free'.* Donald Shoup[30]

An important element of the problem described in section 6.6 above is the demand for land for parking and in particular the demand that it be immediately adjacent to the building it serves. From a health standpoint, it would be highly desirable that parking, other than disabled parking, should not be immediately by the building that it serves but a reasonable walking distance away. When it is suggested that this concept be applied to residential developments so as to improve the streetscape, it is rapidly discovered to be a fiercely countercultural proposition.

This section traces some of the connections between parking and inequalities, social networks, injuries and mental wellbeing. When space for parking is incorporated into the cost of development, it subsidizes cars and provides a disincentive to use other forms of transport. Cars become more affordable and each of the services associated with that development become less affordable,[31 32] for example housing, goods and, in the case of hospitals, health services. This section does not look further at issues associated with free, or very low cost, parking in town centres, retail developments or hospitals (for the last of these see section 19.3.1).

In 2007 the Commission for Architecture and the Built Environment (CABE) found that of 643 residents in 33 new developments[33]

- 47% thought there was not enough car parking attached to individual homes (for example, a garage and/or driveway);
- 62% thought there was not enough other car parking;
- 41% thought the location of this other car parking was inconvenient; but
- 31% thought that roads and car parking dominated their development.

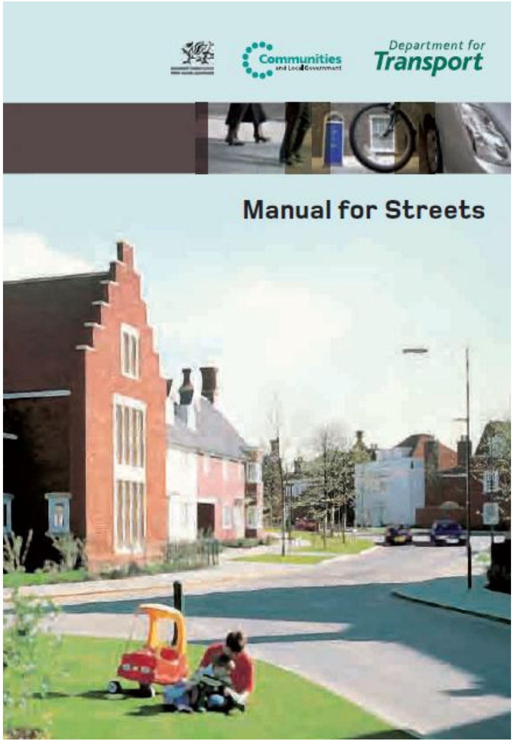
This echoed a theme from an earlier survey where residents stressed the importance of parking, most said they use a car for most or all of their journeys from home and some stated they had never walked out of the housing development.[34] The same publication noted that obtrusive areas of car parking dominated the majority of schemes, and had a negative impact on the public realm. Many new housing developments resemble houses in a sea of tarmac. There is little space for pedestrians or for children to play: the cover of the DCLG and DfT publication *Manual for Streets* shows an adult and child playing, next to a toy vehicle, on a small strip of grass surrounded by tarmac (Figure 6-1).[35]

Local authorities set parking standards. At the time of writing these accord with standards set in Regional Spatial Strategies: for example The London Transport Strategy states that *'parking regulation is ... an effective method in encouraging the use of public transport, walking and cycling which in turn can mitigate the negative environmental impacts of road traffic. Loading regulation can be an effective way of influencing the time of delivery and its effect on congestion'*.[36] Other commentators agree with this analysis but are less certain that they are being used correctly.[30,31,32,37]

Parking standards are clearly important to the quality of the built environment and to health and wellbeing. Drivers are inconvenienced by having to search for parking spaces. Parked cars can obstruct vision[38] and increase social severance rendering the pedestrian environment inhospitable.[39] This affects everyone but especially vulnerable groups. A visually impaired man in Wales was arrested after consistently requesting help from the police to deal with cars parked on the pavement.[40] A 75-year blind old man describes the hazards posed by cars parked on pavements.[41] A blog, written from the perspective of 'a 20 something blind woman' states[42]:

"As a pedestrian, I am acutely aware of how much drivers and car owners think that their cars are more important than anyone who tries to use the sidewalk. I personally live on a street that has limited parking because the driveways are too close together. Instead of my neighbors parking far from their homes, or using their garages to park their cars, too many of them choose to double park in their driveways, which blocks the sidewalk. Alternatively, some of them will park on the sidewalk if their vehicle is too large to fit in between the driveways. Both of these actions are illegal, but I have a feeling that if I called the police to complain, nothing would change."

Figure 6-1 Manual for whom?



In San Francisco, California, USA a voluntary sector organisation working with the visually impaired has run a successful campaign Sidewalks are For Everyone (SAFE).[43]

What has been reported? The effects of heavy traffic on social networks was reported in section 2.1 above.[10 20 21] In 1990 Hillman et al asked what the psychological effect was going to be on generations of children whose world is constrained by the car.[44] In 1998 Roberts et al reported that a high density of curb parking is associated with increased risk of injury for children.[45] In 2005 the Greater London Authority reported that in streets where the majority of gardens have been converted into parking bays the width of the road is effectively trebled leading to increased traffic speeds and increased risk and occurrence of accidents.[46] This also applies to streets where people use the pavement for accommodating their vehicles. A survey carried out for the *Manual for Streets* reported that parking issues were the most frequently mentioned issue concerning what respondents did not like about their streets. This included having problems parking, other people parking inconsiderately and problems with other residents using designated parking spaces.[47] Parking was found to reduce speeds on links and at junctions by 2mph to 5mph because drivers react to the perceived danger by reducing their speed. The effect of this on safety is unclear. Reducing speed increases relative safety, but parked vehicles reduce lines of sight and can consequently obscure (crossing) pedestrians. There was no clear indication that this resulted in higher numbers of casualties from the accident statistics analysis. However, many of the reported accidents from the household survey were related to parked vehicles.[47]

In 2007 Smith noted that well managed parking can provide friction and slow the flow of traffic thus giving greater priority to pedestrians.[48] The management of parking is of crucial importance and as noted in the examples above, often neglected. It is worth noting that a yellow, or double yellow line, extends from the centre of the road to the edge of the highway. This includes pavements and verges alongside the yellow lines. A car parked on a pavement next to a yellow line is liable to the same parking restrictions as one that is parked on the road. Pavement parking is a civil and not a police matter. The police are only likely to intervene if they see a car moving on a pavement. Actions to counteract pavement parking seem to be restricted to distributing leaflets[35] or to local action by individuals or groups.[40,41,42,43]

In summary, parking distorts the value of land, property and services in favour of car owners. It enforces the dominance of the car in our built and social environment and it creates an inhospitable environment for pedestrians. Parked cars can provide a hazard to everyone and especially to older people, children and visually impaired people. Parking is essential for people with special needs regarding mobility and it has been described as slowing traffic. Parking needs to be properly managed and regulations need to be enforced. Actions to control parking must be shown to be of immediate benefit to the local community. Shoup describes how parking charges in Pasadena, USA were used for local improvements and how this has proved to be a politically successful way to unlock the public realm.[30]

Figure 6-2 Your meter money makes a difference (www.streetfilms.org)

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7 Cycle safety: an evidence-based approach

Malcolm Wardlaw

7.1 Long term trends in cycle casualties

Detailed information on long term trends in cycle casualties can be found in chapter 4 (Injuries), section 4.2. It summarises problems of hospital statistics in relation to road casualties, in particular the different definitions used for 'transport accident' for cyclists and for pedestrians, that distort the data: cyclists who fall when on the highway are coded as road traffic injuries but pedestrians who fall are not (Table 4-5). Additionally, children playing off road will have cycle injuries coded as transport accidents if the place where the injury happened is not specified. Serious injuries to cyclists caused by collisions with motor vehicles are accurately reported by police in Stats 19 but are under-reported for pedestrians (Table 4-4). Section 4.2 identifies a number of other sources of bias in routine data, that prevent 'like with like' comparisons of injury risk by mode.

The generally downward trend in road traffic fatalities has been similar in drivers and cyclists (Figure 4-1). By 2007, cyclist deaths had fallen from almost 7% to fewer than 5% of all road traffic deaths (Figure 4-2). Section 4.2.2 provides an overview of cycling injuries among children. Although the risk is higher overall than for child pedestrians, this is almost totally accounted for by the predominance of boys among child cyclists.

7.2 Risk: the fundamental misperception of cycling

7.2.1 Risk of cycling for the individual

Is cycling a risky form of travel? If one states that the average risk of mortality amongst UK cyclists is about 0.4 fatalities per million hours' use (f/mhu), what does that really mean? It is in fact an exceedingly low risk. Imagine a cyclist who rides one hour per day for fifty years. This would amount to almost 160,000 miles of cycling. The risk accumulated in all that riding would be one chance in 140 of fatal injury. This analysis is pessimistic in that it assumes no learning with experience. Still, the lifetime risk is about the same as for the average European driver. The two big differences are that the cyclist would almost certainly not kill anybody else, and they could expect to live a longer, healthier life. That is one of the reasons why we encourage active travel. Another calculation, assuming the average distance cycled is 60km per year, puts the risk to an individual as one fatality every half a million years.[1]

What about risk of less severe injury? What is the risk of being injured in a collision and getting admitted to hospital? Taking the national average, each serious injury corresponds to two million km of cycling. Since a typical cyclist only rides about 1,500km per year, it is clear that the odds of being seriously injured, for the typical cyclist, are very low - less than one in a thousand annually. So, as an absolute risk, cycling is a low risk form of travel. An individual who completes the National Cycling Proficiency, uses a well-equipped bike, and has a conservative attitude faces very low risks. It should not be thought that cycling incurs risks that are unusual by the standards of daily life. It should further be noted that cycling in a city where the bicycle is popular is safer still, following the safety in numbers effect – as will be detailed in Section 7.3 below.

It must also be recognised that not all cycling is for transport. A sporting cyclist who rides 20,000 miles per year at 20mph is not ‘typical’ or anywhere near it. Likewise, off-road mountain biking and BMX riding are distinct from cycling as transport. Judgement of risks in these activities would require separate analyses but are often rolled up into statistics of “cycling injuries” exaggerating the issue.

7.2.2 Implications of more cycling on road casualties

From a policy perspective, it is necessary to study risk across populations in more detail. Cycling might be a low risk form of travel for the individual, but so is driving. It does not mean we can be indifferent to the implications of an increase in cycling. Would more cycling lead to an increase in road deaths and injuries?

There are two ways of approaching this question. One is to review cases where there in fact were substantial increases in cycling. This is dealt with in Section7.3 below. The other approach is to compare the population level risks of cycling with other modes of travel, especially driving, since the purpose of active travel promotion is to replace driving with cycling.

In the 2007 edition of *Road Casualties Great Britain*,[2] the DfT presents a risk assessment of walking, cycling, driving and motorcycling, for the first time. It follows recent work by independent researchers in Britain and Denmark.[3 4] The risk per hour is taken to be the most significant measure because personal travel budgets are fixed at about one hour per person per day.[5] This result is consistent across time and even across wide ranges of human cultures, from pre-industrial to post-industrial.[6] The population spends the same amount of time travelling now that it did in the early 1970's; the reason for traffic congestion is because more of those hours are spent in cars and fewer on buses, trains, bicycles or walking. Overall distances travelled have increased. Modal shift to active travel means less time in cars; shorter distances; more hours of public transport, walking and cycling; but no overall change in the time spent travelling. Time is fixed for all road users, but mobility varies greatly between drivers, cyclists and pedestrians. This is why risk per hour is significant, while risk per km travelled is of only limited relevance, mainly to compare walking and cycling.

Taken at face value, the results appear rather mixed. The risk per km travelled is lower for cyclists than for pedestrians. However relative to driving, the risk of fatality per hour is four times higher, and the risk of serious injury is six times higher for cyclists. These ratios appear to contradict Section 7.2.1 above, claiming that cycling is low risk travel but there is actually no contradiction. Driving is very safe in Britain, relative to most other industrialised countries. A small risk multiplied by a small factor remains a small risk.

It must be emphasised that cycling is at least ten times safer than riding a motorbike. It is therefore inappropriate to lump cycling and motorcycling together as is sometimes done by agencies that do not consider the relative risks: even the World Health Organisation is capable of this error.[7]

Is the same individual really four times more at risk if they leave the car and get on their bike? The answer is no, they are not.

Comparison of cycling risk with other travel is fraught by a number of complicating factors.

1. Each travel mode involves a different sub-group of the population. In the UK, most cyclists are young and male, two factors that correspond to the highest injury and death rates from trauma in any population. In some other countries, the cycling sub-population is about the same as the national population, because most people are cyclists. This factor alone will account for at least some of the difference in average risk observed between the UK and cycling countries.

2. Cyclists spend less time travelling than drivers do (approximately 120hrs versus 300 hrs per year, respectively). This is at least partly because cycling is far more productive, losing little time in traffic jams and looking for parking spaces. The difference in annual risk between cyclists and drivers is thus negligible. Indeed, the annual risk even to a more than averagely active cyclist will be lower than the annual risk to drivers in many industrialised countries, notably Belgium and France.

3. The relative risk of driving is reduced by mileage on long-distance trunk roads and motorways, where risks are low. For example, across Europe 25% of distance driven, but only 8% of deaths, are on motorways.[8] There are no comparable journeys for cyclists. It would be fair to consider the train and cycle combination as a veritable transport mode in which case figures would include the safe, long-distance miles travelled by cyclists in trains considerably reducing the risk result for cycling. Alternatively, the risks of travel by bike should be compared with the risks of urban and rural driving excluding motorways and ‘A’ roads. This has been done in the Netherlands: accident rates were 20.8 per million kilometres for car drivers and 21.0 per million kilometres for cyclists when motorway journeys were excluded and the risk to other road users was also included. It should be noted that these figures include cyclists aged 12-17y but no drivers in this high risk age-group.[9]

What is the risk in driving? The average risk across the whole driving population is one number, but the risk experienced by individuals spans a range. The data in Tables 7-1 to 7-3 below illustrate how strongly age influences the risk in travelling. Data from the mid 1980's showed that young drivers were ten times more at risk than middle-aged drivers.[10] More recent UK data show this difference has increased. The data in Table 7-3 are based on National Travel Survey and STATS19 road fatality data. The NTS data are less reliable for cycling, with the result that the cycling result should be seen as somewhat pessimistic.

Table 7-1. Traffic deaths for cyclists and car users in the Netherlands 2008, by age

Age Group	Risk (Fatalities / billion passenger kilometers)	
	Car users	Cyclists
<15y	0.6	4.9
15-20y	7.4	5.4
20-30y	4.6	4.2
30-40y	2.0	3.9
40-50y	1.0	6.6
50-60y	1.2	9.6
60-70y	1.6	18.6
70-80y	7.6	117.6
>80y	8.1	139.6
Aged 20-70y	*2.2*	*12.2*
All ages	*1.9*	*8.2*

Data source: Central Bureau of Statistics, the Netherlands, cited by de Hartog et al.[8] There is a discrepancy with the all-ages data presented in Table 7-6. The Table 7-6 data are drawn directly from the official source and are considered reliable, whilst the above data are useful in showing risk sharply increasing in elderly cyclists, as with pedestrians.

It is not appropriate to compare driving and cycling on a risk per unit distance basis, because drivers are typically ten times more mobile than cyclists. The figures are reproduced from the study. As a rule of thumb, dividing the cyclist figures by three will indicate a risk per hour estimate. This table also overestimates the difference between cyclists and drivers for local trips, as the data for car users includes the relatively safer long car trips on motorways.

In the age groups most active in cycling, there is little material difference in individual risk between drivers and cyclists (Tables 7-1 and 7-3). The low overall risk for drivers is due to the predominance of low-risk, experienced users. As Tables 7-1 to 7-3 (and especially Table 7-2, which is more of a like-for-like comparison) show, teenagers are safer as cyclists than drivers (and everybody else is far safer when teenagers cycle rather than drive). For older cyclists, the contrary would appear to be true, but this is because experienced drivers face extremely low risks, rather than because middle-aged cyclists are at high risk. Also, cycling is dominated by males, with higher risk behaviour than females. Note that annual risks are about the same, due to drivers spending more hours travelling per year. Both UK figures are much better than for French drivers (Table 7-4).

Table 7-2. Accident* risk for cyclists and drivers in the Netherlands, excluding motorways, by age

Age Group	Risk (Accidents* / million kilometers)	
	Drivers	Cyclists
12-14y	-	16.8
15-17y	-	18.2
18-24y	33.5	7.7
25-29y	17.0	8.2
30-39y	9.7	7.0
40-49y	9.7	9.2
50-59y	5.9	17.2
60-64y	10.4	32.1
>64y	39.9	79.1
'All' ages	*20.8*	*21.0*

**The report uses the term 'accidents' without indicating whether this indicates 'collisions' or 'injuries'.*

Data source: Central Bureau of Statistics, the Netherlands, cited by Dekoster and Schollaert[9]

The footnote to Table 7-1 about comparing on a risk per unit distance basis applies here too. In addition, this table overestimates the difference between cyclists and drivers because teenagers are included as cyclists but not as drivers in the 'all ages' figures.

Table 7-3. Risk per hour for UK drivers and cyclists 2008 data

Age Group	Risk per hour (Fatalities/million hours' use)	
	Drivers	Cyclists
17-19y	0.7	0.4
20-29y	0.2	0.4
All ages	0.1	0.4

Base data provided by DfT. Note that figures based on small numbers for cyclists aged 29+.

Table 7-4. Risk per year, UK & French drivers, UK cyclists

	UK Cyclists	UK Drivers	French drivers
All ages	1 in 23,000	1 in 30,000	1 in 10,000

There are other factors that affect driving risk. Driving at night is, on average, four times riskier than in daylight. Driving on difficult, rural roads may be ten times riskier than driving on a motorway.[35] If we extend this assessment to include the European Union, which would appear appropriate, then the range increases further, as noted above. UK drivers' safety vies with the best in the world. If UK cycling cannot yet match that, it is still doing well against driving in many other industrialised countries.

For any valid comparison to be made, what is therefore required is age-, sex- and social class-standardised rates per mode per type of journey, which are not available. The small number of serious cyclist casualties in each sub-group would in any case make conclusions problematic, except perhaps for young males. Comparison of young males (sex and age only) does show about the same risk of fatality per hour for cyclists and drivers,[10] although this could be confounded either way by social class. Such data are not available by level of experience. On close inspection, therefore, it becomes clear we must be wary of drawing too literal conclusions from population-level risk assessments. The average risk per hour of riding a motorbike is more than forty times greater than for driving. It is thus justified to conclude that motorbikes are a relatively risky mode of travel. But driving risk might easily vary by a factor of five or even ten for the same person, as they move from one class of road to another, from daylight to night time, or from driving on flat roads to driving in the mountain. So a factor varying from one to four difference in risk between cycling and driving in this country is not great enough to prove that cycling is riskier than driving, in a way that is meaningful to the individual. It is important to emphasise that this is a comparison of small risks. The health benefits of cycling far outweigh these small risks.

7.2.3 Superior overall safety of cycling versus driving: Risk in Use

Research at the Transport and Road Research Laboratory in the mid 1980s[10] showed that the risks per hour for young male drivers and cyclists specifically were not significantly different. Additionally, young male drivers impose significant risk on the population; young male cyclists generally do not. Cyclists and pedestrians almost never kill other road users. Cars are a major cause of deaths to pedestrians, cyclists and motorcyclists, as well as to other car users. 70% of car occupant deaths are due to collision with another vehicle. "Risk in Use" is the measure that combines the risk to the user with the risk imposed on others (Table 7-5). This exercise reveals why road deaths would not increase if there was an increase in cycling. In fact, it is much more likely that more cycling would be an effective road safety intervention. This conclusion is further supported by Section 7.3 below Safety in Numbers.

Table 7-5. Risk of different modes of transport to all travellers by time spent travelling

Transport mode and duration	Fatalities to all road users per million hours of travel
Driver (300 hrs/annum)	0.45
Cyclist (120 hours/annum)	0.50

Source data [3]

As previously noted, drivers spend about three times longer driving per year than typical cyclists do cycling. On a Risk in use basis, there is nothing to suggest that cycling contributes more to road fatalities than driving. Some 60% of deaths associated with car use are to third parties other than the driver. By comparison, cyclists very rarely kill third parties. These results are true despite the loading on cycling due to "young male effect" and British drivers having the best safety record in the world. There are about three pedestrian deaths a year due to collision with cyclists, and there are about three cyclist deaths a year in collisions with pedestrians.[2]

7.2.4 Risk in Cycling in UK compared with the Netherlands

The difference in risk between cycling in Britain and in other countries is frequently exaggerated. Although the population average fatality rates for Dutch or Danish cyclists is about half that for British cyclists,[3] further data in Table 7-6, it is difficult to untangle the extent to which this reflects genuinely better safety, or just less of the 'young male' effect[i]. The difference is less than that between French and British drivers.

Table 7-6. Comparison of cyclists' risk in the Netherlands and the UK

Year	Fatality rate per billion km	
	Netherlands	UK
2003	14.2	25
2004	11.8	32
2005	11.3	33
2006	13.8	31
2007	12.0	32

UK fatality rate data [2]; NL fatality rate figures derived from Central Bureau voor Statistek national distance data and the Netherlands road casualty report "Kerncijfers Verkeersveiligheid 2009"[11]

The risk data for NL in Table 7-6 are higher than the "all-ages" figure of Table 7-1. It is not known why this is. Table 7-6 data are direct from the official source and are reliable. Table 7-1 is useful in showing varying risk by age.

Despite perceptions of different conditions for cyclists, the causes of fatalities are nearly identical in the two countries (Table 7-7).[212,]

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[i] Casualty rates are available for sex and age groups in the Netherlands at least, because there are enough cyclist casualties in most age groups to make these feasible. In the UK, they are only available reliably for young men; other age and sex groups hold too few casualties to form reliable conclusions.

Table 7-7. Comparison of cyclists' fatal traffic crashes in the Netherlands and the UK[2,12]

Cause of fatality	Netherlands	UK
Fall, or collided with stationary object	8%	8%
Collision - with pedestrian	2%	2%
Collision - other cyclist	2%	n/a
Collision - car	53%	55%
Collision - commercial vehicle	35%	35%

As so often with perception of cycling risk, the popular image is a magnification of reality.

7.2.5 Conclusions regarding risk

1. The risk to the individual when cycling is very low. One case of serious injury corresponds to almost 2 million km of cycling. Since cycling is under-measured, it actually corresponds to a lower risk than that.

2. Cycling appears to compare poorly with driving in risk assessment based on UK national data, but the cycling figures are inflated by a number of important factors. It is not possible to carry out a proper like for like analysis (comparing cyclists who have undergone proper proficiency training with drivers of the same age making the same kinds of journeys) but the overall risks in broad-level analysis are such that it is highly plausible that such a detailed analysis would show no great difference between cyclists and drivers. Doubtless it would be shown that cycling is generally safer for younger people and driving for older people, but no cycling age group faces risks that are unlike other ordinary risks of life accepted without second thought. It is implausible that driving would be safer by a large margin. In most other countries, the risks of cycling and driving are more clearly equivalent.

3. If there is some greater risk in cycling for some individuals, it is greatly outweighed by the health benefits, and for society at large by the great reduction in third party deaths and injuries.

4. If there is some greater risk in cycling for some individuals, it is of the same order as other risks that people take without thinking of them as particularly dangerous, such as driving in France rather than in the UK, or driving on an all purpose road rather than on a motorway, or driving rather than taking a train.

5. It is therefore fair to say that the risks of cycling are within the range of risks faced by drivers, but drivers and cyclists both clearly bear much lower risks than motorcyclists.

6. Because of the safety in numbers effect (see below section 7.3) and the near absence of third party deaths from cycling, an increase in cycling will not increase deaths overall. It is most likely that there would be a decrease. Cycling in the UK is disadvantaged by an exceedingly low modal share of trips. Even in a showcase example like London, the modal share of trips for cyclists was only 2% in 2008,[17] tiny by the standards of Northern Europe. Low modal shares are invariably associated with higher risks for cyclists. Risk falls with increase in cycling. Cyclists in London have seen no increase in the overall number of serious injuries, while the amount of cycling has increased by about 70% since 2000 (see Section 7.3 below). Also, the above data

relate to traffic collisions alone. They do not include falls. As was noted in chapter 4, pedestrian falls are a large but not reliably quantified cause of serious injury.

7.3 Safety in Numbers: More cycling means safer cycling

What actually happens when there is a resurgence of cycling? The question can be answered directly from experience, since there are now many examples of successful cycling programmes.

In Britain at least, there is no known case in the post-war era of an increase in cycling being followed by an increase in cyclist deaths, let alone road deaths overall, nor are the authors aware of any such case in another country.

Interest in "Safety in Numbers" (SiN) stirred during the 1990s. It was widely noted that the cycling programmes in the Netherlands had increased cycle use by 45% during the 20 years to 1997, yet deaths in those years declined by almost 40%[Error! Bookmark not defined.] and the risk per cyclist declined by 60%. Wardlaw noted that in the UK, there had also been a similar revival of cycling after 1973, and cyclist deaths had also fallen during those years.[13] Jacobsen's wider survey of data showed a power law rule: that if the amount of cycling doubled, the number of fatalities would increase by only about 40%.[14] Broughton et al studied cyclist safety in English counties and found a similar but slightly less pronounced effect: doubling cycle use would increase fatalities by only 60%.[15] These power-law effects turn out to be pessimistic since in practice it has been found that cyclist deaths do not increase at all, even with cycling levels doubling or more (see case studies below). There appears to be a contradiction: SiN studies suggest some increase in casualties as cycle use rises, whereas the actual result is stable or falling numbers of casualties. This contradiction is resolved by acknowledging contributions from not just SiN, but also wider improvements, which reduced casualties amongst all groups of users.

There are now a number of case studies of cities that have revived, or at least stirred, cycling cultures. An international review of 14 such cities is available.[16]

Available data show that rising levels of cycling and walking were accompanied by falling road deaths and serious injuries overall. Recent bike rental schemes such as "Velib" in Paris, have contributed to increasing cycling levels. Some examples of increased cycling and reduced injuries are:

- In Portland, Oregon, all deaths due to traffic crashes declined from 46 to 28 per annum between 1997 and 2007, whilst the share of commuters cycling to work increased about four-fold to 6%.
- In London, England, Transport for London data show a doubling of cycling during the years 2000-2007, although cycle use overall remains low at 2% of trips.[17] The introduction of the Congestion Charge in February 2003 is thought to have had a significant influence in boosting cycling in central London. Cycle use in the more peripheral areas of London has grown less or not at all. During these years, cyclist fatalities fluctuated about an average of 17 per year; serious injuries varied about an average of 400 annually. The erratic nature of cyclist casualties can be exploited by those wishing to sensationalise cycling risk. For instance, serious injuries increased by 34% between 2004 and 2007, but this followed a drop of 25% in the preceding three years.
- In Berlin, the number of bicycle trips almost quadrupled between 1975 and 2001. Between 1990 and 2007, the share of trips doubled to 10%, but serious injuries fell by 38%.

- In Copenhagen 1970–2006, there was a 70% increase in total bike trips, with a 60% decline in serious injuries between 1995 and 2006.

7.4 Cycle helmet evidence

7.4.1 Injury prevention

A significant body of literature is available on cycle helmet effectiveness. This has been reviewed from time to time[18 19] and these reviews have been subject to criticism.[20 21 22] In December 2009, the Department for Transport issued a further review of cycle helmet effectiveness[23.] Its principal scientific conclusion was that "it was not possible to quantify the amount of benefit offered by modern cycle helmets in the UK from the literature review alone". However, the summary still claimed life-saving benefit from helmets – but close reading reveals this is based merely on the opinion of the authors, not on the basis of the scientific evidence.[24] As a result, the report has drawn heavy criticism.

The published literature falls into two main types of study: case-control studies and population-level time-trends analyses. Case-control studies report high levels of protection from wearing a cycle helmet, up to 88% protection from brain injury. Some population level studies have reported injury reductions from helmets, but in every case the effect was actually due to secular falling trends across all road users. Population-level studies that account for secular trends show no noticeable prevention of serious head injuries, either in traffic collisions or falls in the highway. The case-control studies were conducted while helmet use was still at a low level (3-10%), whereas the population-level studies had to wait until there were high levels of helmet use. The debate thus opened in the mid to late 1980s with apparently strong reasons to promote helmets and make them a legal requirement. The later population level studies have attracted less notice, and have been ignored by official reviews. For instance, the 2002 UK government review,[19] the Cochrane Review[18] and a recent review by NICE[25] all omit mention of population-level studies. The latest (2009) DfT helmet review did consider population level studies, but denied their relevance to judging helmet effectiveness. An explanation is required for the disparity between case-control studies and population-level studies.

In case control studies, people with a particular outcome (such as head injury when cycling, the 'cases') are compared with 'controls' (such as, non-head injuries when cycling). The 'cases' and 'controls' are asked about previous 'exposure' (i.e. whether or not they were wearing a helmet at the time of injury). Case control studies are very useful for generating theories but are less good at confirming cause and effect, both because of difficulties with time sequences and recall bias and also because of confounding: there may be systematic differences between the cases and the controls that affects both the outcome (head injury) and the exposure (wearing a helmet).

The case-control studies were conducted on a 'best endeavours' basis, but nonetheless can aptly be criticised for serious flaws. For instance, it is now known, from directly observed helmet surveys, that social class has a strong influence on helmet use by children.[26] Recent experience has taught the perils of relying on case-control studies when personal choice is involved[27] because of confounding.

The largest case-control study ever conducted[28] gathered data on cyclists' injuries in Seattle during a 2.5 year period from 1992. There were c.3,900 cyclists treated in Emergency Rooms, with adequate data being captured for c.3,400 cases. However, only c.300 (9.4%) required admission. The low number of serious injuries, despite the prolonged data gathering period, underlines that cycling is not in fact a significant cause of serious injury even in a city of (at the time) 2.5 million. The study's conclusions regarding prevention of serious injuries thus rest upon a fairly small dataset. The results show a mysterious pattern, as displayed in Table 7-8 below.

The data show that, apparently, the protective effect of a helmet increases with increasing severity of injury. It is extremely difficult to accept such a result, and indeed, it is the opposite of what is seen in population level studies, which return the more sensible outcome of declining protection with increasing severity of injury. It must be the case that confounding factors systematically caused non-helmeted cyclists to be in more severe crashes. This is in fact explicit in the data presented in the most widely cited of the Cochrane Review papers.[29] Those with head injuries (the cases) had a greater proportion of bicycles damaged beyond repair than the non head-injured (the controls), 9% versus 5% (or <1% in the second control group); a much greater proportion had been in crashes with motor vehicles, 23% versus 13% or (4% in the second control group); as well as the lower rate of helmet use, 7% versus 24% in both other control groups. The cases had a higher proportion of those of limited educational completion (17% versus 12%) and in the lowest household income group (19% versus 16%, or 6% in the second control group). These results are consistent with helmet use being associated with less violent crashes and non-helmet use being associated with low incomes.

Table 7-8. Case-control study of helmet use and injury in Seattle

Outcome	No. with helmet	No. without helmet	Odds Ratio[ii]
Any head injury	222	535	0.32
Brain injury	62	141	0.33
Severe brain injury	15	47	0.24
Fatality	1	13	0.07

The Seattle study dataset forms the core of the Cochrane Review of bicycle helmet effectiveness. Its small dataset of serious injuries and the above noted implausibility of the results are not widely recognised. On the contrary, the results are still widely cited in the literature and media. The other main case-control study[30] cited in the Cochrane Review took place in Cambridge, England and is likewise based on a small dataset of serious head injuries (104 cases). None of the studies considered the full implications of socio-economic differences between helmet and non-helmet users.

In addition to confounding factors, a recent analysis[31] has found evidence of publication bias and time-trend bias in reviews of helmet effectiveness. Publication bias is the tendency of contradictory or inconclusive results not to be published, resulting in a literature formed of apparently consistent findings that exaggerate, or even misconstrue, the actual effect. Time-trend bias is the tendency of findings to change over time. Correction for these factors reduced the original protective effects of helmets, although what remained was still significant. Considering injuries to the head, face and neck together, however, the protection of helmets

[ii] Odds Ratios are the measure that can be obtained from a case control study. In this case it is the ratio of the odds that someone wearing a helmet had that outcome compared with the odds that someone not wearing a helmet had that outcome. An odds ratio below 1.0 means the ‘exposure’ (helmet wearing) is protective.

was small even in the older studies (a point not necessarily emphasised or even reported in the original papers). In more recent studies, there was no net protective effect after correction for biases. That is, reduced risk of head injury was off-set by increased risk of face and neck injuries.

A fuller discussion of the problems with case-control studies of cycle helmets is available.[32]

In contrast, population studies are much harder to challenge. A number have appeared, two of which stand out as being particularly rich in terms of the time period covered and a control group being presented. Hendrie et al[33] studied the effect of the state helmet law of Western Australia, concerning serious head injuries to cyclists in traffic accidents (collisions or falls in the highway). This was based on study of the proportion of serious casualties with head injuries, when set against a control group. It thus examines the prevention of head injury when crashes happen, not the number of crashes or the risk of being in a crash. They concluded the law prevented 10-20% of head injuries. However, as the authors point out, the result rests upon one step change in the year prior to the law, not upon reductions as the law was enforced, nor upon any reduction with rising voluntary use pre-law.

Scuffham et al[34] studied the same injury class for New Zealand, using a similar technique. They concluded 19% prevention of serious head injuries (mainly scalp lacerations) due to enforced legislation. However, the authors did not model the helmet law as a step change in helmet use. Surveys showed a step increase in helmet use as the law was enforced, but this was not reflected as a step change in head injury trends. The base data show that serious head injuries continued a smooth secular decline through the law enforcement, while serious non-head injuries markedly increased. Other data show that cycle use (in time spent nationally) declined by 33% between 1989/90 and 1997/98[35], the period of helmet promotion and law enforcement. This would imply an increase in risk post-law.

Because there was scope for further analysis as per above, these data, and others from Victoria, Australia *inter alia*, were gathered and published[36] with a conclusion of *"no clear benefit".* The failure of mass helmet use to affect serious head injuries, be it in falls or collisions, has been ignored by the medical world, by civil servants, by the media, and by cyclists themselves. A collective willingness to believe appears to explain why the population-level studies are so little appreciated. It should be noted that the definition of head injury applied in these population level studies was not especially exclusive – for instance, scalp lacerations were included. In both the Hendrie and Scuffham studies, 70% of the head injuries occurred in simple falls, not traffic collisions. Despite this, no reduction of head injuries relative to non-head injuries could be linked to increasing helmet use in the populations concerned.

7.4.2 Helmet standards and mechanisms in relation to head injuries

Confirmation of the lack of benefit seen in population-level studies comes from physical evidence. One leading engineer has reported: *"Another source of field experience is our experience with damaged helmets returned to customer service... I collected damaged infant/toddler helmets for several months in 1995. Not only did I not see bottomed out helmets, I didn't see any helmet showing signs of crushing on the inside".*[37] The significance of this is that crushing of the liner is evidence of significant energy absorption and therefore impact alleviation. Even earlier, in 1987, the Australian Federal Office of Road Safety found that in real accidents: *"very little crushing of the foam liner was usually evident... What in fact happens in a road crash impact is that the human head deforms elastically on impact. The standard impact attenuation test making use of a solid head form does not consider the effect of human head deformation, with the result that all acceleration attenuation occurs in the compression of the liner. Since the solid head form is more capable of crushing helmet padding, manufacturers have to provide a relatively stiff foam in the helmet so that it would pass the impact attenuation test... cracks* *developing partly or fully through the thickness of the foam renders it useless in crushing and absorbing impact forces".*[38]

Rotational Injury: brain injuries may be caused by linear impact or rotation of the head, or a combination. There is no definitive research on whether cycle helmets increase the risk of rotational injury. Laboratory tests show that rotational accelerations in helmeted head forms can exceed levels likely to cause debilitating injury or death. However, laboratory conditions are not real conditions, as has already been noted above. On the basis of biomechanical test results, one would expect helmets to prevent serious and possibly even fatal head injuries, although probably increase the risk of rotational injury. The absence of noticeable reduction in serious head injuries with mass helmet use is a real world result that cannot sensibly be ignored. An interesting commentary is available that discusses possible reasons for the failure of laboratory results to carry into the real world.[39]

The failings of biomechanical studies do not prevent these results being cited in favour of helmet promotion, in the absence of any positive real world result. Some advocates of cycle helmets dismiss all results from the real world in favour of the assertion that cycle helmets must work because they would be expected to work from laboratory tests. The latest (2009) helmet review[23] by the DfT is an example of this. While concluding that no clear evidence of helmet effectiveness emerges from a review of the literature, it then claims life-saving protection from helmets, but on the basis of the authors' biomechanical assumptions, not scientific fact.

Helmet standards must be mentioned in brief. These have changed since the first ANSI standard for a bicycle helmet in 1966, and vary today around the world. The helmet standard prevailing in Australia and New Zealand at the time the helmet laws came into force (AS/NZS 2063.2) was a tougher specification than the EN1078 standard for helmets in Europe today.[40] Contrary to what one might expect, the robustness of cycle helmets has declined since the 1970s, with the progressive loss of the hard outer shell, increase in venting, and reduction in mass. This has made popular acceptance possible. The most stringent helmet standard in the world today is the Snell B95. Such a helmet is hard to obtain in Europe.

7.4.3 Risk compensation

Risk compensation is the human tendency to alter behaviour when expected consequence changes. For instance, the expected benefits of seatbelt use failed to materialise following legislation.[41] Analysis of car wrecks makes it clear that seatbelts can confer life-saving benefit in a given crash. The only explanation for the failure is a change in behaviour by some drivers forced to wear a seatbelt. Seat belts became law for drivers and front seat passengers in the UK on 1st January 1983, with compliance rising to 90% (from about 30% use) within a few weeks. It has been concluded that one in eight cyclist deaths and one in 12 pedestrian deaths in that year were due to seatbelt legislation.[42] This transfer of danger from those in cars to those hit by them is euphemised as 'migration hypothesis'. Figure 4-1 confirms that 1983 marked no noticeable change in the fatality rate of drivers. The UK government had commissioned research into seatbelt legislation prior to the final Parliamentary debate in 1981. The report by JE Isles of the Department for Transport concluded that seatbelt laws had not detectably reduced road deaths.[43] This was suppressed and only became known when *New Scientist* magazine revealed its existence in February 1985. Thus the 1981 debate that passed legislation was never informed. Claims for success of seatbelt legislation rest upon the long term declining trend that dates back to the 1960s and continues to this day. The lesson of seatbelt laws is: do not ignore risk compensation.

With respect to cycle helmets, risk compensation has not been much studied. One study showed that helmet use altered driver behaviour[44]: some drivers passed faster and closer to a helmeted cyclist. Hedlund has proposed a general model[45] of behaviour, in which cycle helmets score highly in likelihood of causing risk compensatory behaviour in riders. A study of children running around an obstacle course with and without helmets (and other protective equipment) showed strong risk compensation, with children going faster and being more reckless when using the protective equipment.[46] Surveys of US cyclists in the late 1980s found that helmet users were more than seven times more likely to say they had struck their head in the last 18 months than non-users.[47] At this time the rate of helmet use was c.10%. But is this self-reporting bias? Or bias due to self-selection by higher risk cyclists to wear helmets? If risk compensation was a serious problem, one would expect to see an increase in road traffic casualties as helmets become popular. This can happen, but not in a consistent way. One may easily note from Figure 4-1 that cyclist deaths sharply increased after 1994, in the years when helmets first became popular in Britain, although the effect has faded. A US study[48] found a statistically significant association between helmet use and risk of death to US cyclists in the period 1973 to 1985. On the other hand, analysis of Edinburgh road casualties[49] found no evidence that adult cyclist injuries in traffic crashes had worsened since 1990, relative to the control group (pedestrians). Research into cyclists' attitudes has found that the more a person believes a helmet to be effective against serious or fatal injury, the more likely they are to wear one.[50] In summary, on the balance of probability, risk compensation by helmet wearing cyclists is likely, but the evidence is not conclusive. The evidence that drivers may impose more risk on helmet wearing cyclists is disturbing and warrants further research.

7.4.4 Effect of helmets on cycling levels

The British Medical Association has had a policy since 2005 of supporting helmet legislation. This was greatly influenced by one study concluding that the Ontario child cyclist helmet law of 1996 had not deterred children from cycling and that therefore previous experience with enforced legislation was no longer relevant.[51] However, the paper's authors never mentioned that the Ontario law was not enforced; helmet use returned to pre-law levels after about three years.[52] Close inspection of the data shows that cycling levels did in fact increase when helmet use returned to pre-law levels. This paper has been widely misinterpreted as applying to enforced legislation. Another paper[53] claimed that the Ontario law had cut child cyclist deaths by half in the following ten years, and quoted data selectively to suggest that helmet use was maintained at a high level in this period when in fact it was not. The decline in deaths was seen in pedestrians too and was clearly an environmental effect.[54] Still another paper[55] concluded that provincial helmet laws in Canada had not reduced cycling levels, yet data presented in the research show the contrary; notably a 50% decline in the number of trips cycled by youths in Alberta.

It is not widely appreciated that there is now a significant literature of studies casting doubt on the wisdom of helmet programmes.[56] These studies typically do not receive media attention and remain little known. With the sole exception of Ontario, where the law was not enforced and rates of helmet wearing were already high, jurisdictions that have introduced mandatory helmet use have suffered a pronounced reduction in the number of cyclists and cycle trips made. For instance, cycle use in New Zealand has dropped 55% since 1989/90.[35] Analysis of census data shows permanent reductions of utility cycling in Australia too.[57] Helmet promotion also hinders cycling programmes.[58] Reducing active travel has a significant, negative impact on the public's health by reducing physical activity levels.[59]

The disconnect between received wisdom and the facts is stark.

The facts are:

1. It is rational for an individual to choose to wear a cycle helmet - but no more so than to choose to wear a helmet when walking, driving, playing football or playing rugby.

2. There is however a disturbing discrepancy between engineering or clinical evidence of the effectiveness of helmet wearing (which suggest them to be effective) and population studies (which suggest that they are not).

3. Plausible explanations of this discrepancy include cyclists taking greater risks because they think their helmet makes them safe or drivers taking less care of helmeted cyclists because they see them as less vulnerable. A single study has examined this but its findings supports the latter of these.

4. There are also other possible explanations based on postulated unknown hazards of cycle helmets. We consider these explanations to be much less likely than the behavioural explanations given above.

5. It is now well established that legislation mandating cycle helmet use causes a reduction in the levels of cycling and thereby does more harm than good.

6 It is unclear whether this is because many people find cycle helmets troublesome, because many people find them unfashionable and odd or because people consider the mandation of helmet use as evidence that cycling is dangerous.

7. If the last of these explanations is true then not only legislation but also any vigorous promotion of voluntary helmet use are likely to be harmful.

8. The one study in which cycle helmet legislation did not reduce cycle use (Ontario) is highly unusual both because of the high levels of voluntary helmet use before the legislation and the fact that the law was not enforced. This makes it difficult to draw clear conclusions from it. It certainly cannot be regarding as annulling the considerable volume of evidence that cycle helmet legislation is harmful.

As Hedlund warned:

> *"Don't over-predict benefits. Many injury prevention measures promise more benefits than they deliver, due to bad science, political pressures, or failure to consider risk compensation or system effects. While calm and realistic benefit estimates are difficult to produce, unduly optimistic predictions will hamper injury prevention efforts in the long run".* [45]

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8 Transport Trends in the UK

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As discussed in the introduction to Section II, travel affects health in various ways, both positively and negatively. Thus the volume and type of travel are likely to influence health. In this section, factors influencing travel in Great Britain are discussed.

8.1 Travel in Great Britain

Table 8.1 shows the amount of travel on mechanised modes in Great Britain. The dominance of the car is clear. This has not always been the case, as Table 8.2 shows. Back in 1952, there was more travel by bus and coach than car, and the distance travelled on pedal cycles was almost half that of cars. Perhaps the most dramatic figure is the growth in the total volume of travel from 218 billion passenger km in 1952 to 817 in 2007. Almost all of this is due to growth in car use, at the expense of all other modes except rail and air. Over the period from 1998 to 2008, motor traffic increased by 17% on motorways, 11% on rural A roads, but fell by 1.5% on urban A roads.[1] Note that the time spent travelling has remained virtually constant at about one hour per capita per day.[2] Rising traffic is due to access to greater personal mobility and population growth, not more time spent travelling.

Table 8-1 Volume of travel in Great Britain in billion passenger km, 2008

	Billion passenger km	%
Cars, vans and taxis	679	85
Buses and coaches	50*	6
Motor cycles	6	1
Pedal cycles	5	1
Rail	51	6
Air	9	1
Total	800	100

Source: Transport Statistics Great Britain 2009 **Error! Bookmark not defined.** **Transport Statistics Great Britain 2008* [3]

It should be recognised that this growth in car use has both positive and negative impacts: on the positive side, the car has opened up access to opportunities for many people, including leisure, shopping and employment. On the negative side, it has caused the growth in congestion and generated many atmospheric emissions (although technology has been used to address many of these through the compulsory fitting of catalytic converters and the introduction of lead-free petrol). It has stimulated a more diffuse land use pattern which has led to people having to travel further than they would previously have needed to, and to exclusion of people who do not have access to a car.

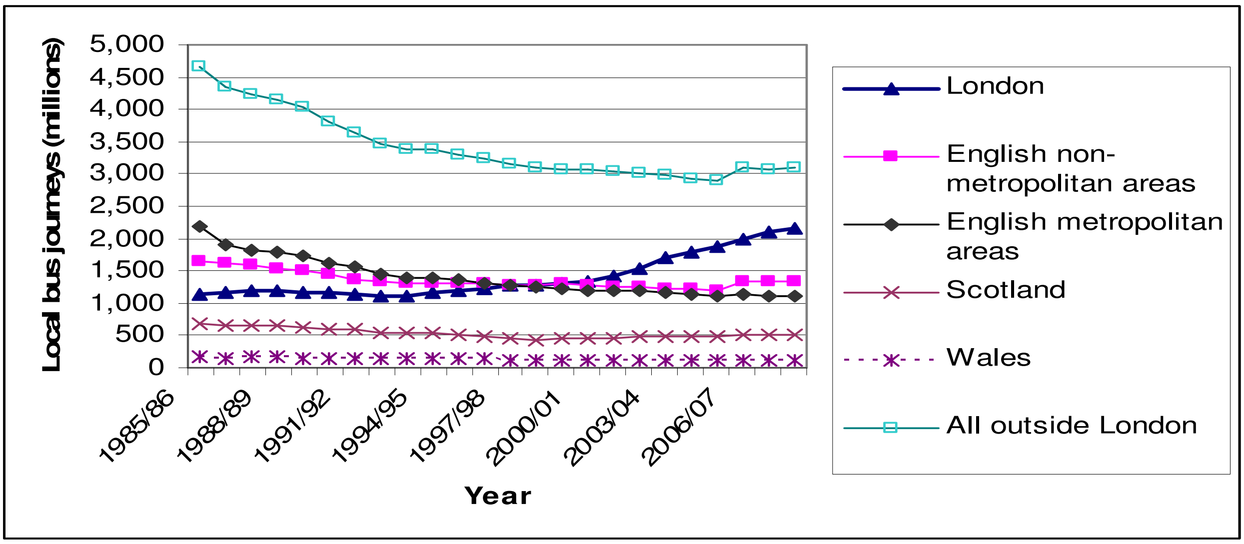
Table 8-2 Passenger transport by mode in Great Britain in billion passenger km, 1952-2007

	Car, van and taxi	Buses and coaches	Motor cycles	Pedal cycles	Rail	Air	Total
1952	58	92	7	23	38	0	218
1957	92	84	9	16	42	1	244
1962	171	74	10	9	37	1	302
1967	267	66	6	6	34	2	381
1972	327	60	4	4	34	2	431
1977	354	58	7	6	34	2	461
1982	406	48	10	6	31	3	504
1987	500	47	7	6	39	4	603
1992	583	43	5	5	38	5	678
1997	632	44	4	4	42	7	733
2002	677	47	5	4	48	9	790
2007	689	50	6	4	59	10	817

Source: Transport Statistics: Great Britain 2008 [3]

It should be noted that the above table shows a 50% decline in bus usage from 1952 to 1992 followed by a limited recovery. However the decline in bus usage outside London was much greater. Bus journeys increased from 2,252 million in 1964[3] to 4,673 million in 1985 (the date of bus deregulation) to 2,910 million in 2005 (the nadir) with limited recovery to 3,085 million in 2007 (Figure 8-1). In the decade from 1998/99 to 2008/09, bus vehicle kilometres for the UK excluding London have fallen by 5% but increased in London by 35% over that same period. Over that same period, passenger journeys by bus were static outside London (3,084 million) while they increased by 70% in London (from 1,266 million to 2,149 million). Despite the operating costs per passenger-km being almost double in London than elsewhere, the fares were higher outside London and increased more over that period.[3]

Figure 8-1 Local bus journeys by area, 1985/86 – 2008/09



Source: Transport Trends 2009[4]

8.2 Trip making

The National Travel Survey (NTS) provides data about trips based upon a continuous survey of households. Table 8.3 shows the average amount of travel per head. Once again the dominance of the car can be seen, but quite a large proportion of trips are walked. Because they tend to be short (1.4 km on average) they do not contribute much to the total distance travelled.

There has been a significant change in the patterns over time. Table 8.4 shows how the modal share of trips has changed over a period of thirty years or so. Once again the growth in car use can be seen, but also the decline in walking and cycling. Local bus use has also shown a decline. This is significant for physical activity because most bus trips include an element of walking. The growth in car use is even more dramatic when the distance travelled is considered, as shown in Table 8.5. The greater proportionate increase in distance reflects an increase in trip lengths. Once a person has started to use a car, he or she can travel longer distances much more easily than by walking, bicycle or public transport. This has encouraged the decentralisation of urban activities, often associated with the development of larger premises, for example hospitals, schools and shops. These larger sites are often in out-of-town or suburban locations where there is cheaper land available and fewer constraints on space. Whilst this may suit the growing number of households with a car available, it causes difficulties for those without access to a car.

Table 8-3 Personal travel in Great Britain per head per year, 2009

	Trips per head per year	Mean distance per head in km	Mean trip length in km
Walk	228	314	1.4
Bicycle	15	73	4.9
Local bus	67	493	7.4
Car	612	8,517	13.9
Other	50	1,444	28.9
Total	972	10,841	11.2

Source: National Travel Survey: 2009 [5]

Interestingly, a comparison of European cities shows that bus travel is greater in cities with rail-based travel than in those with bus-based travel.[6] This could contribute to the explanation of why bus travel has held up better in London than in other parts of Britain. The explanation is probably that rail is better at attracting people out of cars because of its perceived quality, because the network is visible and reasonably stable, and because it avoids road congestion. When people have been persuaded to use public transport they may then start to consider the use of the bus to fill in gaps in the rail network.

Table 8-4 Change in number of trips travelled per head per year

	1976/76	2009	Change
Walk	325	226	-99
Bicycle	30	15	-15
Car	429	612	+183
Local bus	107	67	-40
Other	43	51	+8
Total	935	973	+38

Source: National Travel Survey: 1998/2000 [7] *and 2009* [5]

Table 8-5 Change in distance travelled per head per year, in km

	1976/76	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: National Travel Survey: 1998/2000 [7] *and 2009* [5]

The decline in walking and cycling has been noted. The National Travel Survey (NTS) shows quite detailed information about walking and cycling. As Table 8.6 shows, walking is more popular than cycling, given that 58% of the population walk for twenty minutes or more at least once a week while only 14% cycle this frequently. In fact, 68% never (or almost never) cycle, whereas only 20% take no significant walks in a year. This suggests quite large proportions of the population take no advantage of the health benefits of active travel. Having said that, it should be noted that cycling can be both a means of travel and a recreational activity, as Table 8.7 shows. It can be seen that quite a large proportion of cycling is off-road. This tends to be particularly true of children.

Table 8-6 Frequency of walking and cycling, 2009

Frequency	Walk of 20 minutes or more (%)	Cycle for 20 minutes or more (%)
Once or more a week	63	14
Less than once a week but more than once a year	17	18
Less than once a year or never	20	68
Total	100	100

Source: National Travel Survey: 2009 [5]

Table 8-7 Where people cycle, 2008

Location	Percentage
Mainly on the road	40
Mainly on pavements, cycle paths or cycle lanes that were not part of a road	30
Mainly off the road in parks, open country or private land	17
Variety of surfaces	13
Total	100

Source: National Travel Survey: 2008 [8]

8.3 Why people travel

Not only has there been a significant modal shift, there has been change in the nature of trips, as Table 8.8 shows. The largest three trip purposes were leisure, shopping and commuting in both 1975/76 and in 2009, and all three have declined rather more than the overall decline in trip making. The biggest growth has been in escort trips, that is, trips made by a person to take someone else, for example a child to school. It is interesting that the number of education trips has declined, but the number of education escort trips has increased. This reflects the concern that many parents have about letting their children go out without an adult. These concerns include both road traffic danger and possible abduction (see Table 5-1 in chapter 5). However, use of the car to take children to school also reflects the greater travelled distance to school up from an average of 4.1 km in 1985/86 to 5.0 km in 2009, as shown in Table 8.9. It is likely that increasing emphasis on parental choice of school has been a contributing factor to this, along with the greater availability of cars. The decrease in the length of education escort trips probably reflects the increase in the number of short walk trips that children are escorted on to school which, in previous years, would have been made by children without adult accompaniment. The increases in the average distance travelled on commuting, shopping and leisure trips probably reflect the decentralisation trends mentioned above.

Table 8-8 Change in trips per head per year by trip purpose

	1985/86	2009	Change (no.)	Change
Leisure	277	261	-16	-6%
Shopping	210	193	-17	-9%
Commuting	178	147	-31	-17%
Personal business	97	103	6	6%
Education	77	61	-16	-21%
Education escort	32	44	12	38%
Other escort	74	91	17	23%
Business	32	30	-2	-6%
Other (including ‘just walking’)	46	43	-3	-7%
Total	1,024	973	-51	-5%

Source: National Travel Survey: 1998/2000 [7] *and 2009* [5]

The use of each mode for the various trip purposes can be seen in Table 8.10. The car dominates most trip purposes. Only in the categories of ‘education and education escort’ and ‘other’ do walking trips make up over half those number travelled by car.

Table 8-9 Change in mean distance per head by trip purpose in km

	1985/86	2009	Change (km)	Change
Leisure	15.4	16.7*	1.3	8%
Shopping	6.8	6.9	0.1	1%
Commuting	12.1	8.0	1.7	14%
Personal business	7.7	7.8	0.1	1%
Education	4.1	5.0	0.9	22%
Education escort	4.8	3.5	-0.9	-19%
Other escort	8.9	8.3	-0.6	-7%
Business	34.8	29.2	-5.6	-16%
Other (including 'just walking')	1.8	1.7	-0.1	-6%
Total	10.7	11.1	0.5	3.7%

Source: National Travel Survey: 1998/2000 [7] and 2009 [5] *National Travel Survey 2008 [8]

Table 8-10 Trips per head by mode and trip purpose, as percentage of all trips, 2009

	Walk (%)	Bicycle (%)	Car (%)	Local bus (%)	Other (%)	Total (%)
Commuting	2	1	10	1	1	15
Business	0	0	2	0	0	3
Education/education escort	4	0	4	1	0	11
Other escort	1	0	8	0	0	9
Shopping	5	0	12	2	1	20
Personal business	2	0	6	1	0	11
Leisure	5	1	18	1	2	27
Other (including 'just walking')	4	0	0	0	0	4
Total	23	2	64	7	5	100

Source: National Travel Survey: 2009 [5]

8.4 The cost of travel

One of the factors that has influenced the modal shift has been the changes in the relative cost of travel, as shown in Table 8.11. Overall, the cost of travel by all modes has increased more slowly than the growth in disposable income; travel has become cheaper proportionately to income. This is one of the reasons for the growth in the total volume of travel. It is noticeable that the cost of motoring proportionate to disposal income has fallen more in the last ten years than has the cost of public transport, and indeed the cost of motoring has fallen in real terms whereas that of public transport has increased (albeit by less than disposable income). Throughout this period, there has been a policy of encouraging modal shift[9 10 11 12] and this shift in cost does not seem conducive to that policy. However, the picture is more complex than this because vehicle running costs (petrol, insurance and so on) have increased more than public transport fares, while the cost of purchasing a vehicle has fallen dramatically. Chapter 17 considers the implications of this for reducing driving.

Table 8-11 Changes in the real cost of transport and in income: 1997 to 2009

	Disposable income	Rail fares	Bus and coach fares	All motoring	Vehicle running costs	Purchase of vehicle
1997	100	100	100	100	100	100
1998	102	101	100	100	102	96
1999	105	103	102	101	108	90
2000	109	102	103	101	115	83
2001	114	104	105	99	113	80
2002	117	104	107	97	112	77
2003	120	103	108	95	113	73
2004	121	104	110	93	114	69
2005	124	105	115	91	117	63
2006	126	106	113	90	119	60
2007	126	107	114	87	118	56
2008	n/a	107	117	87	124	50
2009	n/a	114	124	87	124	50

Source: Transport Trends, 2009[4]

8.5 Car ownership

When people buy a car they use it. This is shown in Table 8.12 which shows the number of trips made per head by people living in households with different numbers of cars available. There is a large difference between the 733 trips a year made by those living in households with no car and the 987 made by those in households with one car. Having a second car does not make a big difference to the number of trips made.

Table 8-12 Number of trips per head per year by car availability, 2009

Number of cars available to household	Number of trips per head
No car	733
One car	987
Two or more cars	1,070
All persons	973

Source: National Travel Survey: 2009 [5]

Back in 1952, only about 15% of households owned a car and very few of those owned more than one (Table 8.13). Car ownership has grown steadily since then with over half of all households being car owners by the late 1960s. In recent years there have been more households owning two or more cars than those without. When this information is considered alongside the evidence in Table 8.12, it is possible to postulate increased car ownership as the reason for the massive increase in the number of trips being made shown in Table 3.2. However reverse causality can also be postulated – people feel the need to make more trips because of land use trends and therefore buy a car. A third possibility is that causality and reverse causality operate together in a vicious circle. More people buy cars. They make more trips. This leads to more diffuse land use patterns. This leads to a need for everybody to make more trips. So more people buy cars. And the circle starts again.

Table 8-13 Proportion of households with regular use of cars

	No car (%)	One car (%)	Two or more cars (%)	All households (%)
1952	84	14	1	100
1957	76	22	2	100
1962	67	30	3	100
1967	53	41	6	100
1972	48	44	9	100
1977	43	45	11	100
1982	40	44	15	100
1987	36	45	19	100
1992	32	45	24	100
1997	30	45	26	100
2002	26	44	29	100
2007	25	43	32	100

Source: Transport Statistics: GB 2009 [3]

Chapter 9 considers these data further, in relation to social inequalities.

8.6 References

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9 Inequalities

J Mindell, R Mackett, A Frye, J Cohen

9.1 Social inequalities in use of transport

9.1.1 Introduction

This chapter examines social inequalities in use of transport and in experiencing the adverse health effects of transport before focusing on social exclusion caused by transport problems. Increasing social inclusion through improved transport policies is addressed in Section IV, chapter 13.

Both the health promoting and the health damaging effects of transport are unequally distributed in society. The people who experience the least benefit and the most disbenefit are those who are disadvantaged in many other ways. They include women, children, and people who are old, ill, or have a disability, or are on a low income, or belong to one of the disadvantaged ethnic minorities. Disadvantaged people experience fewer of the health benefits of transport because they have less choice about whether, how, when, and where to travel, or have more difficulties in accessing the places or people they need or wish to visit.

9.1.2 Income inequalities

As this report shows, there would be many health advantages for the whole population from reduced car ownership and particularly greatly reduced car use but this chapter is focusing on inequalities. Table 9-1 shows that those with higher incomes tend to own more cars. In the lowest income quintile, fewer than half the households own a car. In the top one, half own two or more, and only 11% have no car. Similarly, car ownership and being able to drive also vary by ethnicity (Table 9-2).

Not owning a car does not necessarily imply disadvantage either regarding travel and access or as a general indicator of wealth, itself related to health. However, when urban planning assumes access by car, those without a car are unfairly disadvantaged (for example siting hospitals or antenatal clinics at the top of a hill without a frequent – or any – bus service).

Table 99.1. Household car availability by real household income, Great Britain 1995/97 and 2008

	Percentage of households 1995/97			2008		
	No car (%)	One car (%)	Two or more cars (%)	No car (%)	One car (%)	Two or more cars (%)
Lowest real income	66	30	4	51	39	10
Second lowest level	46	45	8	36	46	18
Third quintile	20	52	27	16	51	33
Second highest level	12	49	39	11	40	48
Highest real income	7	45	49	11	39	50

Source: DfT Transport Trends 2009 [1]

Table 9-2. Personal car access aged 17+ by ethnicity, 2005-2008

	Persons in household s without a car (%)	Persons in households with a car Main driver (%)	Other driver (%)	Non-driver (%)	All (%)
White					
White British	17	57	13	13	83
White other	36	38	13	12	64
Asian or Asian British					
Indian	16	46	15	22	84
Pakistani	18	40	14	28	82
Other Asian background	32	32	7	29	68
Black or Black British					
Caribbean	33	42	9	16	67
African	46	31	6	16	54
Other ethnic group					
Mixed; Other Black; Chinese or other ethnic group	37	36	10	17	63
All groups	19	55	12	13	81

Source: National Travel Survey 2008 [2 3]

Differences in car ownership have a consequential impact on the number of trips made by each group, as shown in Tables 9-3 and 9-4. Not surprisingly, those in the higher income groups make more car trips. They also make more 'other' trips because these are mainly rail. Conversely, those with lower incomes make more walking trips and bus and coach trips. This is an example of healthier behaviour by poorer individuals that should be emulated by their wealthier peers, rather than the more common situation of encouraging poorer communities to change their behaviour because of higher prevalence of smoking, low activity levels, and obesity, for example.[4] Interestingly there is little variation in cycling across the income groups.

In 1985/6, only 41% of adult women had a driving licence, compared with 74% of men.[5] By 1997/99 these had increased to 59% and 82% respectively,[6] with the gender gap decreasing further by 2007 to 63% of women and 80% of men.[3] The largest increase has been among women aged 60 to 69, but marked inequalities by gender persist. In 1975/76, 15% of women in this age group held a driving licence, while in 2006 this figure had risen to 63% (compared with 58% and 90% respectively in men).[7]

Females and people in low income households make more walking trips than males or those in higher income households.[8] Although 79% of people living in the most affluent areas feel safe walking on their local streets and 88% agree their local area is a pleasant place to walk, these figures fall to 55% and 57% respectively for people living in the most deprived areas.[8] Walking and travelling by public transport are perceived as dangerous at night time, because of the risk of assault. A report published in 1989 found that nationally, 54% of women avoid going out alone after dark.[9]

Table 9-3. Annual travel by household car availability and personal car access, 2008

	All persons		
	Trips per person per year	Distance per person per year (miles)	Time per person per year (hours)
In households with car access			
Main driver [a]	1,176	9815	439
Other driver [b]	931	7183	377
Non driver [c]	886	4824	314
In households without a car	745	3023	318
All	992	6,923	376

a The main driver of a household car is the household member that drives the furthest in that car in the course of a year.

b Other drivers are people in car owning households, who have full driving licenses to drive a car, but are not main drivers of a household car. No account is taken of whether or not they actually drive a household car.

c Non drivers are all other people in car owning households. They include children below driving age, and adults with provisional licenses

Source: National Travel Survey 2008 [2 7]

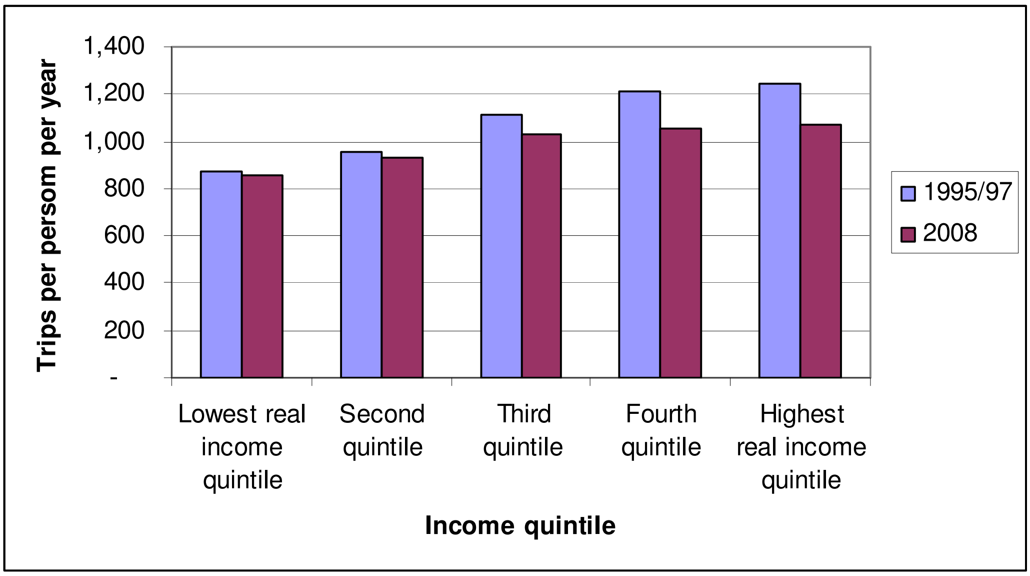
Table 99-4. Number of trips per head per year by mode, by household income quintile, 2008

	Walk	Bicycle	Car	Bus and coach	Other	All modes
Lowest real income	271	15	424	107	41	860
Second lowest level	230	16	553	88	44	931
Third level	228	15	690	55	42	1,032
Second highest level	200	17	737	48	53	1,054
Highest real income	181	16	754	35	82	1,069
All income levels	221	16	637	66	53	992

Source: National Travel Survey 2008 [2]

As more people own and use cars, public transport declines under the pressure of the car, becoming slower, less frequent and less comprehensive, resulting in greater inequalities. The disadvantage experienced by people without cars also becomes greater as spatial planning assumes access by car. More recently, the difference in the number of trips per year has reduced compared with a decade earlier, but people in households with the lowest quintile of income still made almost one-third fewer journeys per year (down from 42% difference to 20% difference in 2006, Table 9-5; and a 24% difference in 2008, Figure 9-1). The impact this has on individuals cannot be inferred from these statistics other than to point out the inequalities. Whether it is desirable to be making more journeys and whether these journeys provide access

Figure 99.1 Annual trips per person by income quintile, 1995/97 to 2008



Source: DfT Transport Trends 2009 [1]

to health-promoting lifestyles is beyond the scope of the surveys that generate these statistics. Inequalities in the average annual distance travelled also reduced from the markedly high 2.8-fold difference in 1995/97 to a 1.8-fold difference in 2006 and 1.5-fold by 2008 (Table 9-5).

Table 99-5. Average annual number of trips made and distance travelled, by household income quintile: Great Britain, 1995/97 and 2006

	Trips per person per year			Miles per person per year		
	1995/97	2006	2008	1995/97	2006	2008
Lowest real income quintile	875	882	860	3,126	4,124	4,112
Second quintile	959	967	931	4,693	5,064	5,241
Third quintile	1,110	1,066	1,032	6,364	6,561	6,519
Fourth quintile	1,211	1,109	1,054	8,620	8,531	8,261
Highest real income quintile	1,246	1,158	1,069	11,827	11,588	10,290
All incomes	1,086	1,037	992	6,981	7,133	6,923

Source: DfT Transport Trends 2008[3] *and DfT Transport Trends 2009*[1]

People living in rural areas make more trips and spend longer travelling than those in urban areas, except for Londoners, who spend the most time travelling. Cars and other private transport are used more in rural and small urban areas than in metropolitan areas. Key services are less accessible to people living in rural areas: only 70% of rural households are within 15 minutes of a shop selling groceries and only 51% within 15 minutes of a GP, compared with over 90% and over 80% respectively in urban areas.[10] Those living in rural areas who do not own a car, cannot afford to run their car, or do not have access to use of the household's car are particularly vulnerable to social exclusion.[11]

However, even within the same type of area, the distance walked per person also varies by car access, again demonstrating that although not owning a car may make access to goods, services, people and places more difficult in a car-based society, not owning a car promotes active travel and can increase the quality of life.

9.1.3 Women

Women tend to have different employment patterns, different time use patterns, and fewer financial resources than men.[12] They are more likely to be travelling encumbered by children or shopping, have greater safety fears, and wear different clothes. These influence the times and ways in which they travel. Inadequate consideration of women's travel can result directly in social exclusion, but has other health consequences such as an inability to access shops selling healthy food, or difficulties reaching hospital care, particularly when pregnant.

For those aged under 60 years, females made more trips on average than males in 2008, with this pattern reversing for those aged 60 years and above. Compared with 1996, the distance travelled by different modes has changed in different ways for men and women. Distance travelled by bus increased by 20% for men and 15% for women by 2007; distance walked has fallen among men but was the same in women; travel as a car passenger fell in both, but more in men. The main difference was that distance driven fell in men by 11%, while in women it rose by 24%. Both these cases show increasing gender equality; in 1995-1997 47% of men's journeys were as a car driver compared with 30% of women's, whereas more women took the bus (7% compared with 5%).[13]

Women's time is under greater pressure than men's.[12] This results in women emphasising commute time over distance when choosing employment.[14] Women studied without a strong career orientation were more sensitive to travel time when they were responsible for pre-school age children, a phenomenon which was even more marked when the women studied were dependent on public transport[14] – showing the extent to which gendered transport inequality can restrict employment opportunities.

Women are more likely than men to be lone parents. The relationship between lone motherhood and poverty is well established, yet the burdens of transport costs and dependence on public transport are likely to be higher: single mothers make more trips than married mothers,[15] are five times more likely to use a taxi and 1.5 times more likely to use a bus.[16] It is no surprise then, that lone parents were twice as likely to be constrained by the cost of travel, and three times as likely to feel limited by lack of facilities.

Women's journeys, including those to work tend to be shorter than men's. This means that women are a potential target audience for cycling to work, as a higher proportion commute within the three mile distance that the British Medical Association suggested the majority of the population could cycle.[17] However, women are twice as likely as men to fear for their safety whilst cycling,[18] and are more likely to organise their day around complex trip chains (work-school-shopping) which are less conducive to cycling.[19] This contributes to a notable, though falling, gender gap in cycling., In 1995, men undertook more than five times as many journeys by bicycle as women[20] but in 2008, the average number of trips per year by bike were 23 for men and nine for women.[2] Female commuter cyclists are more likely to prefer using off-road paths; a phenomenon which should be noted by designers hoping to increase participation in cycling.[21]

Much of the transport system has been designed by men around the needs of the domestically inactive. Emphasis is given to journeys to work and long journeys, rather than to journeys for childminding or shopping. This can be seen in the radial layout of most cities' public transport systems, where the journey to work is catered for by rapid metro-type transit, whereas journeys to schools and shops are catered to by less reliable and often infrequent bus services, if at all. Because of the greater time pressure on women, public transport reliability is more important – yet local off-peak travel is largely by buses, which are markedly less reliable than peak time commuter transport.

Individual vehicle designs also traditionally pay little attention to the needs of women. There has been some progress in increased introduction of low floor buses which are useful to women with children. However other public transport features such as grab rail heights do not take account of women's smaller average stature. Likewise, car designs require women to sit closer to the steering wheel than men in order to reach foot pedals, but airbag designs do not account for this.[16] There is evidence that women are 50% more likely to be injured in car collisions than men.[22]

Figures on car use assume that if a household has a car, all members of the household are thereby mobile. However, in 2008, only 65% of adult females had a driver's license, compared with 81% of adult males.[2] Even in households with a car, 62% of men but only 49% of women have access to the car as the main driver. [2] The possibility that the male partner may have taken the car to work or that some members of the family may be unable to drive is disregarded, as are the effects of young and old age – yet particularly in rural areas, if the household's one car is in use, other household members can be left unable to travel.[12] If this phenomenon were fully considered, it would become glaringly obvious that only a minority of the population derive mobility from the private car.

By neglecting the distribution of mobility within the household and underrating short journeys, current patterns of thought place absurd overemphasis on the car, concealing the fact that car users are the minority and that walking is the second most common journey mode. These same patterns of thought also neglect the transport needs which disproportionately affect women and emphasise the transport needs which disproportionately affect men.

In public health terms, this is significant for two reasons. Firstly, it adds to the health problem of isolation and alienation for many groups of women, such as housewives and single parents. Secondly, redressing these assumptions would lead to changes in transport policy which would improve many of the other problems discussed in this document.

9.1.4 Rurality

Rural areas by their nature have a population less able to support public transport services, whilst people living in rural areas usually have further to travel to reach those services. Figure 9.2 shows how the proportion of the rural population within a set distance of various key services is consistently less than for urban populations.

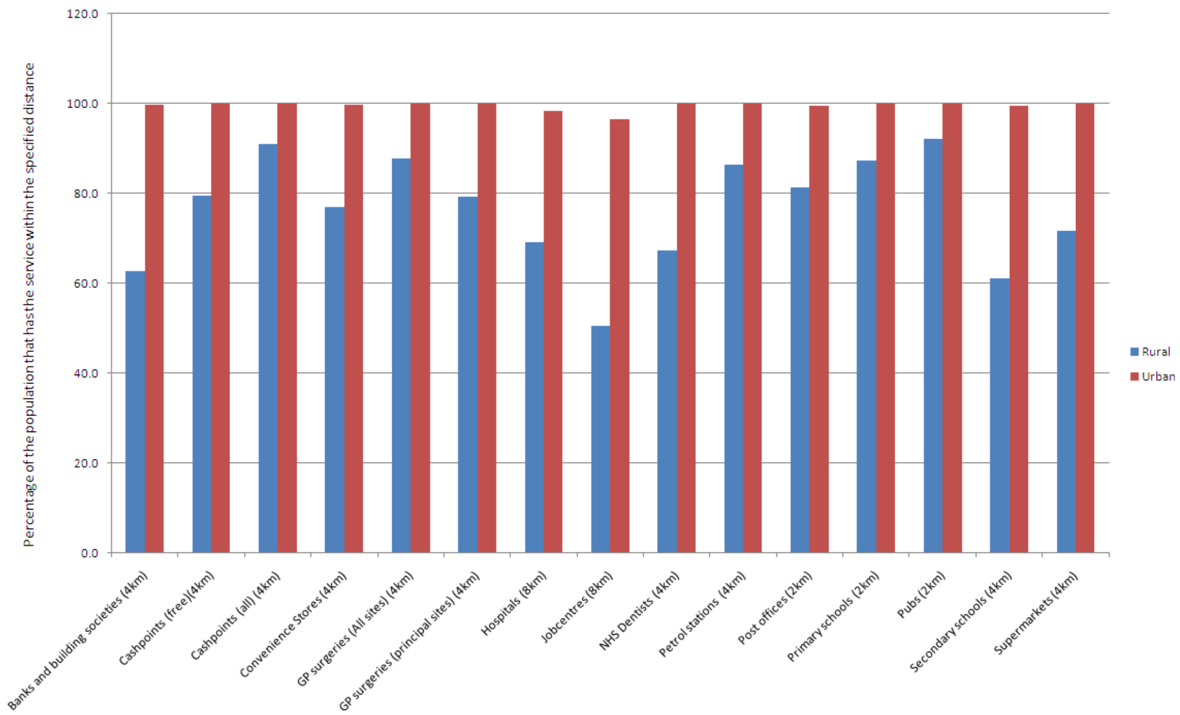
It has frequently been a key assumption of rural planners that those choosing to live in rural areas make the decision in full knowledge that accessibility will be more difficult and they must compensate accordingly, usually by car ownership.[23] This assumption fails to consider those for whom living in an inaccessible location was not a choice. This may include those who are tied to a rural livelihood, elderly people and others unable to move away from rural areas, people who become disabled in such a way as to prevent driving, and children not yet old enough to drive. In addition, there are those who have chosen a rural lifestyle but would inherently prefer not to be dependent on the car, whether for reasons of health, the environment, or cost.

9.2 Social inequalities in effects of transport

People in disadvantaged groups also suffer most from the effects of other people's travel by private motor vehicles. This is best illustrated by injuries, which are the most easily quantifiable adverse health effect of car use. Rates of road traffic injuries show steep social class gradients with the rates increasing with increasing deprivation for most types of road user, especially pedestrians (Tables 9.6 and 9.7), particularly child pedestrians. Children from lower socio-economic households spend more time walking or playing near roads than their more affluent peers.[24] In the past, children from social class V were five times as likely to die as pedestrians from road injuries than children from social class I.[25] Analysis of child road traffic casualties from 2004 to 2008 found a marked social gradient. Injury rates varied from one child in 206 in

Preston City to one in 1,158 Kensington & Chelsea. Analysis of injuries by Mosaic group found rates in Group G were more than twice the national average. Group G is described as 'Families on lower incomes who often live in large council estates where there is little owner occupation', typically living in outer suburbs of large provincial cities. They are some of the most deprived communities in the UK, representing 6.5% of the population.[26] However, this social gradient is not inevitable. Speed restraint measures in Hull have reduced pedestrian deaths and serious injuries, particularly amongst children. Given the marked social gradient in such injuries, this measure has therefore disproportionately benefited the worse off.[27]

Figure 99.2. Percentage of population within specified distance of services[28]



The Department of Transport estimated there would be 600 fewer road deaths among men aged 20-64 if everyone had the same risk of road traffic injury as men in social class I.[25]

These social inequalities are at least partly because people without access to a car travel less by car and walk more than those with cars. Adults in households with two or more cars travel on average nearly four times further than those in households without access to a car and made 45% more journeys in 2007.[2] In 2005, women with access to three or more cars made 50% and men 62% more walking trips than those without car access.[8] Children living in a household headed by a manual worker are more likely to walk to school than those living in a household headed by a professional (Table 9-7).

Table 9-6. Number of casualties by deprivation decile and road user type, England 2007

IMD Decile [a]	Casualty rate per 100,000 population						
	Pedestrian	Pedal cycle	Motorcycle	Car driver	Car passenger	Bus or coach	Total
1 (most deprived)	70	29	32	162	94	19	422
2	57	30	42	157	77	14	392
3	48	28	42	166	74	12	386
4	42	26	41	170	73	9	376
5	36	24	41	179	71	8	373
6	32	22	38	175	67	6	356
7	29	22	37	178	62	6	347
8	26	20	35	175	63	4	336
9	24	20	34	167	60	4	322
10 (most affluent)	21	20	30	162	53	3	297
Total	39	24	37	169	69	9	361

[a] IMD: Index of Multiple Deprivation

Source: Road Casualties Great Britain, 2007[29]

Table 9 9.7. Pedestrian casualty rate per 100,000 population in the most and least deprived decile, by age: England 2007

Age of pedestrian casualty	Pedestrian casualty rate per 100,000 population			
	Most deprived	Least deprived	All	Excess in most deprived decile
0 - 16	121	32	65	89
17 - 19	101	40	68	62
20 - 25	74	29	51	45
26 - 59	47	13	26	34
60 +	39	19	27	20
Total	70	21	39	50

Source: Road Casualties Great Britain, 2007[29]

However, people on low incomes are also more likely to live in an inner city area where traffic is more dense. Walking in this environment may be more dangerous than where there is less traffic. The average distance walked per person per week varies relatively little between different types of area. Motor vehicle mortality is higher in rural than urban areas, probably exacerbated by poorer survival rates.[30]

In Lothian, Scotland, road injury rates were higher in areas with more rented housing, a higher proportion of lone parent households, low car ownership and, apart from car drivers, more unemployment. Pedestrian injuries were higher in areas of higher population density, with the most residents from social class V, and the most older people; areas with most older people also had higher rates of bus and coach injuries. Both pedestrian and car driver injury rates were higher in areas with more migrant households who had moved house in the previous 12 months.[31] In general, roads are busier and homes are less likely to have safe play space, such as gardens, in more deprived areas.

People living in heavily trafficked inner city areas, also experience more of the other adverse health effects of car use such as noise, pollution, congestion, stress and severance of communities by roads. In general, the adverse effects of car use are concentrated where car travel occurs rather than where car owners live. There is strong correlation between poverty and air[32] and noise pollution. Less affluent districts tend to be concentrated in areas with a higher density of roads and traffic and this can lead to impaired air quality, higher noise levels and higher injury rates. For air pollution, these are often further exacerbated by other factors such as poor diet and health care access (with vulnerable groups most at risk). The very young, the old, and the frail not only are most likely to live in areas with higher air pollution but they are also the groups most at risk of the health effects of pollution.

9.3 Social exclusion caused by current transport policies

9.3.1 Poverty

The severe poverty associated with unemployment considerably restricts freedom of movement. In 1990, unemployed households spent less than £1 per head per week on transport, compared with £5 per head per week in the households of employed people living in the same deprived area.[33] This certainly represents less choice of mode or destination and is likely to represent less access to goods, services, and people that can be health-promoting. Even if spending more to enable longer distances to be travelled is not desirable in terms of sustainability and health, it represents inequity and social exclusion given current spatial and transport reality and planning policies.

Transport problems contribute in a number of ways to social exclusion, limiting access to work and education, as well as to healthcare. Two out of five jobseekers report lack of transport as a barrier to getting a job and one in four find the cost of transport a problem in getting to interviews, with a similar number of young people not even applying for a particular job in the last 12 months because of transport problems, while one in ten people in low-income areas have refused a job in the last 12 months because of transport difficulties. Young people without driving licences are half as likely to get jobs than those with. Almost half of 16- to 18-year-olds experience difficulty with the travel costs to college and 6% of 16- to 24-year-olds refuse training or further education opportunities because of transport problems.[34]

We comment in chapters 10 and 15 on government policies on public transport, the history of closing railways and deregulation of buses, and the need for a national, integrated transport network. Travel to hospital is often difficult without a car: 31% of people without a car reported difficulties travelling to their local hospital, compared with 17% of those with a car, with 7% of people without cars reporting they have missed, turned down, or chosen not to seek medical help over the last 12 months because of transport problems, double the rate in the general population.[34] Only 61% of the population can reach their GP by public transport or on foot; this figure falls to 36% for access to a hospital.[1] Access to supermarkets is also much harder without use of a car.[34]

In rural areas, car use can be a necessity for accessing health-promoting locations, whether education, work, services, goods, or family and friends, where adequate public transport provision is lacking. Thus indices of deprivation that include access to a car as indicating affluence can misclassify poor rural areas. Where such indices are used for resource allocation, additional inequality can ensue. Among the poorest households, those who do own a car spend almost a quarter of their income on motoring costs. A family is described as experiencing ‘fuel poverty’ if heating their home costs more than 10% of their income; there is no equivalent definition of ‘transport poverty’.[35]

9.3.2 Disability

Transport difficulties are increased in the presence of personal disability. Fourteen percent of the general population has mobility difficulties, defined as anybody who has a disability or long standing illness or condition that makes it difficult either to go out on foot or to use local buses.[7] Around one in four disabled people have difficulties using transport related to their health condition or disability.[36]

There is a wide range of factors - physical, sensory and cognitive - that can inhibit mobility. For example, major reason why older people stop going out alone is a fear of falling.

A definitive figure for the number of wheelchair users is difficult to obtain. Some sources, including the English Department of Health,[37] quote a figure of 1.2 million wheelchair users in England, while others give a similar figure for the UK as a whole. There are also many more people, predominantly older people, who use mobility scooters to move about locally even though they are able to walk short distances. There are around 350,000 registered blind and partially sighted people in the UK and many more with low vision who are not registered. Some 35,000 people lose their sight every year.[38] Around nine million people are deaf or hard of hearing. There are around one million people with a cognitive impairment and this figure is predicted to rise significantly with the ageing population over the coming years due to increasing numbers of people with strokes or dementia.[39]

There is a strong correlation between age and disability. In 2005, 5% of those aged 16-49 had mobility difficulties, rising to 45% of people 70 and over. Adults in the poorest fifth of households are five times as likely to have mobility difficulties as those in the wealthiest fifth. Those with mobility difficulties are more than twice as likely to live in a household without a car and to make fewer trips as a driver, by foot, or by rail, but more trips by bus and taxi/minicab, although many have difficulties using buses; 8% have difficulty travelling to a doctor or hospital.[40]

The number of older people in the population is increasing significantly. By 2033, 23% of the population will be aged 65 and over compared with18% aged 16 or younger. The fastest population increase has been in the number of those aged 85 and over, the ’oldest old‘. In 1983, there were just over 600,000 people in the UK aged 85 and over. Since then the numbers have more than doubled reaching 1.3 million in 2008. By 2033 the number of people aged 85 and over is projected to more than double again to reach 3.2 million, and to account for 5% of the total population.[41]

Taken together this is a very substantial number of people for whom mobility may be a problem and whose independence in daily living is likely to be severely affected if they are unable to travel. How much the ageing population will result in increasing numbers of people with disability depends on the extent to which increased longevity is a postponement of ill-health (increased disease-free life, or 'adding life to years'), with a fall in age-specific rates of disability and disease prevalence, compared with increasing years spent with ill health and/or disability. In the past, healthy life expectancy has not kept pace with life expectancy so an ageing population has meant a more disabled population. In some countries however healthy life expectancy has started to improve more than life expectancy, producing a "compression of morbidity" in which people live longer but are disabled for less of their life so that actually a smaller proportion of the population experience the disability of old age. This has been shown for those with healthier lifestyles,[42] including smokers who quit smoking.[43] It is difficult to be clear yet whether this is happening in the UK – up until the turn of the century it certainly was not but there have been some recent figures which suggest it might be beginning to change.[44] In the 1990s, healthy life expectancy or disability-free life expectancy rose less than overall life expectancy. However, the trend for men since 2001 has been towards a slightly shorter period spent with a limiting illness or disability or in poor health.[45] Restricted mobility may also occur on a temporary or intermittent basis when people are travelling with children, buggies, or luggage or shopping. Transport solutions aimed at those with disabilities will also improve mobility for these individuals.

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10 Sustainability: Congestion and the case for a National Integrated Transport Web, Active Travel, Road Charging and Working at Home

Stephen Watkins

10.1 Sustainability

A sustainable economy is one which is not dependent on the consumption of non-renewable resources or on the pollution of the environment in a way which will ultimately cause unacceptable harm. Our present economy is not sustainable because it depends on oil, which will run out, and on the atmosphere absorbing greenhouse gases, which will eventually destroy our climate.

Sustainability is a public health issue because of the health damage that will accompany climate change. It is an especial issue for transport because motor vehicles and aviation are major contributors to the production of greenhouse gases.

The Department for Transport (DfT) consultation document *Delivering a Sustainable Transport System* (see chapter 14, section 14.2.2) has five goals: economic competitiveness; reduced greenhouse gas emissions (see chapter 3, section 3.2); better safety, security and health; greater equality of opportunity; and improved quality of life.[1] Active travel can contribute to all of these, although some benefits are more readily understood than others. In health terms, cycling and walking are physical exercise that addresses the trend to obesity and consequent disease (see chapter 2). In ecological terms, the bicycle is a low-carbon form of transport, both in its construction and its use, while walking requires no machine to be constructed. In economic terms, Britain's increasing reliance on imported oil is a national risk that would be at least ameliorated by a cycling revival. In transport terms, Britain's road network is amongst the most congested in the world; it is necessary to use it more efficiently by reducing car use for short trips.

Congestion is a major problem on UK roads. Congestion is defined as the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches its capacity.[2] From 1950 to the early 2000s, road traffic increased by 5% per year (an almost tenfold rise over that time), while road length grew by 0.5% pa and road capacity by around 1% pa.[2] It was estimated in 1999 that congestion cost £20billion a year in the UK,[2] though some argue that the more useful figure is for the marginal cost of an additional vehicle, with a 1998 estimate for this being 10p per vehicle kilometre.[2] Most car owners would admit that their car spends a large part of its time in traffic jams and it is instructive to look at the "average speed" calculation on a trip computer after any significant length of normal mixed driving time – very often the speed will be no greater than could be achieved on horseback.

10.2 Why has congestion arisen? Pigou's Theorem and the Downs Thomson Corollary

Where something costs a lot to set up but is cheap to expand ,a problem arises in economics. Common sense suggests that when you have incurred the expense of setting it up you should attract as many users as possible. To achieve this, the price should be kept low and should correspond to the extra cost of extra use (the marginal cost). But if that is the price charged then the cost of setting the system up will never be recovered. There may be users who will pay the high price necessary to fund the set up costs; indeed there may be enough of them to fund these costs. However they will not pay this if other users are to be charged a cheaper rate. Thus if the higher price is charged then there will be unused, wasted capacity. This is why railways and airlines, both of which are in this position, try to invent fare schemes which will sell seats cheaply but with restrictions that put off the people who are willing to pay the higher price. If this cannot be done, the alternatives are to waste the capacity or to charge the lower price and have a subsidy. This is a valid market reason for subsidising railways. The problem described here in everyday language is academically dealt with in Pigou's Theorem.[3] [4] In academic language, it says that the market will not produce allocative efficiency where there is a downwardly sloping cost curve because the market will clear at a point where there is unused capacity.

Roads are provided almost free at the time of use. This means that anybody who wants to use them will. This is the ultimate of the 'attract as many users as possible by subsidising' option. But a point is reached where the demand for the road exceeds its capacity. When that point is reached, something must reduce the number of people using the road. It could be a charge but otherwise it will be congestion. The number of people using the road will increase until the users consider the congestion is unacceptable.

Thus an equilibrium level of congestion is reached at which the congestion is acceptable enough to just enough potential users. The road is then used by the number of users it can accommodate and no more. It is helpful to this process that road capacity increases as speeds slow down. This process does not work by people making this decision day by day. It works by influencing whether people do or do not adopt particular lifestyles - commuting rather than moving closer to their job for example. If two places are 70 miles apart by motorway (a little less for places further from the motorway), some people will live in one place and commute to the other if they can do it an hour, so they might be willing to commute if the motorway usually had no congestion. There will be fewer people prepared to do this if the motorway is usually slowed to 50mph and the journey usually takes almost an hour and a half, and far fewer if the motorway is usually slowed to 35mph and the journey takes two hours. An uncongested motorway could carry traffic at 80mph and police guidelines on enforcement set the effective speed limit only slightly below that. At that speed, in one hour you could travel from Manchester to Derby, Burton-upon-Trent, Rugeley, parts of Shropshire, Wrexham or Llangollen. Even without breaking the speed limit all the people who would prefer to live in a particular place that is up to 70 miles from their home and do not do so because the congestion means that they cannot in fact travel at 70mph are potential users of the road. Plus, of course, there are those willing to travel for more than an hour and therefore willing to live even more than 70 miles away – theoretically the outer suburbs of Manchester could be in Nuneaton, just an hour and a half away on 70mph roads. If the road cannot accommodate everybody, it will be congested and the congestion will build up until the demand is reduced to equal the capacity. Speed limits narrow the radius and this suggests that they may ease congestion as well as their other benefits. Distance at each end from the motorway also narrows the radius and so the problem is worsened by link roads and by building shopping areas, industrial estates and the like close to motorway intersections.

The fact that this process (which economists call a trade-off) occurs predominantly by people changing or not changing their lifestyles rather than by decisions they make about individual journeys explains why it does not affect very short term changes in congestion such as the fall in congestion that occurs in the school holidays due both to the removal of school run traffic and also to people being on holiday.

Once it is impossible to meet all the demand (the saturation point), road users have to accept that there will always be an equilibrium level of congestion. It is not clear when that point is reached, but the number of people who are potential users of the road is a function of how long people are prepared to spend commuting, the radius of a travel to work area which that creates at uncongested technologically-feasible speeds and the density of population. From the geometry of a circle it will be recalled that the area of a circle is proportionate to the square of its radius so that travel at 70 mph sets an sets an area for potential travel to work that is double that set by 50mph. Social acceptability and police toleration of the unlawful speed of 80mph increases this by a further quarter to two and a half times what it would be at 50mph. As the above examples of the radius from Manchester illustrate, most of the UK (with the exception of a few remote rural areas) is clearly well past the point at which we could possibly accommodate that potential traffic. Commuting is not the only factor in creating potential use and it is not only passenger use that matters but the same principles apply to all the potential use. For example, the extra freight charges that apply when a lorry can make fewer journeys in a day operate in exactly the same way.

This was not a problem in the 1950s because only a small proportion of the population owned cars, the cars could not be driven that fast for a sustained period, and the roads were not good enough anyway. However, as cars became more reliable at higher speeds, as roads were improved, and as car ownership increased, the main limit to the distance people were prepared to live from their work came to be congestion. Hence in the 1950s most congestion resulted from bottlenecks but in this century most congestion results from saturation of the road system. The problem is that this difference is not fully appreciated and we still waste money on solutions that might have worked in the 1950s but will not work in changed circumstances.

10.3 What can we do about congestion? Why road building is not the answer

Is it possible to reduce congestion? It can be done by a road charge because then people will travel only if they are willing not only to spend the time but also to pay the charge. The point at which people decide to arrange their lives so they do not travel as much is a choice. Different people make it at different points. Congestion will be set at the point where the people making that choice reduce the use of the road to the capacity the road has. A congestion charge reduces that number and so increases that equilibrium point. (Road charges and their impacts on travel choices, inequality and social exclusion are discussed in Section IV, chapter 17).

Suppose we build a new road or improve the existing one. This would have worked before the road system was saturated. Most congestion was then caused by bottlenecks, so it became normal practice to respond to it by widening the road or by building a by pass round the bottleneck. Will it still work in a saturated system? If a new road is built, there is a delay before the equilibrium congestion is reached because people do not change their lifestyles immediately. But over a few years, as people move, the traffic rises to the equilibrium congestion again. As the road will carry more people, the equilibrium point might be higher. However this is offset by the fact that whilst the new equilibrium was building up, a number of people will have changed their lifestyles even though they would not have chosen to use the road if they had known what the eventual equilibrium was going to be. These users may well be trapped in a lifestyle they never thought they had chosen and they will take up part or all of the extra capacity. Thus the eventual equilibrium congestion speed may not be very much higher than the original - indeed it may even be the same or less. Mogridge[5] showed that traffic speeds in London did not alter much with road improvements – not even with the substitution of motor traffic for horse-drawn vehicles. SACTRA, the Standing Advisory Committee for Trunk Road Assessment, found that creating more road space for cars merely generates more traffic.[6]

Suppose a toll road is built to compete with the free road. People will not use the toll road unless it offers an advantage that they are prepared to pay for, so traffic on the toll road will travel faster than traffic on the free road. The space created on the old road will fill up but because it is filling up from the next tranche of potential users, the new equilibirum speed will be slightly higher.

One problem of building new roads (whether free or toll) is that any extra traffic which uses them also uses other roads. If those other roads are also saturated, then this increases the demand on those roads and therefore lowers their equilibrium speed. Across the system as a whole, road building simply makes things worse. In fact, if road improvements do have a beneficial effect on a particular route it is probably only because they have made things worse elsewhere and the extra congestion elsewhere has prevented the traffic rising to the equilibrium on the improved road. For example, a driver may make a journey of 24 miles that takes an hour. A new road allows her to do the first 12 miles in 12 minutes. But then all the traffic hits the old road - and as there is now more demand, the equilibrium speed falls. It falls until the whole journey takes an hour again. But this might not be 24mph throughout. It might be 45mph for the improved 12 miles and 16mph for the unimproved 12 miles.

Road improvements can shift congestion around the network but they cannot improve it.

This is important in understanding the significance of a shift from a situation where congestion was caused by bottlenecks to one where it is caused by saturation. It may still be possible in a saturated system to identify a point of maximum congestion and call it a "bottleneck" – but removing it will not have the same benefit as it would in an unsaturated system.

10.4 The Importance of Networks

Suppose that instead of a new road, a public transport route, such as a railway, is established or improved parallel to the road. As far as congestion on the parallel route is concerned, the effect will be the same as if a toll road had been built. However, because the traffic abstracted has been taken off the road system, instead of extra traffic being added, the effect on the rest of the system will be a beneficial one rather than an adverse one. The same will also apply to a cycle route if a significant part of the traffic is amenable to transferring to the bicycle.

In either of these circumstances congestion will still rise to almost the equilibrium level. The traffic taken off the road by the alternative will still be replaced by people who now find the traffic levels acceptable. However for this to happen, congestion has to decrease slightly because it has to attract people who would not have used it at the level that congestion was previously. So public transport routes or cycle routes slightly improve congestion levels. The more choices there are, the more factors figure in the travel/do not travel choice – and how to travel - and therefore the higher the speed at which the choice changes, so the lower congestion is. This is known as the Downs-Thomson Corollary of Pigou's Theorem.[7] [8]

This is the explanation for the contention that road charging, better public transport, better cycle facilities, and better opportunities to avoid travel are the only ways to improve congestion. These are the only factors that impact on the equilibrium by altering the choices available. Improvement of the road does not alter the choices available and it also draws in trapped users, so it does not alter the equilibrium level.

Mogridge tried to test this concept by obtaining data on the speed of traffic in London from the mid 19th century up to the late 20th century. The theory was substantiated. He found that traffic speeds in London were not influenced by anything that happened on the road system but rose and fell with the quality of the rail system. The building of a new Underground line had more impact on traffic speed than even the substitution of motor vehicles for horse drawn vehicles.[5]

But if the alternative simply parallels the original road, these effects are slight. Indeed Downs and Mogridge both warned about this.[5 7] The reason they are slight is that roads are used by a range of traffic making a range of different journeys, so traffic making the journey that the alternative relates to is outweighed by other potential traffic that uses the road but has a destination not served by the alternative. There is still some effect but not much.

To alter the equilibrium substantially, the impact on the range of choices must impact on a large proportion of the traffic using the road. That explains why it is not enough to invest in individual alternatives to individual routes. An alternative network is needed not an alternative route. For example, the opening of the Metrolink tram route from Manchester to Bury reduced traffic on parallel routes such as Cheetham Hill Rd in Manchester only off peak[9]. The authors of the paper which showed this tried to explain it by reference to a number of aspects of local transport policy, such as low car parking charges in Central Manchester. The explanation is more easily provided by the theoretical framework we are advancing here. In the peak hours the roads were saturated and there was enough suppressed demand amongst users who were not travelling from Bury to Manchester to replace the traffic the tram removed. Off peak the road was not saturated and the traffic removed by the tram was indeed removed and not replaced. The explanation for Mogridge's data in London is that a comprehensive rail network was created, improved, allowed to decline, then improved again. On the whole, the changes happened across the network.

This thinking – that we need a comprehensive network – is at the root of the problem of our thinking about public transport for the last half a century. The Beeching Report,[10] bus deregulation,[11 12] and the UK's entire system of funding public transport are all based on the proposition that to optimise the use of the system we need to focus on the most profitable (or socially beneficial) traffic flows in isolation and axe the least well used services when the money runs out. In apparently common sense terms *"We do not pay operators to haul fresh air".* This proposition is flawed.

A striking example of the flaw can be found in the Serpell Report.[13] This was a report commissioned by the Thatcher Government to complete the work that the Beeching Report had started by *"identifying the profitable core of the rail system"*. The Serpell Report suggested closing the railway line from Glasgow to Oban/Fort William at Crianlarich (population 250). At Crianlarich the line divides. Up to there it carries both Oban and Fort William traffic and is 'profitable'. Beyond there, it carries only one of the two traffics and so it is not. This inherent misunderstanding of transport needs - the incongruity of suggesting that a mainline service be terminated at a village – was one of the factors that led to the Serpell Report not being implemented. But still the reason the error occurred was not fully appreciated and certainly it did not impact as it should have done on the way transport was planned thereafter. The Serpell Report erroneously assumed that people who travelled to Crianlarich by train would still travel to Crianlarich by train even if the line no longer went on to Oban and Fort William; they would not have done so.

The same error is made every time a last bus is removed because few people use it. Many people who are not prepared to risk missing the last bus, catch the one before it; if that becomes the last bus, they catch the one before that - until the whole system ceases to serve late travellers and they take the car. People do not take a bus to work or to the pub if there is no bus home – they take their car. If a branch line is closed, people do not travel to a rail head and then start looking around for a way to travel – they take the car. (If there is in fact a good public transport replacement they may use it if they know about it, but not if they do not). If people have to make three journeys in a day and one of them cannot be made by public transport, they use their car for all the journeys. If people buy a car because evening public transport is poor, they may then use it all the time because once they own it they might as well use it.

The apparent common sense of statements like *"We don't pay rail operators to haul fresh air"* or *"Evening bus services don't make an adequate return"* or "*making the best use of the fleet*" or "*focussing on the most popular journeys*" is in fact a strategy that leads to a downward spiral of deteriorating transport. We need to return to providing comprehensive networks: the policy implications of this are discussed in chapter 15.

This raises of course the question of how this can be afforded, an issue that we discussed briefly in Chapter 1 and to which we make some further suggestions in chapter 18.

What will improve congestion are road charging (see chapter 17 section 17.1); comprehensive attractive cycle networks to impact on a wide range of the local traffic using the road chapter 14, particularly sections 14.5 and 14.6); comprehensive attractive public transport networks catering for a large proportion of the journeys that use the road (chapter 15); and arrangements which give people a viable alternative to travelling (such as better facilities for working from home, chapter 17, e.g. section 17.3).

It is the quality of the public transport network which will determine the congestion levels on the road. In their advice to the second Local Transport Plan in Greater Manchester[14], the Directors of Public Health for Greater Manchester, acting off the above analysis, recommended that the conurbation should have a network of trains, trams and limited stop buses, comprising both orbital and radial routes, operating to at least a 15 minutely frequency and running to within 1 km of every part of the conurbation. They believed that the core of the system would be trains and trams but that on orbital routes and corridors not served by rail, the service would be provided by limited stop buses, supplementing the regular bus services which made more frequent stops used for local journeys. Where scheduled services of this frequency were not called for, either in areas where there was insufficient population or at times when flows were light (midnight to 6am for example) demand-responsive transport would be used.

Unfortunately however there is a flaw in this logic as well, not dissimilar to the flaw in the logic of building more roads. The better public transport system will also unlock suppressed demand. So there is a danger of simply passing the problem onto the public transport system, as has happened with rail overcrowding in the South East of England. When this point is reached, it is important that alternatives to travelling figure prominently in the range of alternatives provided. This is desirable anyway for carbon reduction and sustainability reasons.

The strategy of improving public transport described in chapter 15 is thus only half of the solution to the problem. The other half – reduced need to travel – is dealt with in section 17.3. Just as the quality of public transport will determine the congestion levels on the road, so the attractiveness of opportunities to avoid travel will determine the levels of overcrowding on the bus, train and tram. If only half of the strategy is implemented we will simply replace the problem of congestion with the problem of rail overcrowding.

Indeed it may well be the case that both will be insufficient without some element of road charging as well. Because 80% of traffic is now on the road, it is necessary to increase public transport usage by at least four times the desired road traffic reduction. For example, to reduce road traffic by 15%, at least a 60% increase in public transport usage is necessary. It could require more than that if the public transport itself uncovers suppressed demand. This helps us scope the investment in public transport necessary to reduce road congestion. If we moved from a five day week working away from home to a four day working week with only three days being away from home and one day a week being at home, we would reduce commuting traffic by 40% and business travel probably by an even greater amount. We would increase leisure traffic but it would be spread over more days of the week. However we would also increase suppressed demand because people would be prepared to travel further to work if they did it less often. If the process took place gradually, we would avoid trapped users so we would definitely see an upwards shift in the trade off point from a combination of these two strategies. However, the benefit would be much greater if the consequential growth resulting from suppressed demand was priced away by road charging. Road charging alone is not a solution because it imposes an unfair and politically unacceptable burden on trapped users. Accompanied, however, by the provision of realistic alternatives, including a prospect of reduced car usage that will offset the road charges, the potential exists to introduce road charging to prevent the traffic growth that those alternatives would otherwise generate.

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Section III

Chapter 11 Clinical Practice

Chapter 12 Health Lessons for Transport Planners

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11 Transport and Clinical Practice

S Watkins, J Mindell, D Cohen, A Hayward, N Shelton

Whilst most of this book is about health at a population level and the policy measures that are needed for its enhancement, it is important to remember that at the root of any population health effect are real people experiencing specific biological impacts upon their personal health. It would therefore be remiss not to include a chapter written from this clinical perspective.

The purpose of this chapter is to provide a summary of the transport and health agenda for a general practitioner who wishes to understand how transport-related issues affect the treatment of patients. It is therefore a resource for general medical education. Sections of it may, of course, be useful in specialist training as well and it may be of value in the training of other health professionals such as nurses (it is has been particularly disappointing to see a major nursing journal campaigning for free hospital car parking).

This chapter includes information both on the impacts of transport on disease risk and also on the effects of disease on the need or ability to travel independently. It complements the information provided in chapter 9 on disability and disadvantage in association with transport.

11.1 Diseases of physical inactivity

As described in chapter 2, physical inactivity causes obesity, and hence hypertension and type 2 diabetes. It also causes heart disease and osteoporosis. Physical activity improves mental well being and reduces the incidence of mental illness. Physical activity can be an effective treatment of depression.

Physical activity can be taken in many ways but many people find it difficult to find the time for organised sport or fitness programmes and it is easier for people to increase their physical activity if they can build it into their daily life. Using stairs rather than the lift is one simple measure but will not in itself be enough. Travel to and from work, school, or other daily activities is a good opportunity to build physical activity into the daily routine.

Walking and cycling are healthy means of transport. Cycling is especially useful as it is faster than walking and can therefore be used over greater distances. Some people are concerned about the safety of cycling. This is discussed fully in chapter 7. In summary, there is a slight increased risk relative to walking or driving but it is no greater than many other risks that people take in everyday life, such as driving on all purpose roads rather than motorways or driving instead of taking the train. For the population as a whole the risk is more than offset by the reduced risk (relative to driving) of injury to third parties whilst for the individual cyclist the small risk is far outweighed by the considerable health benefits. Cycling does not reduce the individual's life expectancy even slightly: it increases it considerably.

Inexperienced cyclists will often want to become familiar with cycling on quiet roads before mixing with heavy traffic. Assistance in route planning may help them with this. They could also be encouraged to take cycling proficiency courses. Walkers may also benefit from route planning – people prefer to walk along attractive routes and may be unaware of some of the routes available to them.

Many cyclists choose to wear cycle helmets. The evidence on the effectiveness of these helmets is summarised in chapter7.

For people whose journey to work is too long to cycle, public transport offers more physical activity opportunities than driving. Walking to and from the station, walking to and from a bus stop on a high frequency route, walking between stations, and getting off one stop before your destination and walking the rest of the way are all entirely viable approaches.

11.2 Mental health & transport

11.2.1 Stress related disease

The associations between transport and stress are given in chapter 5: section 5.1.1 Stress and anxiety; section 5.1.2 Stress and mental and physical health; section 5.1.3 Transport and the stress reaction; and section 5.1.4, Diseases of poor social support. We have therefore not repeated these sections here but those who are reading this chapter only should also refer to them.

11.2.2 Mental health and transport

The associations between mental health and transport are complex. Active transport is associated with improved mental health and may be recommended as a treatment for mental illness, but some mental illnesses may prevent travel either through fear or restrictions on use of vehicles. Lack of access to transport may also be associated with mental health disorders.

The benefits of active transport

There is a substantial body of evidence demonstrating that walking has significant benefits to mental health.[1 2 3 4 5] Physical activity and hence active transport is associated with improved subjective well-being, mood and emotions. These effects are seen within all age groups and are independent of socio-economic or health status.[6] Physical activity can also improve self-esteem[7] and can result in positive changes in certain aspects of physical self-perception, such as body image or self-worth. The effect is stronger for those with initially low self-esteem such as mental health patients and those with mild depression. Active individuals also report fewer symptoms of anxiety or emotional distress and improved sleep patterns. Inactive people are more likely to develop clinically defined depression.[8]

Physical activity is effective in reducing clinical symptoms in those diagnosed with severe, moderate or mild depression[9] and has been shown to be equally effective as traditional treatments such as psychotherapy.[10] Those who maintain physical activity for at least six months report less use of medication and are more likely to recover than those who rely solely on medication. T here is also strong evidence that physical activity has a positive effect on anxiety with the most notable effects among those who maintain physical activity programmes over several months.[11] Projects such as Bike Minded are aimed at encouraging mental health service users to cycle by offering organised rides, cycle training, bike maintenance courses and vocational activities.[12]

Restrictions on vehicular travel

A systematic review of the literature on motor vehicle crashes and mental illness found that motor vehicle collision rates were higher among certain driver sub-groups including those having the most severe degree of mental illness and those using specific psychotropic medications such as benzodiazepines.[13] In England the DVLA which is responsible for issuing motor vehicle licenses may not grant and may revoke a license to persons with severe uncontrolled anxiety, severe depression with marked psychomotor retardation and/or psychosis, bipolar disorders including hypomania or mania, acute psychotic disorder, schizophrenia or other chronic psychosis.

Fear of travel

Individuals with certain mental health disorders (esp. agoraphobia, obsessive compulsive disorder) may fear travel and there are other phobias specific to transport type (aerophobia – flying; siderophobia – trains). Persons with agoraphobia may either restrict travel or need a companion when away from home, or else endure agoraphobic situations despite intense anxiety.[14]

Access to transport

Persons who reported feeling isolated as a result of the lack of transport (public or private) were more than three times as likely as the sample as a whole to have a GHQ score (general health questionnaire score, which measures minor psychiatric morbidity) indicative of depression.[15]

11.3 Transport and external causes of ill health

11.3.1 Transport related poisoning

See table 3.2 in section 3.1 for the health effects of air pollution from transport emissions.

Other transport related chemical hazards include scrotal cancer due to oil, cervical cancer in women who work in oily occupations or whose partners work in such occupations (most cervical cancer is caused by HPV infection, but most of the small number of non-HPV cases are occupational: most of those are due to oil, although some are due to work with biological materials), and asbestosis in shipbuilding and carriage-making.

11.3.2 Transport related violent injury

Carbon monoxide poisoning from vehicle exhausts and jumping in front of trains or off bridges are common forms of suicide. Some inexplicable single vehicle crashes may also be suicides.

Cars can be used as weapons to carry out violent attacks. Other forms of transport could also theoretically be used in this way but this is less common, although aircraft were the weapon in the horrific mass murders at the Twin Towers and people are sometimes pushed in front of trains.

Road rage – violence provoked by poor driving – is a recognised phenomenon.

11.3.3 Transport Related Crashes

For prevention of transport related crashes see chapters 4 and 18, and sections 7.1, 7.2, 7.3, and 9.2.

The treatment of the injuries resulting from transport-related crashes is a subject which is well covered in textbooks of emergency surgery and it would not be useful to repeat it or attempt to summarise it in this chapter.

One important transport related issue in relation to transport-related crashes is the centralisation of Accident & Emergency (A&E) Departments to produce larger departments with more expertise. The public are often concerned that such centralisation risks lives by making it necessary to take casualties further with consequent delay. The profession tends to believe that this risk is offset by greater expertise.

THSG would also be concerned that centralisation of A&E Departments tends to lead to centralisation of hospitals and hence more travel.

Another issue is the provision of immediate care at the crash site.

11.4 Disease and transport

11.4.1 Cardiovascular disease & transport

Heart disease is both a stress-related disease (chapter 5, section 5.1) and a disease of physical inactivity (chapter 2, section 2.2). Considerable links between heart disease and transport have therefore been described above under these headings.

Long term exposure to carbon monoxide increases arteriosclerosis and causes heart disease and stroke. Smoking is the commonest cause of this but high-mileage motorists may also experience this. Particulates also contribute to heart disease, both precipitating hospital admission and premature mortality (chapter 3, section 3.1).[16]

People who have a stroke, transient cerebral ischaemic attack (TIA) or acute coronary syndrome cannot drive for a month but do not have to inform the DVLA (Driving and Vehicle Licensing Authority) unless the symptoms last longer than this or their doctor says they should not drive for longer.[17 18] However, these events may lead to permanent loss of licence and therefore livelihood for HGV and PSV drivers.[17 18]

Following a stroke, some people may have hemi-inattention, visual field deficits or seizures which render them unfit to drive for longer, possibly permanently. Some of these people may also be unsafe as pedestrians or cyclists, because of a lack of awareness of traffic, obstructions, and other dangers.

Disability, such as a physical deficit following a stroke or significant angina that limits walking, often limits mobility. This is addressed in chapters 9 (Inequalities) and 13 (Reducing social exclusion).

11.4.2 Respiratory disease & transport

Motor vehicle emissions contribute to respiratory disease.[16] Particulates, nitrogen oxides and ozone all cause lung damage. At high concentrations nitrogen dioxide causes inflammation and irritation of lung tissue, increasing susceptibility to viral infection, bronchitis and pneumonia Particulates. especially those of less than 1µm, can be inhaled deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases. Exposure to particulate matter is consistently associated with respiratory and cardiovascular illness and mortality. Ozone also reduces lung function: very high levels increase the symptoms of those suffering from airway diseases such as asthma and bronchitis, leading to increased incidence of respiratory hospital admissions and mortality. Polycyclic aromatic hydrocarbons in vehicle exhaust emissions cause lung cancer.

Traffic pollutants are either a major cause of asthma or a major exacerbator. It may be that it only exacerbates existing asthma by nitrogen oxides acting as sensitisers for other allergens such as pollens. It is probable, although not certain, that there may also be direct causal effects. The main effect is from fine particulates.[19] If there are direct effects traffic may cause asthma rather than merely exacerbate it. This is to some extent a matter of controversy but may not be a great clinical issue – whether traffic caused asthma or merely turned a minor problem into a serious one may be of little importance to the patient. Acute increases in air pollution trigger exacerbations of asthma in susceptible individuals, especially children.[20] Organic compounds and metals such as iron and vanadium bound to diesel particulates in traffic pollution increase the risk of asthma.[20] Early exposure to pollution from traffic increases the risk of developing symptoms in normal, healthy children.[21] Evidence in the UK, accepted by the Environmental Audit Committee of Parliament in 2010, is that previous estimates of extra deaths and deaths brought forward may be an underestimate. In June 2010 the Mayor of London published data which estimated that 4,267 premature deaths a years were due in part to long-term exposure to airborne particles.[22]

It can be seen therefore that it is sensible for those with early respiratory disease to be advised to reduce non-essential exposure to motor traffic. Walking and cycling along quiet roads or travelling by train is better than using main roads. On main roads, pedestrians, cyclists and public transport users experience less pollution than car users since in most circumstances, levels of most pollutants are highest in the centre of a roadway and least by the pavement, and are highest inside cars,[23] with exposure inside buses[24] [25] being intermediate between car occupants and pedestrians on the pavement.

Severe respiratory disease can affect the pace of walking and the distance that can be walked.

Some transport-related industries such as shipbuilding and carriage-making have in the past provided asbestos exposure which, due to periods of latency, are still causing many new cases today.

11.4.3 Gastrointestinal disease & transport

Some gastrointestinal diseases, including minor gastrointestinal upset, are stress-related, which is dealt with in chapter 5, section 5.1.

People with certain gastro-intestinal diseases may have frequent and/or urgent need for a toilet, which can limit certain travel options.

Much food is consumed whilst travelling and food outlets specifically serving travellers are renowned, perhaps by caricature, as of low quality. There are also safety issues of eating or drinking while driving, both through taking hands away from the car's controls and also as a distraction from the road and traffic.

11.4.4 Infectious disease & transport

Susceptibility to infectious disease is increased by stress (see section 5.1)

The ready availability of international travel has increased the mixing between ecosystems. This has a number of effects. It means that infectious diseases spread by droplet, by sex or by blood-mixing will definitely spread more rapidly across the world once they have become established. Whether this will also happen to water-borne diseases or to vector-borne diseases depends upon the circumstances but the risk is certainly there. There is a theoretical risk of carrying a vector insect aboard an aircraft, ship or international train but this has not happened often. With a water/food-borne disease, such as typhoid, movement of a carrier or a case will not necessarily spread the disease unless there is also poor hygiene or employment in food preparation. With such infections international spread has often been by carriage of infected products.

As well as the spread of infectious diseases outside their normal ecosystem there is also the risk to people who intrude into ecosystems where they do not have immunity to local disease. A common cold is a frequent consequence of travel for this reason. More serious are diseases like yellow fever and malaria. Travellers should always be advised to take appropriate precautions.

Mixing of ecosystems may however also have a beneficial effect. The virulence of a disease is an obstacle to its spread and the tendency is for infectious diseases to become less virulent over time as natural selection favours both the more resistant hosts and the less virulent organisms. However if this happens in one ecosystem and the local population becomes immune to it, it may remain virulent in other ecosystems and yet at the same time become more transmissible creating a situation where it may be spread by travellers into an immunologically naive and therefore susceptible population. The most widely cited examples of such disasters – the spread of smallpox into Latin America,[26] measles into the Pacific Islands[27] and the 1918 flu pandemic with demobilising troops[28] all occurred either before international travel became normal or at a time when it was disrupted.

Respiratory diseases such as influenza can be transmitted from infected to susceptible individuals via four direct and indirect mechanisms, each of which modes could occur when on public transport, where people are regularly in closer contact with large numbers of people than they would otherwise be. However, the relative importance of these different modes of spread for influenza is disputed.[29]

Overcrowding can lead to direct physical contact between people, with direct transfer of infectious agents. Secondly, infected individuals produce large droplets that can travel up to 1m during sneezing, coughing or even talking, with deposition on susceptible individuals' mucosae. Droplet spread is therefore very likely in public transport, as passengers are frequently within 1m of each other. Thirdly, airborne spread can occur over longer distances, as small infectious particles remain suspended in the air for long periods. The enclosed nature of most public transport vehicles therefore facilitates airborne transmission. Finally, most public transport vehicles have many hard surfaces, such as door handles or button and hand rails, that are touched by large numbers of passengers. Influenza viruses can survive on hard surfaces for up to 2 hours,[30] so indirect contact through contamination of these surfaces is also a significant route for disease transmission. Despite these theoretical modes of transmission, no outbreaks of influenza have been reported in relation to public transport apart from aeroplanes.[31 32]

The UK pandemic plan advises the public to minimise leisure and social (i.e. non-essential) travel to reduce their personal risk but recommends that while public transport can continue to be used for essential journeys, good personal hygiene measures are important.[33] Staggering journeys where possible would reduce overcrowding at rush hour but this may reduce only the direct person to person spread, given that the other three mechanisms described above are still likely to operate. Mathematical modelling to investigate the effect on spread of pandemic influenza of restricting travel to within 20km of the home in the UK and USA found that this would reduce spread of infection from one area to another only in conjunction with effective border control.[34] However, the authors viewed travel only as a means of moving infected individuals from an area of existing infection to another area where they could spread the infection; they did not consider the impact of travelling on public transport per se as an effective means of increasing transmission of infection.

11.4.5 Musculoskeletal Disease & Transport

Osteoporosis is a disease of physical inactivity (see section 11.1 above).

Many musculoskeletal diseases cause reduced and/or painful mobility that affects all modes of transport. Sufferers may be unable to stand for prolonged periods or use steps and may take longer to get on and off public transport. They may also have difficulty getting in and out of cars, whether as a driver or a passenger.

Those with marked arthritis of the hands, or with neurological disease, may be unable to hold onto handrails for support on public transport.

Cycling may be a useful form of transport for people with arthritis of weight-bearing joints, such as the knee, hip or ankle, in whom both speed and distance for walking are often limited by pain.

There has been a single research study associating rheumatoid arthritis with traffic.[35] Further studies are required to assess whether this was a chance (false) finding, was due to unmeasured confounding, or whether fine particulates or other traffic pollutants are truly associated with greater risk of developing rheumatoid arthritis.

11.4.6 Genitourinary tract disease & transport

Scrotal cancer and cervical cancer due to exposure to oil have been discussed in section 11.3.1 above.

Incontinence or an urgent or frequent need to use a toilet is often an obstacle to walking and cycling – indeed to going out at all – if people are not confident that there will be toilets readily available when they need them. This is an advantage of intercity travel by train or coach rather than car but does not yet apply to urban travel.

11.4.7 Neurological disease & transport

Mention has been made of stroke in section 11.4.1 above. Most neurological diseases have similar effects to those described for stroke and/or musculo-skeletal disease (section 11.4.5 above). Some neurological diseases, such as multiple sclerosis, can also affect balance,.

In addition, they can also affect bladder or bowel control, leading to problems of incontinence. As discussed in sections 11.4.3 and 11.4.6 above, these can be a substantial deterrent to travel and can severely limit the options available.

11.4.8 Cancer & transport

Cancer is in part a stress-related disease: this has been discussed in chapter 5, section 5.1. Scrotal cancer and cervical cancer due to exposure to oil have been discussed in section

11.3.1. Pleural mesothelioma is a consequence of asbestos exposure, which has been discussed as being associated with shipbuilding and carriage-making.

Benzene and 1,3-butadiene are carcinogens in vehicle exhaust emissions. They are particularly associated with leukaemia. 1,3-butadiene is also associated with lymphoma and cancer of lymphoid and blood-forming tissue. Polycyclic aromatic hydrocarbons in vehicle exhaust emissions are also carcinogenic. They cause lung cancer and may have other carcinogenic effects as well.

11.5 Effects of disability on transport

Aspects of impairment and transport which have already been covered in detail in chapter 9 are not discussed further in this chapter.

11.5.1 Old Age & Transport

Current knowledge and needs for research were summarised in a paper published in 2008.[36]

Short car journeys by elderly drivers are important for their continuing independence, although they cause substantial anxiety to their younger relatives. Crashes per mile are low and generally result in little injury,[37] except for those driving less than 3,000km annually.[38] Fatal crashes at night are lower in older people (aged 65+) than in young drivers (under 25), although they are higher than in adults aged 25-64.[39]

Loss of independence due to an inability to drive and then a further loss due to becoming too frail to use public transport are important factors in the decline into dependency. Research suggests that transport policy options to enable older people to maintain independent mobility are important especially such as those with dementia because even for older people with recourse to family and other support the 'burden' on carers as chauffeurs.[40] Past research has reported that both for those independent and dependent older people in rural areas they are unable to travel far and a minority housebound.[41] Although increased car ownership has increased mobility for older people in recent decades, this does not detract from the impact on health when license holding or car use has to be given up.

11.5.2 Driving impairment

Functional deterioration in vision, hearing, co-ordination, and mental processing of information can each lead to impaired ability to drive, particularly in the dark.

In addition to these endogenous causes of impairment, any alcohol, some prescribed medication, and some illegal drugs can affect an individual's ability to drive. The number of collisions in which these are a factor is described in chapter 4 section 4.5, while chapter 17, section 17.6.2 considers the evidence for what the legal limit for blood alcohol should be.

11.5.3 Legal issues

The General Medical Council's updated advice on Confidentiality, which came into effect on 12th October 2009, and its supplementary advice also covers reporting patients to the DVLA, even where that breaches confidentiality.[42]

> *"Personal information may be disclosed in the public interest, without patients' consent, and in exceptional cases where patients have withheld consent, if the benefits to an individual or to society of the disclosure outweigh both the public and the patient's interest in keeping the information confidential. You must weigh the harms that are likely to arise from non-disclosure of information against the possible harm, both to the patient and to the overall trust between doctors and patients, arising from the release of that information.*
>
> *"Disclosure of personal information about a patient without consent may be justified in the public interest if failure to disclose may expose others to a risk of death or serious*

harm. You should still seek the patient's consent to disclosure if practicable and consider any reasons given for refusal."[42]

It is the Driver and Vehicle Licensing Agency (DVLA) and Driver and Vehicle Agency (DVA) (Northern Ireland) that are legally responsible for deciding if a person is medically unfit to drive. They therefore need to know if a driving licence holder has a condition or is undergoing treatment that may now, or in the future, affect their safety as a driver.

Doctors are advised to seek advice from an experienced colleague or the DVLA or DVA's medical adviser if unsure whether a patient may be unfit to drive and to review any decision that they are fit, particularly if the patient's condition or treatments change. The DVLA has published information about a variety of disorders and conditions that can impair a patient's fitness to drive.[43]

Although it is the driver him/herself who is legally responsible for informing the DVLA or DVA about such a condition or treatment, it is the doctor's responsibility to explain to the patient both that the condition may affect their ability to drive, and that they have a legal duty to inform the DVLA or DVA about the condition.

Where a doctor does not manage to persuade the patient to stop driving, the patient is incapable of understanding the doctor's advice, for example, because of dementia, or the doctor discovers that the patient is continuing to drive against medical advice, the doctor must contact the DVLA or DVA immediately and disclose any relevant medical information, in confidence, to the medical adviser. However, the doctor should try to inform the patient of their decision to disclose personal information before contacting the DVLA or DVA, and should also inform the patient in writing once the DVLA or DVA has been informed. [42]

11.6 Health Promotion In General Practice

It is now a recognised role of general practice to conduct health promotion in the practice population. It is important that the role of walking and cycling in physical activity should be incorporated into the physical activity elements of such programmes and that physical activity should be given at least equal prominence to food when discussing obesity, given that the obesity epidemic is predominantly associated with falling activity levels. General practitioners might wish to familiarise themselves with pleasant walking routes in their vicinity so that they can advise patients to build them into their daily lives.

General practitioners who involve themselves in their local community might wish to make known their support for living streets, walking and cycling networks and improved public transport. Provision of cycle parking for staff and the many patients who could cycle would be a good start, as has been done by some – but few – health centres. Some GPs have set excellent example of practicing what they preach by walking and cycling to visit patients.

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12 Health Lessons for Transport Planners and Their Implications

J Cohen and S. Watkins

The purpose of this chapter is to summarise the scientific conclusions of this book where they are likely to be significant for transport professionals and yet unfamiliar to them. The chapter also explores the implications for professional practice in certain areas where this is necessitated by the promotion of walking and cycling, the new discoveries concerning the harmful impact of traffic in residential streets, or advancing understanding of congestion and the impact of saturation.

12.1 Introduction: Transport, Health, and Sustainability

The term ‘sustainability’ is a byword for ‘sustainable development,’ a term coined by the 1987 UN Report ‘Our Common Future[1]’, commonly known as the Brundtland Report. The term was defined as:

> *“development which meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

The corollary of this definition is the ‘triple bottom line’ – the recognition that for development to be sustainable it must consider and provide for economic, social, and environmental wellbeing.

The idea of sustainable development was originally developed to tackle the concern that economics trumped all other concerns when development decisions were made. Considering the way that ‘sustainability’ has now become a byword for ‘environmentally friendly’ or ‘green’, it is vital to keep in mind that economic and socio-economic considerations are equal partners in sustainability.

This is of particular importance for transport professionals, as transport impacts extend well beyond the environment into both economic and socio-economic spheres. For example, intensified development without proper transport links is economically unsustainable, and masterplanning new developments without proper consideration of walkability and access to services is socially unsustainable.

The discussion of sustainability and health should also, however, note that climate change will increasingly impact directly on health (chapter 3). This applies not only overseas but also in the UK, where more frequent heatwaves will present a serious risk,[2] and increased overall temperatures will increase the incidence of food poisoning and bacterial outbreaks in water supplies, as well as making possible occasional outbreaks of diseases such as malaria.[3]

The most important conclusion for transport professionals to take from *Health on the Move 2* is that when considering the sustainability credentials of a policy, a travel plan, or a development, the subject matter should not be limited to the environment. It is a fortunate coincidence that policies that are good for the environment are frequently also good for health, which in turn benefits society and the economy. Thus, efforts to promote sustainable policies should not focus only on the environment, but should seek to engage a wider group of stakeholders and demonstrate a wider set of benefits, in order to promote the business case.

12.2 Principles of Transport, Physical Activity and Health

Physical inactivity is one of the ten leading causes of death in developed countries.[4] It is associated with increased risks of developing many of chronic diseases such as type 2 diabetes, obesity, cardiovascular diseases, certain cancers, depression, osteoporosis and anxiety.

Physically active adults have a 20-30% reduced risk of premature death.[5] Taking up physical activity in middle age leads to a reduction in death rate comparable with stopping smoking.[6] The government currently recommends that adults should undertake at least 30 minutes of moderate intensity activity at least five times a week; this activity can be accrued in bouts of at least 10 minutes.[5] Walking two one-mile journeys or cycling two three-mile journeys daily satisfies this physical activity recommendation.

A Finnish study illustrated the extent of the benefits of exercise, finding that 55-year-olds who were physically active had the aerobic fitness of average people 30 years younger. A Dutch study found that those who cycle to work take fewer days sickness leave compared with those who do not cycle.[7]

12.2.1 Physical health

In England, nearly a quarter of adults are classified as obese,[8] and two-thirds are obese or overweight.[9] The increase in obesity over the past 30 years is mainly due to a significant decline in energy expenditure, rather than an increase in energy intake[10]: 25% of the British population do not walk for 20 minutes or more even once a year.[11] Government guidance recommends that 45-60 minutes of moderate intensity physical activity on most days is required for weight management. Each additional kilometre walked per day is associated with a 4.8% reduction in the likelihood of obesity, whereas each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity.[12]

The WHO estimated that physical inactivity is responsible for 22-23% of coronary heart disease, 16-17% of colon cancers, 15% of diabetes, 12-13% of strokes, and 11% of breast cancers.[4] Men who walk or cycle to work have a lower rate of death from heart disease than men who travel to work by car, with public transport users having in-between rates.[13]

Particulate pollution from traffic is a major cause of premature death and early or additional hospital admissions from circulatory and respiratory diseases, particularly among the very old, the very young, and the frail. It can also cause asthma attacks, partly because nitrogen oxides act as sensitisers for other allergens such as pollen and also by direct effects of particulates.[14] In the elderly, long-term physical activity is associated with reduced memory loss,[15] reduced risk of osteoporosis,[16] and reduced deterioration of physical ability.[17]

12.2.2 Mental illness and stress

Physical activity is as effective an anti-depressant as psychotherapy and is more effective than relaxation and enjoyable activities. Exercise, including walking and/or jogging can reduce depression by half, whether clinical or not.[18]

Exercise has long been prescribed as a treatment for stress. Because the stress hormones prepare the body for action by putting the digestive and immune systems on hold, it is thought that physical activity can mop up the hormones, removing the physical effects of stress, which can include gastric conditions, cancer and infection, and heart disease. In addition, exercise provides contemplation time which can tackle the mental effects of stress. Walking and cycling for transport both therefore provide opportunities to treat stress.

Studies have found stress-related illness to be caused by a wide range of life changes such as moving house, or searching for a job, being trapped in an unsatisfactory situation, and even by the perception of inequality and being excluded from opportunities offered to others. Many of these situations can be caused, exacerbated, or improved by transport. Uncertainty and delays in transit, difficulties mastering driving skills, constant traffic noise outside the home, and inability to access social services and support can all contribute to stress. Conversely, good urban design incorporating slow traffic speeds, good walking permeability, and an aesthetically pleasing environment can reduce stress by facilitating community support networks and creating a pleasant living environment.

12.3 Promoting Active Travel: The Role of Highway Engineers

The promotion of walking and cycling is a fundamental public health goal of lifesaving significance. Transferring car journeys under five miles onto foot or cycle has a potential for saving heart disease deaths equal to all non-physical-activity heart disease prevention programmes put together. The decline in active travel has played an important role in the emerging obesity epidemic. This is often seen as due to changing patterns of food consumption but this is only part of the story. The obesity epidemic is predominantly an epidemic of declining physical activity and active transport has a key role to play. The adoption of a pedestrian impermeable street design (a loop and lollipop cul de sac design without cross linkages, for example) can add 6lbs to mean population weight, equivalent to an extra death rate of 1 per 1,000 or one extra death every ten years for every 100 people (perhaps as few as 30 houses) affected. The promotion of walking and cycling saves lives from heart disease, diabetes, low bone density, high blood pressure, and respiratory problems. It is therefore important that highways engineers consider the role that a road plays as part of a walking and cycling network and the potential that the road has for severing such networks and wider policy goals such as health.

- NICE guidance published in 2010 for government, local government, the NHS, and others whose actions influence the population's cardiovascular health[19] has two policy goals for physically active travel. The first is to ensure government funding supports physically active modes of travel. The second was to consider the following evidence-based measures: Ensure guidance for local transport plans supports physically active travel, such as allocating a percentage of the LTP block allocation fund to promote walking, cycling and other forms of travel that include physical activity.
- Create an environment and incentives which promote physical activity, including active travel to and at work. This includes prioritising the needs of pedestrians and cyclists over motorists when developing or redeveloping highways. It also includes developing public

sector workplace travel plans that incorporate physical activity and encouraging and supporting employers in other sectors to do the same.

- Consider and address factors which discourage physical activity, including active travel to and at work, such as subsidised parking.

A recent review concluded that the evidence supports the crucial role of public policy in encouraging cycling. Substantial increases in cycling require a raft of complementary measures, including infrastructure provision and pro-bicycle programmes, supportive land use planning, and restrictions on car use.[20]

12.3.1 The Use of Roads for Cycling

Some high speed roads may not need to be used by cyclists but if a road is to be used by cyclists we recommend the following measures:

Measures welcomed by novice and established cyclists alike

- Long quiet routes formed by closing rat runs
- Long quiet routes formed by cycle paths to link quiet streets
- Long quiet routes formed by establishing traffic lights or other safe crossings across major roads to link quiet streets
- Cycle lanes or paths where a short length of such provision creates long quiet routes by linking quiet streets
- High quality off-road routes where opportunities exist to create these
- Cycle lanes or parallel cycle tracks on roads which carry such heavy high speed traffic that cycling cannot be made safe except by segregation, and where no effective alternative parallel route can be constructed at reasonable cost or designated

Measures welcomed by established cyclists but less likely to meet the concerns of novice cyclists

- Traffic reduction overall, through for instance road charging
- Speed reduction treatments
- Junction treatment, hazard site treatment, traffic management

Measures welcomed by novice cyclists but often seen as fussy and segregating by established cyclists

- Other reallocation of carriageway space: bus lanes, widened nearside lanes, cycle lanes
- Other cycle tracks independent of road network
- Other conversion of footways/footpaths to shared use cycle tracks for pedestrians and cyclists

Established cyclists are particularly concerned that the design of cycle lanes or segregated cycle networks often leads to cyclists losing the priority at junctions which they would have had if they had used the main road. This can lead to cyclists repeatedly dismounting to cross quite minor roads. There is no basis for a presumption that motor traffic should have priority over cycles: where an important cycle route crosses a minor road, the cycle route is the major route and should have priority.

Major Roads

After asking the question "Is this road saturated or at risk of being saturated?" (Section 12.6.1), the next question that needs to be asked of a major road is "Does it need to be used by cyclists?" If there are parallel routes on off-road routes or on parallel quiet roads, the answer may be "No" (although this may require attention to the means of cycle access to buildings and settlements along the major road). The answer may also be "No" on interurban roads which cross remote areas with a gap between settlements greater than cyclists are likely to attempt for a serious interurban journey (more than 20 miles, say). However, there then arises the possibility that recreational cyclists will be attracted to the road because of the beauty of the remoteness unless there are more attractive access routes to the countryside in question. Accordingly, a good general rule is that if there is no alternative route, the road should be designed on the basis that cyclists need to use it. If the road carries fast motor traffic expecting free passage, then a separate cycle lane is needed.

Major Urban Roads

Unless an alternative direct high quality direct cycle route exists, for example on a parallel quiet road, the presumption should be that roads within the urban envelope will carry cyclists making short journeys. Appropriate measures need therefore to be put in place.

Rural Roads

Unless an alternative direct high quality direct cycle route exists, for example on a parallel quiet road, the presumption should be that roads linking villages and small towns will carry cyclists. Cycling will be an appropriate means of making utility journeys unless the distance is too great, but areas which are so remote that utility cycling ceases to be viable are usually so beautiful that recreational cyclists are attracted. Where these roads are carrying traffic at high speeds and on narrow carriageways, appropriate cycle facilities must be provided to enable safe cycling.

Quiet lanes offer considerable potential for providing high quality pedestrian and cycle routes away from the main flows of motorised traffic. They also offer considerable recreational benefit. These benefits often depend on them seeming to be remnants of a slow bygone age and are adversely affected by road improvements which destroy the bucolic tranquillity. The problem for a highways engineer is how to safely combine this key role of quiet lanes with their role as the end linkages in the rural street system providing access to homes, farms and businesses. If a quiet lane is disrupted by significant through vehicular use where there are main road alternatives (a rural rat run), the lane should be closed to all motor vehicles other than for access. Rural rat runs often exist for a different reason than urban ones – drivers may use them to experience their bucolic quality rather than to save time. In this situation, provision could be made for drivers to park and walk along the lane, or traffic could be kept within acceptable (very limited) levels by rationing through use to, say, one vehicle very 15 minutes, or by imposing road charges on through traffic. If through traffic is permitted on quiet lanes, a 20mph speed limit (or even less) should be imposed.

12.3.2 The Use of Roads for Walking

Any road which is to be used by pedestrians requires:

- a footway
- <u>or</u> a wide highways verge maintained so that it is easy to walk on
- <u>or</u> measures allowing traffic and pedestrians to mix safely by restricting traffic flow, improving mutual visibility of pedestrians and traffic so that they are visible to each other

within the stopping distance and slowing traffic down. This requires 20mph speed limits or potentially lower speeds driven to enable such shared space to be used with freedom from fear of injury.

Roads for walking also require regular, high-quality, and accessible crossing points located on desire lines, as described further on page 12-18.

Directness matters – pedestrians are very sensitive to deviation, and counting jaywalkers has been suggested as an indicator of where pedestrian improvements are required.[21] Link and Place[22] recommends counting the number of interruptions to pedestrian flows per km as a measure of the (in)efficiency of a pedestrian link.

People will walk further if the route is attractive, so in urban settings it is important to maintain a network of aesthetically attractive pedestrian routes. In such networks, aesthetic measures such as trees, floral displays, green verges and green patches, public art and attractive views should be seen as part of the design of the road rather than as something ancillary. Quality of place around a pedestrian link can be measured by comparing the ratio of people engaged in necessary activities to people engaging in optional activities such as strolling, chatting, or window shopping.[21 22]

Other matters to which attention needs to be paid if pedestrians are to be encouraged include ensuring the route feels safe and secure, is well surfaced, is free of litter and dog mess, is wide enough, and is well-maintained to prevent overhanging and encroaching vegetation.

In the past, major roads have often been built with little attention to their impact on walking routes. As a result some quite dangerous situations exist, such as the point where the Wainwright Coast to Coast Path crosses the A66 unassisted. Such situations should not be allowed to come into being in the future and those that have been created in the past should be progressively removed. Pedestrians have a right to cross roads and safe crossing points should be created without long diversions that disrupt the pedestrian network

Paths and Minor Urban Roads

The THSG advocates a fundamental rethink of the way that highways engineers think of paths and minor urban roads. They should be seen as the centre of a walking and cycling network rather than as peripheral to the road network. In the case of adopted streets their dual role as the core of the walking and cycling network and the periphery of the road network needs careful attention to balance. The role of streets as community facilities rather than just as passages also needs to be drawn into this balance. T he traditional distinction between adopted highways and unadopted highways is less important than a classification based on the role the highway plays.

Traditionally the first question a highways engineer has asked about a minor urban highway is whether it is adopted. If it is adopted this leads to an obligation to maintain and an assumption that it will be maintained in accordance with traditional standards and design assumptions. If however it is not adopted this often leads to responsibility passing to rights of way officers whose concern will be limited to ensuring that it provides free passage, generally with little concern for how surfacing and maintenance for example will affect usability, particularly for cyclists who are very sensitive to poor surfacing.

However this distinction pays little attention to the actual role of the route. Footpaths and bridleways may be important routes in a cycle or pedestrian network which not only supports the key obligation to promote walking and cycling but may also provide alternatives to adopted highways on which it may be more difficult to make adequate provision. Adopted highways may also be more important in their pedestrian or cycle role than they are as a vehicle route and residential streets need to be considered first and foremost as community facilities.

It is also necessary to be aware that the attractiveness of a walking route will affect the distance people are prepared to walk. A diversion from a tree-lined, green (eg through fields or parks, or past greenspace or open plan gardens) or waterside path onto a route lacking equivalent attractive features is likely to seriously affect the walking route. So is diversion from a quiet route to a pavement alongside heavy traffic. Highways engineers have traditionally thought only in terms of the width and availability of the highway but on walking routes they need also to think in terms of its aesthetics. Green infrastructure is as important as surfacing and lighting.

12.4 Road Safety

12.4.1 Road safety and (mis)perceptions of danger

The safety of active travel has improved. In 2006, the fatality rate for pedestrians was 54% lower than the 1980 level and for pedal cyclists it was 46% lower.[23] However, the perceived safety when walking and cycling has not improved. Rather, perceptions of danger from rising motor traffic levels has increased.

Children and elderly people dying from road injuries are most likely to be pedestrians, while other adults are most likely to be car occupants. Pedestrian death rates are highest for children and elderly people, while car occupant and motor-cyclist death rates are particularly high for young adults.[24] Motorcyclists represent 20% of road fatalities but just 1% of traffic.[25] Rural areas also have their own particular risks including speed limits and visibility on country roads. In addition to the picture painted by road safety statistics, it is telling that 65% of respondents in a 1999 survey[26] reported feeling threatened some or all of the time when walking, cycling or riding on country lanes.

12.4.2 Danger aversion

Changing behaviour to avoid danger may be stressful or may be restricting (e.g. keeping children indoors instead of allowing them to play). The side-effects of danger aversion may also be hidden from standard transport statistics. For example, a busy main road in an urban area may have very few pedestrian injuries because pedestrians perceive it, correctly, to be so dangerous that they avoid crossing it as much as possible and take great care when doing so. A new approach within road safety to augment casualty reduction is required and this is road danger reduction, to place greater emphasis on the threat rather than the victims.

12.4.3 Road danger reduction

It is worth stating that a more accurate gauge of safety is whether pedestrian and/or cyclists use increases and this needs to be central to understanding perceived and real danger posed by motor traffic and the inequitable burden on injury among those mode users which are least carbon intensive and most health promoting. Much of the emphasis within traffic management to date has been upon getting the vulnerable road users to bear the burden of responsibility for their own safety and through the promotion of secondary safety measures, largely focused on improving safety within vehicles.[27] To achieve a substantive change would require a road danger reduction approach which tackles danger at source as illustrated perhaps most clearly through the Dutch national Sustainable Safety Programme. The idea behind the programme has been to make the Dutch road network inherently safe. In many cases this means slowing down motor traffic in any settlements.[28]

12.4.4 Driver behaviour

90% of crashes are attributable to driver behaviour,[29] such as excessive speed or alcohol consumption. Excessive speed was recorded as a contributory factor in 26% of road fatalities in 2007.[25] In collisions between cars and pedestrians at 20mph only 5% of pedestrians are killed, whereas at 30mph about half are killed, and at 40mph only 5% survive.[30] The reason for this is that kinetic energy increases in proportion to the square of vehicle speed – therefore there is a steep increase in fatality risk with increased speed.

In addition to promoting good driver behaviour, drivers also need to be trained in what to do in unforeseen circumstances, such as when hit by another vehicle or skidding on ice. If driving is compared with the extensive worst case scenario training given to pilots or train drivers, it is clear there is a long way to go in this area.

12.4.5 Walking

Pedestrians admitted to hospital are more severely injured and their treatment costs twice as much as motor vehicle drivers and passengers.[31] It is therefore paramount to understand how pedestrians are injured and tackle the source of these injuries.

Collisions between pedestrians and motor vehicles during road crossing occur either due to a failure of the driver and the pedestrian to detect each other, or to anticipate each others' movements. Measures to reduce these risks include reducing road speeds to increase the time available to react, reducing crossing distances to reduce the area to be assessed by the pedestrian, and improving visibility by providing clear zones around junctions and crossings. Failures of anticipation may result from both parties assuming precedence. While speed reduction can mitigate the effects of this, it is also important to avoid measures that imply motor vehicle precedence, particularly in areas where pedestrians may want to cross the road or where children may run out.

12.4.6 Cycling

Studies have found a substantial decrease in the risk of death among those who spent three hours per week commuting to work by bicycle compared with those who did not commute by bicycle.[32] Overall, studies show that the life-extending health benefits of cycling are about 20 times greater than the life years lost in road crashes.[33]

It is a popular myth that cycle crashes are under reported by police. This is because more KSI (Killed or Seriously Injured) incidents are reported in Hospital Episode Statistics (HES) which is based on hospital admissions than in the STATS19 database maintained by the Department for Transport (DfT) which is based on police reports. The difference between the two arises because while STATS19 reports only genuine road traffic collisions, HES includes all hospital admissions involving a cyclist – even if the cyclist simply fell of a bicycle in their own front drive. In the same way as a pedestrian tripping over is not a traffic incident, neither is a cyclist falling off their bike with no external influence, either on or off the highway. It is calculated that by including falls in the highway or in an 'unspecified place' within cycle casualty figures, the figures are inflated by approximately 3.2 times.

Road casualty trends show that cycling has experienced a greater relative increase in safety since 1970 than the car.[34] Considering the improvements to vehicle safety technology in the intervening period, such as seatbelts, airbags, and crumple zones, the improvements in cycle safety are striking.

12.5 Children's travel & safe routes to school

Nationally, 46% of children walk to school.[35] Travel to school by car increased from 16% in 1985/87 to 32% in 2006.[36] The biggest growth in trip types nationally between 1975/76[37] and 2008[11] was escort trips made by a person to take someone else. The statistics show that children's independent mobility has been curtailed, with an increase in the average age at which they are allowed to travel unescorted by foot, bicycle or bus.[38] Parents restrict their children's movements or escort them because of fear of traffic[11] and fear of attack by strangers.[39]

Driving children to school reduces social interaction. Accompanying children on the journey to school, particularly when it involves sitting in a car rather than walking to school, can adversely affect children's development, due to reduced opportunity for exploration and social and motor skill development.[4041] The consequence of the increased trend for children to be driven to school has led to high proportion being insufficiently active, partly through reduced walking and cycling leading to high obesity levels.[42] For comparison, the average number of trips cycled per child in the UK is 18 per year, compared with 530 for a Dutch child.[43]

The 2008 National Travel Survey[11] showed that the greatest reason for children to be accompanied to school, accounting for 58% of 7-10 year olds and 34% of 11-13 year olds, was fear of traffic. Although Great Britain has one of the lowest mortality rates for all road injuries in Europe, the best figures for child pedestrians in Sweden are a third of the UK figures.[44] Child cyclists and pedestrians together account for almost 80% of serious injuries to children from motor traffic.

Measures to improve child safety and perceptions of safety will therefore be key to encouraging parents to let their children walk to school. Road safety education and cycling proficiency should be integrated into the usual school and PE curriculum to teach good habits from an early age, and the requirement to provide these lessons should be built into school travel plans. Because of the increased risk of children behaving unpredictably in or near the road, speeds on roads outside schools should be limited to 20mph at the beginning and end of the school day as standard, to ensure that drivers are moving slow enough to react. Visibility is also important: a high density of kerbside parking is associated with increased risk of injury to children.[45] Visibility provided by 'school keep clear' markings will only be provided if they are policed effectively; many parents see them as a convenient drop-off zone. The ideal situation is one in which the roads outside the school is as free of motor-traffic as possible. Moreover, residential streets should have speed limits no higher than 20mph. There are no significant time penalties nor changes in vehicle emissions or noise, rather there is reduced danger and increased quality of life for residents.

12.6 Demand Management

12.6.1 Saturation vs. Congestion

Everyone has a certain 'time budget' that they are willing to spend travelling each day. Through major changes in transport conditions, this has remained fairly static since 1952 at around an hour.[46] However, over time the distance that an individual can travel in one hour has increased substantially due to higher car ownership and a more fine-grained and high speed road network. This means that whereas in the 1970s a person may have chosen to live five miles from their work and spend half an hour each way cycling, the same person in 2010 could live 20-30 miles from their workplace on a motorway corridor.

It follows, therefore, that if the average speed of the roads is 40mph, then the person would be willing to live 20 miles from their place of work. If those roads are improved so that the average speed increases to 60mph, the person might decide to move to a more pleasant location another 10 miles away from their place of work – keeping the journey time at 30 minutes each way. However, they will not be the only person having the same idea, and over time the average mileage increases, which means the number of vehicles on the network increases, increasing congestion and reducing driving speeds to something like their original levels. Road building has been shown to increase road use by as much as 8-10% per year between the improvement being opened and returning to a state of congestion.[47] This state of being, where there is a dense enough travelling population that journey time benefits from road improvements, is referred to as saturation, and is considered in more detail in Chapter 10.

In the 1950s people might have expected an uncongested journey on a trunk road to average 30 to 40mph. Now they might expect an uncongested motorway journey to average 60 to 80mph. The radius of a circle is proportional to the square of its radius so a doubling of speed increases fourfold the area that can be visited in a given time. Metcalfe's Law predicts that the number of potential connections in an area is proportional to the square of its size so a fourfold increase in the area that can be visited is a sixteen fold increase in journey opportunities. Accordingly, a two lane trunk road that was at capacity in the 1950s would need to be replaced by a 32-lane motorway to avoid congestion - even before making provision for increase in car ownership.

There are two potential ways of tackling congestion in a saturated system: managing demand by reducing the incentives to travel, either by increasing the cost or providing benefits to staying local, or by providing parallel networks that do not result in an additional load on the existing saturated network.

12.5.5 The Implications of Saturation for Highways Engineers

Highways engineers have been slow to grasp the significance of Mogridge's work,[50] of Pigou's Theorem and of the SACTRA study.[48] There is still inadequate understanding of the differences between highways engineering in saturated and unsaturated road systems.

Many traditional methods of highways planning, including traffic prediction methodologies, plans for removing bottlenecks to get traffic to flow more freely, and increasing capacity to ease congestion are inappropriate on saturated roads. They are not wrong – on unsaturated road systems they are as valid as they ever were. It is simply that less and less of our road system is unsaturated. The distinction between a saturated and an unsaturated road network is therefore a fundamental one as it points to one or other of two entirely different mathematical analyses of congestion, each of them valid where its own preconditions are met and each of them wholly unhelpful in the opposite setting.

To understand the concept of saturation we need to think of a motorway system in the absence of congestion as being technically capable of conveying traffic at 80mph. Since large numbers of people are prepared to commute for up to an hour this means that Manchester, Liverpool, Teesside and Sheffield are within commuting distance of Leeds. Once this situation arises and starts to feed itself into life choices the range of possible home to work linkages becomes unplannable and the potential traffic flows exceed any possibility of being accommodated on the road system. Congestion is the factor which corrects this situation – it limits the speed of traffic and hence the number of potential linkages and the consequent traffic flows.

In this situation we need to learn a new approach in which new roads do not ease congestion – it returns to equilibrium levels with more people exposed to it. Removing bottlenecks does not ease traffic flow – it simply exposes to congestion areas which were previously protected by the bottleneck. No longer can traffic flow be predicted by projection from past trends – it can only by predicted by calculating the flow which will occur at the present equilibrium congestion speed along any enhanced or reduced road capacity.

The choices which drive the tendency to equilibrium congestion speeds are not choices on a day to day basis about individual journeys. They are life choices made by individuals choosing where they can live and work. As a result the old methods will still achieve a temporary relief even in a saturated system. These effects however will be temporary and when the equilibrium levels of congestion reassert themselves those who chose lifestyles dependent on a freer flow of traffic will be left high and dry. Highways engineers who have not learned the concept of saturation create human misery for those who succumb to the chimera they transiently create.

One of the first questions that a highways engineer ought therefore to ask is “Is this road system saturated?” This is a fundamental question which leads to completely different predictive and design approaches. Unfortunately the question has not been analysed as extensively as it should have been. There are no clearly defined criteria for answering it. However from theoretical first principles it seems that it will occur when:

- the distance between major settlements is less than the distance which can be covered in the time people are willing to commute at the speed attainable in an uncongested system.
- one practical symptom of saturation is “spreading of the peak” whereby people alter the times of their journeys to avoid maximum congestion and the traffic levels rise to a more even level at all times (reflecting the tendency to equilibrium congestion)
- evidence that congestion is general across a wide network rather than occurring only at a few points would also suggest saturation
- so would evidence that road improvements lead to traffic rising until congestion re-emerges

Major Intercity and Interurban Roads

Inverness is the only city in Great Britain which is more than 80 miles from another city (although Penzance is almost 80 miles from Plymouth). It is therefore only in such lightly populated areas as the Highlands of Scotland or in Cornwall that the question “is this congested intercity road saturated?” is even worth asking. If congestion exists on most of the British motorway or trunk road system it is because of saturation. Plans to widen such roads or to build relief roads are therefore doomed to failure. Bypassing bottlenecks is pointless unless it is to ease quality of life in a settlement affected by heavy traffic and even then the bypass should be designed so that it does not enhance road capacity – it should be no wider or faster than the existing road and the existing road should simultaneously cease to be a through vehicular route.

Congestion on the motorway system will be eased only by investing in high capacity public transport alternatives or in alternatives to travel. High speed trains can easily exceed the speed of motorways and it is probably only the lack of a comprehensive network, fare levels and inadequacy of feeder systems that prevent the rail system competitively increasing the trade off point that creates the equilibrium congestion speed.

The development of rolling motorways (trains carrying road vehicles) as part of a service on reinstated railway lines may be worth consideration in some circumstances (the Woodhead route is much talked about). In mopping up some of the road traffic, it is open to the same criticism as other means of enhancing road capacity, in that the traffic removed will in theory be replaced. However if other trains also use the route, it simultaneously creates rail capacity which may increase equilibrium congestion speed and thus prevent the freed road capacity from filling up. The conversion of motorways into automated highways with the road space released being given up to rail use has the same dual characteristic.

A similar analysis applies to most interurban roads although there are some parts of the country where roads linking relatively dispersed relatively small towns may not yet be saturated. Sometimes however this unsaturated situation exists only because the roads are not fast enough for 80 miles to be a theoretically viable commuting distance and that if they were improved the result would be traffic generation which would saturate them and create congestion.

Urban Network Roads

Most congestion on urban network roads is due to saturation and therefore it will be exceptional for it to be possible to address it by road improvements. It will require improvements of the alternatives (cycling and public transport) so as to raise the trade off point. Taking road space away from general traffic and giving it to buses, trams and cyclists ought counterintuitively to improve congestion if it takes place across a wide enough area to impact on the quality of the cycle network and public transport network thus raising the trade off point. This may not happen however if it is limited to a short isolated stretch and more traditional assessments of its impact may need to be made.

Rural Roads Linking Villages and Small Towns

These roads may well be unsaturated, especially some distance away from large towns, and traditional approaches to congestion and road improvement may be appropriate. However closer to large towns care needs to be taken that speeding up traffic with road improvements doesn't encourage commuting and draw the road into the saturated urban network.

12.6.2 Road user charging

Road user charging is a way of getting over the economic problems of roads encompassed by Pigou's Theorem. Pigou's Theorem points out that when a system is expensive to set up but then cheap to expand, it is common sense to attract as many users as possible to offset the setup costs. However, if the setup costs are so great that they can never be recovered from the users at a price the majority are willing to pay, then the options are either to subsidise use, or to price the system so that only those who can pay the high price necessary to fund the setup costs will use it, and leave the rest of the capacity empty.

The road system, being free at the point of use, is therefore effectively subsidised. However this has resulted in a situation where demand exceeds capacity. Because roads are free at the point of use, they also exhibit a classic 'tragedy of the commons' scenario. This occurs where everybody tries to buy an advantage and as a result destroys the very advantage they were trying to buy, while making things worse for everybody else.

While the cost of travel by all modes has increased more slowly than growth in disposable income, the cost of motoring proportionate to disposable income has fallen more in the last ten years than has the cost of public transport. Indeed the cost of motoring has fallen in real terms to approximately 85% of 1997 costs, whereas that of public transport has increased (although by less than disposable income).[49] The fall in the cost of motoring has been a result of reduced setup costs – the cost of purchasing a vehicle in 2008 was half the 1997 cost, whereas running costs have increased by almost 25%.

Road user charging makes it economically efficient to have a level of unused capacity, and is therefore both a useful way of managing demand to de-saturate the network, and internalising the external costs of each additional user, to combat the tragedy of the commons situation.

12.6.3 Alternative networks

If an entirely alternative network is provided, it is possible to remove people, and therefore congestion, *en masse* from a saturated system. For this to happen, the alternative network must be comprehensive enough to be able to cater to whole trips, rather than just individual routes. In practical terms, this means that providing a bus route from A to B is not enough to remove cars from the saturated road system if what travellers really want is to travel from A to B and then on to C before travelling back to A.

This theory was tested by Mogridge using data from London. The analysis showed that congestion in London was affected more by the quality of rail services than by anything done to the roads[50]. In the UK there is four times as much road traffic as public transport traffic, so to overcome saturation by providing alternative networks it will be necessary to increase public transport use by four times the desired proportionate road traffic reduction.

A key action is ensuring that public transport operators and planners are consulted when new road schemes are proposed, to ensure that new roads do not diminish opportunities to expand the public transport network. Although it seems counter-intuitive, reallocating road space to public transport should over the long term reduce congestion, if the public transport is part of a sufficiently comprehensive and efficient network.

12.6.4 Land use planning

Land use planning has a role to play in managing the need to travel and enabling alternative networks to be used. The shift towards mixed use development has intended to increase the extent to which services and employment are provided within a short distance of homes, minimising the distance travelled. Simultaneously, increasing development concentration increases the viability of public transport networks by creating a situation where fewer routes are needed to provided the same level of service, or a greater level of service can be provided on an existing route.

12.7 Reducing car dependency: public transport networks

In addition to the well-known environmental effects of car dependency, car dependency is detrimental to the viability of public transport networks, and exacerbates social inequalities by creating a society whose spatial layout assumes car ownership: in the lowest income quintile, fewer than half the households own a car, whereas in the top quintile only 11% have no car – and half own two or more (Chapter 9).

12.7.1 Suppressed demand

Demand suppression results from potential users travelling by another mode because the network only caters to part of their travel requirements. This can occur on either a spatial or a temporal level. Spatially, if a user could get the bus from A to B but then needs to travel on to C where there is no public transport route, they will either drive the entire route, or avoid travelling to C.

Temporally, a similar situation occurs with the last bus. Many people are not prepared to risk missing the last bus so catch the one before it; the bus operator notices that the last bus runs empty and so cancels it. The penultimate bus then becomes the last bus, and passengers shift to the one before it – and so on, until the system completely fails to serve late evening travellers and they drive or avoid travelling instead.

Both of these can only be tackled by a spatially and temporally comprehensive transport web, and raises the question of the aim of providing public transport. If it is to make a profit, then suppressing demand is a short-term gain that in the long run will make the mode as a whole less viable. If it is to achieve mode shift, then comprehensive networks need to be provided to stimulate mode shift, rather than modal shift stimulating additional provision. Either way, suppressed demand needs to be considered more widely when planning public transport provision and operations.

12.7.2 Safety and attractiveness

The perception of public transport is key to its uptake. A comparison of European cities shows that bus travel is greater in cities with rail-based travel than in those with bus-based public transport.[51] The explanation proposed is that the perceived quality and greater reliability of the rail network is better at attracting people out of cars. Once they are out of their cars, rail users then may consider other modes of public transport.

Safety is also a key consideration on public transport. A DfT survey found that 27% of bus users had seen someone being insulted, pestered, harassed, threatened or spat at in the last 12 months; 10% had seen someone assaulted, mugged or robbed.[52] A measure to improve safety on trains is to designate a 'safe coach' on late evening services, allowing passengers to group together in the same part of the train rather than being dispersed alone in separate carriages. Open or walk-through carriages achieve the same aim of ensuring no-one is trapped with someone threatening in a carriage between stations.

12.7.3 The cycle-train combination

The only way that the public transport system can compete with the car in terms of flexibility is to combine it with a personal transit system to create a speedy link between the origin/destination and the nearest public transport stop. The bicycle is the ideal way of doing this.

The cycle-train combination is currently under-developed in the UK compared with best practice elsewhere. 50% of the population own a bike and 60% live within 15 minutes ride from a train station, but only 2% of train passengers travel to the station by bike. In contrast, 40% of passengers in the Netherlands cycle to the station.[53] There is apparently suppressed demand for cycling to stations; 70% of respondents to a London Assembly Transport Committee survey considered that cycle facilities at Tube stations are inadequate, and 62% considered cited National Rail stations as providing inadequate facilities.[54]

Another approach that has been successful internationally is on-train bicycle carriage. Cal Train in California provides at least one cycle van on every train, and two vans on the most popular commuter trains, creating capacity for 80 cycles. Cal Train measures the success of its promotion not in terms of the percentage increase in cyclists carried but in terms of the percentage increase in total ridership attributable to cyclists: from 2003 to 2006, walk-on passengers increased 16%, whereas bicycle passengers increased 41%.[55] Using this measure, Cal Train has experienced payback times of just six months.[56]

12.8 Urban design: home zones, walkability and social support

The replication by Hart of the earlier study by Appleyard & Lintell now makes it clear that motor traffic in residential streets diminishes social support networks amongst residents and also leads to a lack of sense of possession over large areas of the street. The implications of this are very serious – social support is a major factor reducing mortality while areas of street over which residents do not feel possession will increase crime, disorder and vandalism. It should now be regarded as unacceptable for a residential street to have a steady flow of traffic and development control must prevent any further such situations on new developments.

A major rethink of the street system is necessitated by the recognition of the high public health priority attached to walking and cycling coupled with the recognition from Appleyard/Lintell/Hart's work that steady traffic flows in streets have a serious impact on the health of residents. The urban street system needs to be seen as fulfilling three roles. It is the final link in the urban road system allowing vehicles to reach homes, shops, workplaces and businesses. It is the gap between houses – a community open space with important functions in maintaining social networks and community interaction. It is a set of routes that can be used to make provision for walkers and cyclists away from main roads. The problem for the highways engineer is how to balance these three roles. This balance may not be achieved by unthinkingly applying traditional design approaches which give pre-eminence to its role as a passage for local traffic.

12.8.1 Walkability: permeability and pedestrian priority

According to the DfT National Travel Survey 2007, the majority of adults agreed everyone should be encouraged to walk for their health (97%), the environment (94%) and to ease congestion (92%).[57] However, only 41% of men and 33% of women questioned in a general population survey reported walking 'brisk or fast' for ten minutes in the previous four weeks.[42] Nationally, 11% of commuters walk to work.[58]

Residents in a high walkable neighbourhood are likely to take more steps per day and walk more for transport than residents in a low walkable neighbourhood.[59] This is particularly pronounced for adults who previously had a preference for non-active transport and/or a low intention to walk or cycle. Pedestrian-permeable street designs are associated with 6lb lower mean population weight than pedestrian-impermeable environments.[60] This difference in weight is equivalent to an annual death rate of 1 per 1000 – which means one extra death every ten years in a population of 100, which could be as few as 25-30 houses. Walking more slowly than needed to increase fitness still aids weight control, as the same amount of energy is used up almost independent of the speed walked.[61]

The key elements of a walkable neighbourhood are small block sizes and low, slow traffic flows. Block size is usually determined by architects, so a key role of transport professionals is to influence designs at an early stage, referring to best practice such as the Urban Design Compendium.[62]

Slow traffic flows means traffic should move at 20mph or less. Driving two miles at 20mph takes 6 minutes, as opposed to 4 minutes at 30mph or 3 minutes at 40mph. There is little to be gained by driving faster than 20mph in residential side streets or streets outside schools, and therefore the safety of pedestrians in these areas should be the clear priority. 20mph zones should therefore be the standard in residential areas and outside schools at the beginning and end of the school day. Manual for Streets[63] provides the key design guidance on how to create these.

Where closure or diversion is proposed of minor urban roads (eg alleys) or rights of way used for utility walking it is important to be aware of the fact that utility walking is very distance sensitive. Any diversion of more than about 50 metres needs to be thought of very carefully and diversions of more than 100 metres should be seen as seriously affecting a walking route.

This is important when alleygating proposals are concerned. Alleygating of a back alley which is no more attractive than the parallel main street may well be acceptable. This cannot be said for gating of cross alleys, link passages or routes that are more attractive than the proposed alternative. Other solutions must be found to security problems. If 30 houses suffer loss of pedestrian permeability then, if there are on average just over 3 residents per house, there will be one extra death every ten years. We cannot solve problems of minor antisocial behaviour by killing people.

12.8.2 Social support

Research has shown that strength of social support is associated with a four-fold difference in all-cause mortality – a difference comparable in magnitude to the effects of poverty. The effect was so striking that the researchers initially refused to believe it, and undertook extensive further studies which confirmed the effect.

Studies by Appleyard & Lintell in San Francisco, repeated more recently in Bristol by Joshua Hart, show that motor traffic levels in streets are a key determinant of the strength of social support – the greater the traffic levels, the less likely people were to know and interact with their neighbours. However, street design can also promote community networks, by providing space to interact and play.

Access to state social support such as health services requires there to be relevant transport services. Hospitals with poor public transport access or located at the top of a hill will not provide as good a level of social support to people without access to cars as they would if provided with comprehensive public transport and a good walking environment.

12.8.3 Severance

Severance was defined in the late 1970s as: *"the sum of the divisive effects a major urban road has on the inhabitants on either side of it."*[64] Severance results in: *"pedestrian delay, trip diversion and suppression, pollution, perceived danger and overall unpleasantness."*[65]

Because severance disproportionately affects pedestrians and cyclists, it also encourages modal shift towards the car, or trip suppression where people do not have access to a car. Severance by major roads or train lines also creates noise, pollution and frequently leads to visual blight. Community severance can give rise to stress and isolation, by increasing the effective distance to places of employment and health promoting facilities such as schools, parks, shops, leisure centres, and health services. This means that community severance is linked to social exclusion[66 67] and its associated health disbenefits. In addition to causing stress, noise can also impair health by causing a lack of sleep. A 2006 survey found that half a million Britons move house each year because of noise,[68] although it is not clear to what extent traffic is the cause. However noise effects can to some extent be designed out – quieter road surfaces such as porous asphalt can reduce noise by 4-8 decibels, equivalent to almost halving the volume of traffic.

Community severance cannot be quantified effectively at present. Valuable indicators of community severance that could be empirically assessed include traffic volume, noise levels and pedestrian delay in crossing roads.[69 70 71] In 1969, the Urban Motorways Committee proposed pedestrian delay as the most important indicator of severance by major urban roads,[72] and pedestrian delay was used in the willingness to pay study of traffic calming by Garrod and colleagues.[73] In San Francisco, 94% of pedestrians on the light traffic street reported waiting not at all or only a few seconds, compared with 49% on the street with medium, 25% heavy and 19% very heavy traffic[74]. The Kensington Environmental Management Study considered that a peak figure of 300 vehicles/hr provided an appropriate standard.[75] However the amount of traffic is mediated by the road layout: the Buchanan report *'Traffic in Towns'* showed that the wider the road, the lower the volume of traffic required to cause the same pedestrian delay.[69]

The Standing Advisory Committee on Trunk Road Assessment (SACTRA) and the Transport and Road Research Laboratory (TRRL) proposed that vulnerable groups be identified, the facilities (such as post office or health centre) they are likely to use be listed, and the catchment areas of those facilities be delineated.[65] The number of people living within this catchment area but separated from these facilities by major roads would form a measure of severance. Unfortunately, however, decisions regarding the critical delineation of these catchment areas remain arbitrary. The TRRL approach specifically involved creating a severance index which considered how many people (especially vulnerable people) have impaired access to their nearest facilities, together with traffic density and a mitigation factor representing the presence and acceptability of crossing facilities.

Although there is not yet a widely accepted methodology for assessing, quantifying, and monetarising severance, there is an assessment of severance in DfT transport analysis guidance (WebTAG), meaning that new infrastructure that would sever communities should be avoided. Where existing infrastructure or physical features such as rivers exist, the priority should be increasing the density of pleasant, safe, and universally accessible crossing points. These crossing points should be at grade, since steps and ramps add distance and time to walking and cycling trips, and can be insurmountable barriers to less mobile people. Subways and bridges can also be dangerous and unpleasant for users.

The Crossing of Roads by Pedestrians: minimising physical severance

Roads on which traffic creates a steady flow without many gaps or on which traffic is fast require safe crossing points. It is essential that these crossing points are located on pedestrian desire lines and do not require deviation – because each step is noticed, pedestrians are highly sensitive to deviation from their intended direction and will often take unsafe routes where a direct crossing is not provided.

It is tempting to provide crossing points on the basis of observed flows of pedestrians. However this approach is open to the very powerful criticism that there may seem to be no demand to cross the road simply because it is too dangerous for people to attempt it and hence the pedestrian cross flow is small. Such assessments should be replaced by a deliberate planning of pedestrian flows based on an assessment of local trip generators and attractors, and the desire lines between them. These should be provided in such a way as to minimise pedestrian deviation when accessing key destinations along the road (e.g. bus stop, school entrance) and destinations past the road (e.g. hospital or train station one block back from a main road). Where there are no ‘stand-out’ trip attractors, crossings should be provided at regular intervals to ensure that pedestrians are not deviated unacceptably from their desire line.

Where pedestrian networks are carefully designed so as to provide flows of pedestrians separate from flows of motor traffic a safe crossing point should be provided wherever a pedestrian route crosses a road with steady or fast traffic. This same principle can be followed for allowing walkers on rural footpaths to cross the main road – wherever a footpath crosses a road there should be a safe crossing and wherever a footpath ends on a road there should be a safe crossing before the next footpath on the other side of the road.

On roads with speeds above 40mph only signalised or grade-separated crossings will suffice for this purpose. At-grade crossings are preferred whenever they are feasible due to a myriad of problems with grade-separated problems: not only are they often unattractive and leave pedestrians vulnerable to attack, they are also difficult for people with mobility difficulties to access, whether it is stick-users for whom flights of stairs are a major barrier, wheelchair users for whom extensive ramps are too large a challenge, or scooter users who can frequently have their path blocked by barriers intended to prevent cycle access.

On roads where visibility is greater than sight stopping distance at the actual traffic speed, zebra crossings can be a satisfactory alternative to signalised crossings, although it is important to note that a study of elderly pedestrians and scooter users found that feeling in control of traffic (using signalised or zebra crossings) was key to a feeling of safety on crossings.[76] On such roads central refuges may suffice if the traffic flow is small enough that gaps in the traffic will occur every minute or so even if only in one direction. When speed falls to less than 20mph and cars and pedestrians mix more as equals, the majority of crossings are likely to be at informal locations. However even in these areas, regular formal crossings should be provided with raised tables and tactile pavings, to ensure that people who need these facilities are adequately catered for.

12.8.4 Aesthetics

Studies have shown that aesthetically attractive settings, particularly those including greenspace or water features, may diminish physical ill health.[77] [78] Conversely, traffic impacts that preclude tranquillity such as heavy traffic or aircraft noise have been shown to have negative impacts on health. These are discussed further in Chapter 5.

Traffic, whether moving, stationary or parked, reduces the visual amenity of streets. A 2007 survey by the Commission for Architecture and the Built Environment (CABE) found that 31% of residents in new developments thought that roads and car parking dominated their development. Aesthetics are also key to establishing the priority on a street – whether it is a place for people or a link for vehicles. In streets where the majority of gardens have been converted into parking bays the width of the road is effectively trebled, leading to increased traffic speeds and increased risk and occurrence of accidents.[79] Conversely, streets where trees, benches, and grassed areas are used instead of chicanes or road humps as natural obstacles to slow traffic benefit from an attractive public realm and better traffic control.

12.8.5 Urban Residential Streets

Hart's replication in Bristol of Appleyard & Lintell's San Francisco study about the effect of traffic in streets on social networks has far reaching consequences for design of residential streets. It should now be regarded as unacceptable for a residential street to have a steady flow of motor traffic that interferes with its use for community networking.

The first impact of this should be on the attitude taken to rat runs – streets which are not intended to be major roads but have come to have heavy traffic flows because they form short cuts. Such rat runs should be closed to through motor traffic. This has two benefits; the residents are given back their lifesaving tranquillity and if a passage is retained for cyclists a new cycle route is created. The closing of rat runs has in the past often been a last resort, partly because of technical difficulties and partly out of a sense that motorists have the right to use the highway system. In future it should be the first and immediate professional response to steady traffic building up in a residential street due to a through traffic flow developing on what was meant to be only a local road. Rising bollards can be used as the obstruction if there is a wish to allow selected traffic (eg residents, buses, refuse vehicles, emergency vehicles, delivery vehicles).

The second impact should be on the advice highways engineers give in relation to planning applications which route traffic along residential streets as their means of access or which create a risk of such a route being chosen. Highways engineers should strenuously object to any development which will create a steady traffic flow along a residential street for a significant part of the day (there may perhaps be a balance to strike if it is only for a very limited part of each day). If this means that car parking must be remote from the development and access on foot then so be it. Where the development is accessed by a proper access road, but there is a risk of traffic ignoring that and taking short cuts along a residential street, highways engineers should ask that the developer is required to fund the closure of the potential rat runs.

The third impact should be to render out of date the traditional design of the street as consisting only of carriageway and footway. The aim in future should be to carve areas for community interaction from the street– perhaps a tree with a seat around it, perhaps a picnic table for residents to chat, perhaps a play space, perhaps a communal garden to be maintained together, perhaps extensions to private gardens to be maintained privately but to be walked through and enjoyed together, or perhaps zanier ideas like a swimming pool. A residential street is the gap between houses. It needs to be possible to walk along it and move vehicles along it and there needs to be space to park vehicles but there can and should be other things as well. The carriageway may in the end be merely the gap between obstacles and in this context parking spaces can be arranged so as to serve as obstacles and to provide chicanes to slow traffic down and barriers to protect gardens or communal areas.

12.8.6 Urban Shopping Streets

Just as we must now think of urban residential streets as primarily for community interaction so we should think of shopping streets as being primarily for shopping. Studies conducted in Austria 10 years ago and in the UK recently found that retailers greatly overestimated the importance of the car and how far their customers travelled and underestimated how many of their customers walked, cycled or used public transport and how many shops they each visited.[80]

The passage of heavy traffic between rows of shops served from narrow pavements is unpleasant to shoppers. It removes spontaneity from crossing and recrossing the street, which becomes a barrier. It is dangerous in enticing people into dangerous crossing movements.

Where the street can be pedestrianised (except for cycles, buses and access) this should be the norm. It may be, however, that this is impossible without routeing through traffic along residential streets, which need protection even more.

A “high street” design with wide pavements, frequent crossing points, and controlled traffic speeds is the solution to such situations. Traffic should be slowed both for safety and also to increase the capacity of constrained road space so that the traffic flows freely but slowly.

12.9 Inclusive Transport

The people who experience the least benefit and the most disbenefit from transport are those who are disadvantaged in many other ways: women, children, people who are old, ill or have a disability, or are on a low income, or belong to a disadvantaged ethnic minority. The transport literature identifies these groups that are affected more as those who are more dependent on walking for transport.[65]

12.9.1 Women

Women tend to have different employment patterns, different time use patterns, and fewer financial resources than men.[81] They are more likely to be travelling encumbered by children or shopping, have greater safety fears, and wear different clothes. Women’s time is under greater pressure than men’s; women working full time have on average 23 fewer minutes per day leisure time than men working full time.[65]

Much of the transport system has been designed by men around the needs of the domestically inactive. Emphasis is given to journeys to work and long journeys, rather than to journeys for childminding or shopping. This can be seen in the radial layout of most cities' public transport systems, where the journey to work is catered for by rapid metro-type transit, whereas journeys to schools and shops are catered to by less reliable and often infrequent bus services, if at all. Because of the greater time pressure on women, public transport reliability is more important – yet local off-peak travel is largely by buses, which are markedly less reliable than peak time commuter transport.

Figures on car use assume that if a household has a car, all members of the household are thereby mobile. However, in 2003, only 61% of adult females had a driver's license, compared with 81% of adult males.[65] The possibility that the male partner may have taken the car to work or that some members of the family may be unable to drive is disregarded – yet can be vital in terms of informing design or service provision.

Women are a significant target audience for cycling to work, as their journeys to work tend to be shorter than men's so a higher proportion commute within the 3 mile distance that the British Medical Association suggested the majority of the population could cycle.[82] However, women are twice as likely as men to fear for their safety while cycling[83]. Data show that female commuter cyclists are more likely to prefer using off-road paths; a phenomenon which should be noted and acted upon by designers and travel planners hoping to increase female participation in cycling.[84]

12.9.2 Mobility difficulties

Fourteen percent of the general population has mobility difficulties, defined as anybody who has a disability or long standing illness or condition that makes it difficult either to go out on foot or to use local buses.[35] 45% of people aged 70 and over experience mobility difficulties, compared with 5% of those aged 16 to 49. Around one in four disabled people have difficulties using transport related to their health condition or disability.[85]

Restricted mobility may also occur on a temporary or intermittent basis when people are travelling with children, buggies, or luggage or shopping. Transport solutions aimed at those with disabilities will also improve mobility for these individuals. The 2005 Disability Discrimination Act has gone some way towards improving

12.9.3 Rural issues

Planners frequently assume that those choosing to live in rural areas make the decision in full knowledge that accessibility will be more difficult and they must compensate accordingly, usually by car ownership.[86] This assumption fails to consider those for whom living in an inaccessible location was not a choice. This may include those who are tied to a rural livelihood, elderly people and others unable to move away from rural areas, people who become disable din such a way as to prevent driving, and children not yet old enough to drive. In addition, there are those who have chosen a rural lifestyle but would inherently prefer not to be dependent on the car, whether for reasons of health, the environment, or cost. Even for households with a car, if the car is in use, other household members can be left unable to travel.[81] To fulfil the considerations of accessibility set out in the 1998 White Paper 'A New Deal for Transport' and Planning Policy Guidance 13: Transport (PPG13), it is essential to take into account all these groups and their different needs when considering rural transport.

12.10 Scheme appraisal

Reducing noise, improving air quality, reducing greenhouse gas emissions, and improving physical fitness are currently assessed within the Environment objective of DfT Transport Analysis Guidance (WebTAG) used in England. The Safety objective covers 'accidents' and personal security.

Best practice as expressed in WebTAG is to monetarise the health benefits referred to above. For example, for the physical fitness sub-objective, as set out in WebTAG unit 3.3.12,[87] the method is to calculate the change in all-cause mortality rates, translate that into lives saved or lost as a result of the scheme, and monetarise the cost/benefit using the standard economic value of a life.[88]

Health Impact Assessment is a mandatory requirement included within the Welsh Transport Planning and Appraisal Guidance[89] (WelTAG). However there is no set methodology, nor is there guidance on monetarising impacts. The Scottish Transport Assessment Guidance (STAG) does not cover health benefits of physical fitness. Although they could be included as part of 'wider economic benefits', this would rely on an individual planner's technical knowledge in the area or willingness to refer to the English guidance. This is a key issue in appraisal because standard appraisal software such as COBA and TUBA do not monetarise health benefits and so correct appraisal of health benefits/costs is overly reliant on the knowledge of the individual or organisation undertaking the study.

The accuracy of monetary estimations relies on the availability of information. Whereas improvements in physical fitness are relatively well documented and can be monetarised relatively easily, it is more difficult to estimate issues like reduction/increase in injuries as a result of a new walking/cycling facility: this relies on an estimate of the change in demand for walking or cycling and an estimate of the combined effect the new facility and the change in demand will have on injury rates, in order to calculate the value of injuries caused/prevented.

A major update to WebTAG currently in draft will place more emphasis on health benefits, establishing a new Safety, Security & Health objective, which will include sub-objectives assessing the extent to which a scheme will reduce the risk of death or injury, improve health through physical activity, and reduce air quality health costs. While these costs/benefits are monetarised, other issues such as severance and access to the transport system are not yet monetarised, which means they are easy to leave out of cost:benefit analysis. Furthermore, the health costs of stress caused by severance, noise, and inaccessibility are not currently considered in any way. While there has been progress, there is a long way to go. It is also important to note that all appraisal guidance is subject to overall government direction and is therefore under review following the formation of a new government.

There is an important difference between WebTAG and the approach public health professionals would advocate to Health Impact Assessment (HIA).[90] While WebTAG focuses on monetarising benefits public health focuses on identifying ways to maximise benefits and mitigate disbenefits. Thus HIA is not just about evaluating the scheme but also about shaping it. For that reason it should take place early before design is frozen. The NICE guidance referred to in section 12.3 above[19] has two policy goals for HIA:

1. Ensure government policy is assessed for its impact on cardiovascular disease (CVD); and
2. Ensure any such assessments are adequately incorporated into the policy making process.

It is important that any health impact assessment should address all the key transport determinants of health. The following is an appropriate list

- Crashes and injuries
- Impact on traffic levels
- Impact on walking and cycling
- Impact on public transport use
- Community severance
- Air quality and noise
- Impact on the number of houses experiencing constant traffic in their street
- Impact on access to facilities for car users and for others
- Impact on social support and stress
- Impact on availability of patches of tranquillity
- Impact on inequalities

12.11 Spatial & Transport Planning

12.11.1 The Role of Integrated Land Use & Transport Planning

There is now considerable evidence that congestion is a limiting factor in transport usage and therefore it cannot be eliminated – it will increase until it reaches the point at which it is unacceptable. This arises once the road system becomes saturated and although there is no research as to the criteria which lead to the conclusion that a road system is saturated, it seems from first principles that it will occur when the distance between major settlements is less than the distance which can be covered in the time people are willing to commute at the speed attainable in an uncongested system. Except in some remote areas, the UK road system is well past that point. The Downs-Thompson Corollary of Pigou's Theorem shows that once the road system is saturated road congestion will be influenced most by the availability of public transport as this provides an additional alternative to using a car or not travelling and therefore raises the equilibrium speed at which congestion leads people to make a decision not to travel. It should be noted that the decision not to travel is not on the whole a decision which is made journey by journey but is made in terms of life choices – what is the travel to work area of a particular employment site, how far will people travel to shop, will they restructure their lives to avoid travel at peak periods etc The Downs-Thompson Corollary however only addresses part of the problem because it assumes available capacity on the public transport system. When the road system and the rail system are both congested, or where reserved track public transport is not available, some other solution is called for. Walking and cycling provide alternatives to the car for short journeys and not travelling provides an alternative to the car and train for longer journeys.

Spatial planning has three major contributions to make to the avoidance of congestion. The first is that in those remote rural areas where the road system has not yet become saturated, it should avoid developments which will lead to it becoming saturated. This requires the maintenance of a rural economy which will avoid the rural area becoming dependent on the city, and it requires recognition of striking a balance between the development necessary to create such an economy and developing the rural area to such an extent that it creates its own saturation.

The second is that in both urban and rural settings, spatial planners should aim to minimise the need to travel to access key facilities. This will further increase the options when choices are to be made and will therefore raise equilibrium congestion speed and reduce rail overcrowding. In the first instance this simply requires the maintenance of local facilities and restraints on the creation of facilities with excessive large catchments. However most areas of the UK have long passed the point at which a dispersed pattern of land usage can be avoided. Reversing the trend is therefore likely to include re-establishing local facilities, increasing working from home (which may require attention to broadband speed and capacity), promoting local multi-employer neighbourhood work stations (a largely new idea but probably one whose time is soon to come) and encouraging centralised facilities to have local outposts (eg shopping cooperatives to order from out of town shopping centres, tele-health to make some of the facilities of the large centralised hospital accessible in local health centres).

The third is that it needs to ensure that facilities are accessible by walking, cycling and public transport and that centralisation without such facilities is absolutely prohibited.

Although congestion alone would dictate such a strategy, reduced travel also addresses the problem of climate change, the promotion of walking and cycling addresses the problem of obesity, and the promotion of local facilities encourages the maintenance of strong local communities which will contribute to social support. Social support is a strong positive factor in reduced mortality.

12.11.2 International Transport Network Planning

Local transport planning is addressed in chapter 20, section 20.1.

An international high speed rail network needs to be developed if we are to curb the growth of air transport. Although in the first instance this needs to be developed by individual EU nations and linked on an EU basis, ultimately the EU needs to cooperate with other parts of the world to create an intercontinental network.

12.11.3 Development Control

We have discussed above in section 12.8.5 the role of development control in protecting residential streets from steady flows of through traffic. Development control officers are used to residents objecting to development on the basis of traffic creation and have tended to regard this as a relative factor to weigh in the balance. The discovery that a steady flow of traffic in streets causes serious health damage raises the significance of such objections. Development Control officers should be prepared to insist on separate access roads (with the developer paying to close the potential rat run along the existing street) or even car parks some distance from the development, with a walking route from the car park to the development. Development Control officers should ask for living streets design in all new residential developments.

Development control is one of the ultimate enforcement mechanisms for the roles we ascribe above to spatial planning. Development Control officers need the support of proper policies and development frameworks – this issue is discussed in chapter 20.

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Section IV What should be done?

What is a healthy transport system?

Transport promotes health by enabling access to places and people and providing exercise. However, it also damages health by, for example, injuries, pollution, noise, congestion, stress, and severance of communities by roads. The damage affects both people who are travelling and others in society, as outlined in Section II.

The health effects of transport are unequally distributed in society with disadvantaged people experiencing the least benefit and the most disbenefit. For example, cars provide great mobility for their users, but do most health damage to those without cars.

Present patterns of transport do not meet existing, and cannot meet projected, transport needs. Furthermore there is growing evidence that increasing dependence on the private motor vehicle is neither a cost effective, nor an environmentally sustainable, way of meeting these needs.

The aim of a healthy transport policy should be to maximise access to facilities for everyone at minimum cost; these costs, including health costs, should not be unfairly distributed throughout society.

Therefore a healthy transport policy must:

- encourage walking and cycling, which are healthy exercise, do not impose danger on others, and do not generate pollutants.
- reduce the dangers faced – or perceived - by pedestrians and cyclists. This requires road designs that reduce speed of motor traffic, the provision of cycle and pedestrian facilities and, most importantly, changes in driver attitudes.
- ensure that people without cars are able to get about independently. The savings to health and welfare services provided by improved accessibility more than offset any subsidies paid to improve public transport.[1]
- seek to reduce pollution levels resulting from car use and seek to reduce injuries from motor traffic, which may require reduction in traffic levels and car use generally.

Outline of Section IV

Section IV presents the views of the Transport and Health Study Group on what needs to be done to achieve a healthy transport system, drawing on the evidence that has been presented in Section II.

Chapter 13, *Reducing social exclusion*, considers how transport could be provided to meet the needs of those with disabilities, impairments and encumbrances and those who are excluded due to poverty, gender, age, or geography.

Chapter 14, *Promoting walking and cycling*, summarises strategies to increase physically active transport.

Chapter 15, *Revitalising public transport*, discusses how public transport can be improved to be the default mode when walking or cycling are not possible.

Chapter 16, *Rethinking streets*, considers how the built environment needs to be changed in future to reduce car use and make streets better places for residents, pedestrians, and cyclists.

Chapter 17, *Driving less but driving better*, recommends strategies to reduce the use of motorized road vehicles and also to improve the standard of driving when these are used.

Chapter 18, *Preventing injuries,* considers what can be done to reduce injuries to travellers, particularly those using roads and especially those caused by collision with a motorised vehicle.

Chapter 19, *The roles of the NHS,* considers the importance of the NHS influencing societal norms both in its role as the biggest employer in Europe and through the close link between NHS departments of public health and local government.

Chapter 20, *Other strategies for a healthy transport system*, makes further recommendations that cut across the areas discussed earlier in Section III.

Chapter 21 makes recommendations, with Chapter 22 concluding the report.

As with Sections I, II and III, references are listed at the end of each chapter.

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13 Reducing social exclusion

Anne Frye, Stephen Watkins, Rachel Aldred, Stuart Murray, Jennifer Cohen

13.1 Extending social inclusion

Social inequalities in the use of transport, the adverse effects of transport, and the effects of transport policies were described in chapter 9. In 2000, the UK government described four ways in which people can be excluded by transport from participation in society:

- Spatially (they cannot reach there are all)
- Temporally (they cannot reach there in time)
- Financially (they cannot afford to travel there)
- Personally (they do not have the mental or physical abilities to use the available means of travel).[1]

Social inclusion is the removal of the causes of social exclusion, which is a combination of circumstances (such as low income, unemployment, poor housing, poor skills and poor health) which prevent people from participating fully in society. Usually those who are socially excluded have two or more of these characteristics, for example unemployed teenagers and low-income people living in rural areas. Extending social inclusion entails removing barriers and facilitating access. The Social Exclusion Unit defined accessibility as *'at reasonable cost, in reasonable time, and with reasonable ease'.*[2] The 'New Approach to Appraisal' (NATA),an appraisal framework for transport projects and proposals in the UK, includes accessibility as one of the five strands (see section 12.10 for information about WebTAG for appraisal methods).

Social inclusion involves many issues that have nothing to do with transport, including politics, poverty and the nature of society. However, better transport can help to overcome many problems associated with social exclusion by enabling people to reach opportunities that can help them earn money, improve their health, and enjoy a rich social life, all of which can help make people to feel more included. Hence, it is increasingly being recognised that transport policy should take into account explicitly the needs of those who are socially excluded.

There are a number of reasons why social inclusion should be increased, including increasing equity, increasing the potential of the whole of society, and reducing the risk of friction between groups in society.

A number of barriers to social inclusion can be identified in transport:

- Fear, e.g. fear of mugging;
- Confusing layouts, e.g. shared spaces for visually impaired people
- Lack of confidence, e.g. in using buses;
- Information barriers, e.g. inability to understand bus timetables because of learning or language difficulties; incomplete knowledge of transport options available
- Social/cultural barriers, e.g. women not being allowed to drive;
- Physical barriers, e.g. high steps onto buses, absence of dropped kerbs
- Financial barriers, e.g. unaffordable fares.

There are a variety of ways in which the barriers to increased social inclusion be overcome, for example:

- Continue to increase the accessibility of transport services (low floor buses, driver training, and so on);
- Recognise that those who are currently excluded are potential customers and sources of revenue;
- Develop ways of increasing the confidence of potential travellers;
- Consult those who do not use public transport now to find out what needs to be done to help them;
- Develop new ways of providing information;
- Encourage co-operation between agencies that provide facilities;
- Be imaginative: novel fare schemes, clever marketing, better information, and so on.

However, there is currently no comprehensive way to ensure that transport policies do take social inclusion into account. This issue is being addressed in a research project being carried out in the Centre for Transport Studies at University College London as part of the work programme of the AUNT-SUE consortium (Accessibility and User Needs in Transport in a Sustainable Urban Environment).[3,4] In this part of the programme, a software tool, AMELIA (A Methodology for Enhancing Life by Increasing Accessibility) is being developed to test the extent to which transport policies can increase social inclusion.[5,6] AMELIA is a user-friendly, policy-based interface to a GIS (Geographical Information System). It has been used to examine the impact of reducing barriers to movement, such as those facing elderly people walking in an urban area, using the city of St Albans as a case study.

13.1.1 Principles for inclusion

The hierarchy of needs prioritises disabled people, and it is possible to add other groups vulnerable to social exclusion to this area of top priority.

Inclusive design will benefit more than just the target group – step-free access for example benefits anyone using a wheeled suitcase. A demand-responsive network designed to give mobility to disabled people can also give mobility to people in areas poorly served by other public transport. The Disability Discrimination Act 2005 requires that facilities for disabled people are not merely tacked on, but are the main facilities for use. This means that whenever a facility, space, or transport provision is considered, a needs assessment should be made to determine what the design or system needs in order to cater properly to groups at risk of social exclusion.

It is worth noting that facilities for one group of disabled or vulnerable people are not always the optimum provision for another – a case in point being shared surface shopping areas. These mean that people using wheelchairs or pushing buggies can move freely from one side of the street to the other, and create social space which can fulfil a community-building role. However, they are also much more challenging than 'normal' streets for visually impaired people to navigate, and have received much opposition from advocacy groups. In situations like this, it is a question of weighing up the benefits of various options, and developing solutions that cater to most vulnerable groups without excluding others.

Mackett and Titheridge have listed the range of appraisal and funding sources relevant to increasing social inclusion.[4 7] Although government policies and priorities change, many of the appraisal tools can be used, even if requirements vary over time. A number of software packages have been developed to assess accessibility.[4] Economic appraisal is discussed further in chapter 20.

13.1.2 Reducing social exclusion through public transport provision

The DETR/TRaC report in 2000[1], referred to in section 13.1 above, also identified four attributes of adequate public transport to prevent social exclusion:

- Availability (eg bus stop within 400m of their home; routes; frequencies; timings)
- Acceptability (comfortable, clean vehicles and facilities; driving style; staff friendliness; provision of waiting facilities).
- Affordability (the financial cost of the journey; whether cheaper options are available – eg lower daily costs of season tickets require greater capital expenditure up front)
- Accessibility (the ease with which all categories of passenger can use public transport).[1]

However, there is a key fifth element: awareness of the transport options available.[7]

13.1.3 Active travel

Most of this chapter relates to motorised travel but it should be remembered that for many people, walking and/or cycling are affordable and physically possible modes of travel, given suitable conditions. Many people who cannot yet cycle can do so, given adapted bicycles or tricycles, a front-seat partner for a tandem, or special training.[8] Active travel can also contribute to reducing health inequalities associated with a sedentary lifestyle, as described in greater detail in chapter 2.[9]

13.2 Rural disadvantage

Historically, access to services in rural areas has been dealt with inconsistently. For example, the statutory right to education is supplemented by a right to transport providing access to education, whereas the statutory right to healthcare does not include a statutory right to transport needed to access the healthcare. Likewise, responsibility for rural accessibility was historically fragmented between eight different government departments, meaning that none had ultimate accountability.[10] Responsibility for accessibility has been brought within the remit of transport planning, via the 1998 White Paper 'A New Deal for Transport' and Planning Policy Guidance 13: Transport (PPG13).

For people living in rural areas where public transport is scarce, door to door, on demand, services are increasingly a solution for all those without access to a car. In some areas these are funded by the local authorities, in others they are provided by the voluntary sector running community transport or car schemes in which volunteers provide transport in their own cars in return for the cost of fuel.

Good practice guidance exists for developing transport schemes in rural areas.[11] One example is the Polegate Taxi-Rider, a service which has a published timetable, but the vehicles only turn out if someone has phoned in to say they require the service up to two hours beforehand.[12] This way, empty buses do not clutter up rural lanes. There is also the Wiltshire Wigglybus,[13] which has more than one possible route it can take, dependent on demand, and the award-winning Lincolnshire Interconnect service which is a fast cross-county bus services which has feeder services to it from small communities.[14]

13.3 Poverty

Programmes such as Wheels to Work[15] and Wheels to Learn are designed to reduce social exclusion and improve access by the loan of a pedal or electric bicycle or a moped. Many of the demand-responsive and flexible transport initiatives which are suitable for rural areas are also appropriate for deprived urban areas. However, demand-responsive transport is also an example of a transport option of which many potential users are not aware.[7]

13.4 Women

The most common cause of women experiencing transport-related social exclusion is as a result of the traditional gender division of labour. This results in women undertaking more linked trips, more trips across (rather than along) public transport network routes, more off-peak trips, and more trips encumbered by children or shopping – yet women are less likely to hold drivers' licenses, less likely to drive, less likely to have use of the family car if there is only one available, and have less disposable income to afford alternatives (see chapters 8 and 9). They are therefore heavily reliant on local services. This means that women are a key group at risk of being excluded by a car-based transport system and for whom flexible, reliable, affordable public transport is vital.

Measures to tackle social exclusion of women therefore combine elements of those required to tackle transport exclusion in deprived and rural areas, with those required to tackle exclusion to those with disabilities and encumbrances.

13.5 Older people

The current transport system is largely hostile to older people. Of all UK pedestrian deaths, over 40% involve people aged 60 years and over, largely in urban areas. Roads are often perceived as barriers to the day-to-day movements of older people, and studies of pedestrian crossing behaviour indicates that children and older people are particularly delayed by motor traffic. Roads can lead to a perceived danger of travel which causes feelings of insecurity, anxiety and stress. This could in turn lead to restricted travel with a consequent loss of any health benefits that might otherwise have been gained, such as contact with neighbours. The decline in public transport over decades has had a detrimental effect on the independent mobility of older people but where inexpensive and regular services exist older people appear to enjoy a high level of mobility.[16]

Although conventional public transport, especially buses, remain well used by a proportion of older people, many adults in the 50 – 70y age group are 'lifelong' car users with limited experience of ever using a bus. Transport policies to reduce car use (Transport Demand Management, TDM) will affect this cohort as they age and travel differently from the current older population, expecting door-to-door transport. Increased health has enabled encouraged older people to keep driving.[17] However, the need for many older people to retain their independence, remain socially active, and reduce levels of loneliness and isolation, is seen as a priority which conflicts with the environmental imperative for us all to travel less. The choice of people to live in their own homes for as long as possible, to "age in place", including those in single person households, is considered the preferred option[18] which reduces service costs. Thus the prospects for reducing travel demand overall will be compromised unless the additional pressures on mobility and travel demand caused by increasing numbers of older people are addressed. Work with older people to meet their expectations of choice, while encouraging of change at key life stages, will be required for effective TDM.

A key domain in the World Health Organisation's Age Friendly City project[19] is mobility and transport. Older people are more likely to live in a smaller household: while about 10% of both men and women live alone in their early 50s, this increases to one-third of men and two-thirds of women by the time they reach 80. Increased urbanisation has increased trip frequency and duration[20]; although people tend to travel less as they age, the decline has flattened in recent years. Pressures on transport demand include an ageing and expanding population, particularly of the very old, who will have different needs to maintain their mobility, and an increase in the proportion of older people who have a driving licence and are used to driving as their sole or main form of transport – such people may have particular difficulties when they can no longer drive. Free local bus journeys, improvements in vehicle and infrastructure accessibility standards, the growth of flexible transport solutions and travel training are all developments that support older people to manage the transition they have to make towards a reduced reliance on driving – 'managed progress along a mobility continuum'.[21] In many cities, older people are found more in areas further from urban centres and with less good public transport links.

A number of projects in Greater Manchester have addressed these issues. The Integrated Social Needs Transport Project (ISNT) has centred on building a robust booking, scheduling and despatch (BSD) system for all of the Local Link DRT services operated by community transport operators. This has been achieved through the use of the Trapeze system. It has subsequently created the conditions for other local authorities within the Association of Greater Manchester Authorities (AGMA) to 'bolt on' their own scheduling requirements without costly investment in staff or an additional system. It has also encouraged the development of a business model based on the use of Trapeze for the Ring and Ride Service operated by Greater Manchester Accessible Transport Limited (GMATL).

Department of Health funded Partnerships for Older Peoples Project (POPP) in Rochdale, which has been concerned with the provision and maintenance of choice and independence amongst older people, partly through transport provision, enabling integration of transport services with the delivery of health and social care. A jointly funded Transport Co-ordinator brokered practical transport solutions after they had been commissioned by older people in response to identified needs. Transport offered quick wins to support activities such as luncheon clubs who were able to recruit isolated, transport poor older people and additional initiatives sprung from this base. A Volunteer Driver Scheme (VDS) was established to meet individual needs, particularly in relation to health appointments. A dedicated Shopping Link service for older people was also commissioned, delivered through a taxi company operating a shared minibus service. In addition, links to the Carers Project in Rochdale enabled journey planning and travel training programmes to be developed with older people who needed to gain confidence in their use of public transport options. This element of the project linked to the development of IT skills, with journey planning via the internet proving one of the most popular ways onto the web.

ERDF funding from the Interreg IVB Programme has allowed Greater Manchester Passenger Transport Executive (GMPTE) to lead the Improving Connectivity and Mobility Access Project (ICMA). This project includes 11 partners from 7 member states within North West Europe and is concerned with bridging mobility gaps, particularly on the 'first and last miles' of journeys because the ease with which people can make the first and last miles of journeys impacts on their modal choice. For older (or disabled) people in particular, there may also be an impact on whether a journey is made at all. This may also become more significant in circumstances where a greater proportion of someone's journeys may be discretionary (for example, fewer work related trips). It employs approaches ranging from cost and price models for demand responsive transport, the use and application of ICT solutions to enhance transport choices, skills development for transport staff and users, and practical improvements to connections.

Travel behaviour is frequently habitual, making travel behaviour change difficult to deliver. Alternatives to habitual transport options may be expensive to source in terms of both time and money; projected gains may be perceived as uncertain; and it is usually easier to stick with known travel patterns and behaviour. However, travel behaviour is susceptible to change when key events in relation to the three domains of mobility, accessibility, or lifestyle occur. The resources needed to support mobility may change when, for example, someone is no longer able to hold a driving licence, when a partner who drives dies, or when a positive decision to buy a new bicycle to keep fit is made. Accessibility changes may result from moving house or leaving or transferring employment. Lifestyle changes may be forced through a deterioration in health or new family responsibilities such as caring duties for even older parents or for grandchildren. At such times there are opportunities to influence behaviour, including travel and mobility decisions. The increasing demands of people over 50y are diverse and require an integrated approach to be taken to ensure as many needs as possible can be met. The provision of services must be focussed not only on quality and efficiency but also on the extent to which this provision is sympathetic to that changes people will make and the choices which they will want to make.

13.6 Disabilities and Encumbrances

There have significant improvements in the accessibility of public transport over the past 15 years. Under the Disability Discrimination Act 1995,[22] regulations have been introduced requiring all new trains coming into service since 1998[23] and all new buses since 2000[24] to be accessible to people who use wheelchairs and to include a range of other features to help people with difficulty balancing or gripping as well as those with low vision or hearing loss.

In parallel, the Disability Discrimination Act (DDA) of 2005[25] has placed clear duties on local authorities to adopt policies that do not discriminate against disabled people. This applies to the streets and pavements and has led to significant improvements in the accessibility of the pedestrian environment. This means that many more disabled people now have the opportunity to use streets and conventional public transport than was the case ten or even five years ago.

Physical features such as tactile paving, dropped kerbs, contrast colours and railings are making the streetscape more inclusive. In addition, it is increasingly recognised that providing seating at regular intervals improves accessibility for those who find it difficult to walk long distances: the

Manual for Streets[26] recommends that seating should be provided every 100m, and it is recommended to reduce this distance on slopes.

13.6.1 Mobility vehicles

Electric mobility scooters are used by many on a full-time or part-time basis. However, there is room for improvement in the way that street infrastructure caters to scooters and that part-time hire schemes are publicised to those who could take advantage of them.

Mobility vehicles take up more space and need more room to manoeuvre than wheelchairs. It is therefore important to consider them when designing streets. Features that require particular consideration include pedestrian islands, which if too narrow can mean the scooter protrudes into the carriageway, and barriers to prevent or slow cycle access, which may also block scooters.

Shopmobility electric chair/scooter hire schemes provide mobility to over 1.5 million shoppers in the UK via over 400 town centre schemes.[27] However, there are many more people who could benefit who do not know about the schemes, and therefore it is important for transport and health professionals to know about and promote them where possible.

13.6.2 Public transport for those with disabilities or encumbrances

The rate at which new accessible buses have come into service varies considerably across the country. Many big towns and cities now have 100% accessible buses. Smaller towns and rural areas generally still have a mixed fleet as replacement is at a slower rate. However, a deadline has been set by which all non-accessible vehicles must be off the roads of January 2016 for single deck buses and January 2017 for double deck buses. There is a similar regime in place for trains, with a deadline of 2020 for all non-accessible trains to leave service.

The Government has not yet introduced national accessibility requirements for taxis but many towns and cities have local rules requiring that some or all of their licensed taxi must be able to accommodate wheelchair users. Again, this ranges from 100% of taxis being accessible in all the major cities, down to one or two in smaller towns where most taxi use is pre-booked.

However, even when the goal of 100% of public transport accessibility has been reached nationwide, there will be disabled people who are unable to use public transport. For some it will be because they cannot make the journey from home to the nearest bus stop, for others it may be a question of time of day, weather or health conditions. Others may have wheelchairs that are too big to be accommodated (for example if they need to travel with their legs outstretched or with a reclining backrest). In some cases, the use of a door to door service to an interchange point where they can board accessible public transport (at a rail or bus station for example) may be an option.

For some (including people with learning disabilities or mental health problems) it may be a question of lack of confidence and not understanding how public transport works. In this case, an escort who can help to explain a route or to build up confidence to travel alone may be a way to make the transition from door to door special services to mainstream transport.

For those who cannot use mainstream accessible public transport for any of these reasons, the provision of door to door services (dial-a-ride or ring and ride or taxi) remains a vital lifeline.

Need for public transport

Chapter 9 section 9.3.2 described who we mean by those with disabilities or encumbrances. As well as setting clear requirements for the accessibility of public transport vehicles, the Disability

Discrimination Acts 1995[22] and 2005[25] mandate more general requirements for transport infrastructure (stations etc) and the pedestrian environment.

THSG has in the past suggested a three tier classification of impairment for the planning of public transport. We have now modified this by dividing one of the tiers into two to acknowledge the situation of people with intellectual difficulties who could use mainstream rather than door to door services if they had an escort, and also by recognising the temporary disability-like states that we call "encumbrances". We now suggest that the following classification can be used as a guide to determine which options are most suitable:

- Level 1: People who can make their own way to the bus stop but, due either to disability (for example inability to climb steps), or to a temporary encumbrance such as a baby buggy, cannot use a bus which is not accessible. These users need accessible mainstream public transport.
- Level 2A: People who cannot use mainstream public transport due to cognitive disabilities which prevent them orienting themselves or to a temporary encumbrance such as lack of information about a strange city. These users need door to door services or a guidance system or escort service.
- Level 2B: People who cannot use a mainstream transport system, even one that is accessible, because of physical difficulties that prevent them getting to the bus stop, either due to permanent disability or to a temporary encumbrance such as heavy luggage. These users need a door to door service such as a dial-a-ride or accessible taxi.
- Level 3: People who cannot get out of their own front door or who need care in transit, whether due to permanent severe disability or to temporary incapacity to look after themselves. These users need an ambulance service to act as a public transport service.

The inclusion of encumbrances within these definitions emphasises that the four levels of response to the above classification (i.e. accessible mainstream transport; guidance systems and escort services; door to door services; and ambulance services able to act as a public transport system) are not only the four levels of provision for disabled users, they are also essential parts of the general public transport system.

Recommended Actions

At the time of the first edition of *Health on the Move,* the THSG had viewed transport for disabled people as being a special system once you were beyond level 1. Our recognition that level 2 of the system could also carry people with heavy luggage led us to question this. Do dial-a-rides need to take people all the way to their destination or can they transfer to mainstream transport at an interchange point? Do we need to have specialist door to door services separate from the demand-responsive services that we advocate in our proposals for extending our proposed National Integrated Transport Web into areas and routes which do not warrant frequent scheduled services (chapter 10, section 10.4)? Our concept now would be that demand-responsive accessible local transport should act as a feeder to mainstream accessible scheduled services. Only at level 3 should there be a special system, and here we should reshape the ambulance service so that it is expanded in scope for those who require it, no longer being limited to hospitals as destinations, but also no longer provides a service to users at levels 1 and 2 once the demand-responsive local accessible transport system is in place.

The requirements for buildings and the streets and pavements are not quite so explicit and talk in terms of outlawing '*policies, practices and procedures'* that discriminate against disabled people. This means that it is important to follow good practice to make sure that money spent on accessibility is delivering the best possible improvements to meet the widest possible range of needs.

In addition to requirements for people with musculo-skeletal or cognitive difficulties, facilities to help people with impaired hearing or low vision are also required. Key features include:

- A barrier-free pedestrian environment (free from clutter and obstruction such as shop signs, parked vehicles, and overhanging branches);
- Well maintained, non-slip pavements to avoid tripping hazards;
- Correct and sensitive use of dropped kerbs and tactile surfaces at crossing points (together with audible signals);
- Good clear directional and information signage at a height that people can see and in lettering and colours that people can read;
- Accessible bus stops that also provide shelter, seating and, ideally, real time information;
- Accessible transport terminals with:
  - good signage and plenty of seating;
  - colour contrast to help people with low vision to navigate; and
  - both audible and visual information displays.

Useful guidance on best practice in all these areas can be found in *'Inclusive Mobility'*, published by the Department for Transport.[28] Other solutions that benefit some individuals include guide dogs and other assistance dogs.

The needs of those with restricted mobility should be considered in all aspects of transport planning with the aim of achieving equal mobility for everyone.

Section 17.4.2 considers the provision of accessible transport to healthcare facilities.

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14 Promoting Walking and Cycling

A Davis, M Wardlaw, S Watkins, J Cohen

14.1 Introduction

"Cycling and walking are a very simple way for people to incorporate more physical activity into their lives and are very important for increasing access to jobs and services for many people." *Active Travel Strategy*[1]

In Chapter 2 we described the considerable benefits to health from physical activity. We pointed out that physical activity helps reduce the risk of obesity, heart disease, diabetes, osteoporosis, mental illness and some types of cancer. We pointed out that there is a major obesity epidemic and that the majority of the population are overweight or obese. We pointed out that this epidemic is predominantly associated with inadequate physical activity levels. The evidence is also summarised by Cycle England[2] and Sustrans.[3]

In Chapter 8 we pointed out that active travel, walking and cycling, were in decline. We identified that one factor in the decline of cycling was the belief that it is unsafe and yet in chapter 7 we showed that this is a mistaken belief.

In this chapter, therefore, we discuss how this situation can be changed and active travel promoted.

14.2 Promoting active travel

14.2.1 The need to increase activity levels

The amount of habitual physical activity undertaken is closely linked with the risk of death from all causes[4] and the risk of developing ischaemic heart disease,[5] diabetes,[6] osteoporosis,[7] and certain types of cancer,[8 9] as shown in chapter 2, section 2.2. Physical activity also improves mental health. If a drug were invented tomorrow with this range of effects it would be hailed as the biggest medical advance since the discovery of antibiotics.

However, in many countries most people do not accrue sufficient exercise to derive health benefits.[10] Although most adults in England report they would like to do more physical activity, both men and women cite work commitments and not having enough leisure time as the most common barriers to being more active.[11] There have been a succession of public health promotion policies and government health strategies to increase physical activity levels in England since the early 1990s,[12 13 14] with physical activity guidelines for optimal health since the 1970s.[15] In 2004, the Chief Medical Officer (CMO) published '*At least five a week: evidence on the impact of physical activity and its relationship to health'*.[16] Adults of all ages are recommended to be active at least 30 minutes a day (accrued in bouts of activity of at least 10 minutes) at moderate or greater intensity on at least five days per week. The recommended targets can be achieved through lifestyle activity, structured sports and exercise, or a combination of these. In 2008, 39% of men and 29% of women reported that they undertook that level of activity.[17] *'Game Plan'* set out physical activity targets for the UK:

- By 2020, 70% of adults should be undertaking 30 minutes of physical activity on at least 5 days a week.
- An interim target was also specified: 50% of individuals partaking in this amount of physical activity by 2011.[18]

That aspirational target was based on the levels of physical activity reported in Scandinavian countries, especially in Finland.[18] However, the report identified as its primary aim, '*to develop a sport and physical activity culture to produce a fitter, more active population and realise the significant health benefits and savings available, and the potential wider social benefits. Such an aim requires long-term cultural change'.*

Although a subsequent government policy focused on increasing sport participation by 2012, the London Olympics,[19] other government policy and programmes are concerned with increasing physical activity levels in the general population, such as the Department of Health document '*Be active, be healthy: A plan for getting the nation moving'*. This policy included three targets for 2012:

- Lift one million people out of inactivity by reducing the proportion of the population achieving 30 minutes of continuous physical activity on less than one day per week;
- Help 200,000 more people to realise the general health benefits of achieving 30 minutes of physical activity on five or more days per week; and
- Increase the average weekly duration of physical activity by approximately 5% over the baseline.[20]

Table 14-1 shows the numbers of people in England affected.

Table 14-1. 2012 target population numbers for meeting recommendations and low activity groups, based on 'Be active, be healthy'

Activity level	**2008 prevalence in HSE**	**Estimated number of adults aged 16+ in England in 2008 [a]**	**Target for 2012[20]**
Meets recommendations (at least 30 mins MVPA [b] at least five times per week)	34%	14,961,000	15,161,000
Low activity: 30 mins MVPA less than once per week)	34%	13,669,000	12,669,000

Source: Table 2A in Health Survey for England 2008[17]
[a] *Based on HSE Population number estimate tables 2008.*[21]
[b] *MVPA: moderate (3-6 METs) and vigorous (more than 6 METs) intensity activities*

14.2.2 Active travel as a solution to inactivity

Walking is the easiest and most accessible form of physical activity; it is still a commonly practiced mode of travel despite the limited investment and policy support over recent decades. Walking is classified as a moderate intensity activity, as is cycling at 10mph. Walking two one-mile journeys or cycling two three-mile journeys daily satisfies the 'Half an Hour a Day' physical activity recommendation for adults.[22] Walking or cycling to school or work is as effective as a training programme and can fulfil the recommendations for physical activity (see section 2.2.3). In 1989, 62% of primary school children walked to school, by 2008 the figure had dropped to 48%.[23 24] It is important that children are encouraged to be more physically active, not only for the short-term effects on their well-being and body weight[25] but because adult habits are formed predominantly in childhood.[26 27]

The evidence base for the health benefits of walking is strong.[28 29 30] Moreover, unlike so much physical activity, there is little, if any, decline in middle age. It is a year round, readily repeatable, self-reinforcing, habit-forming activity and the main option of increasing physical activity in sedentary populations.[31] Given that the majority of the population of the UK is overweight or obese[17 32] a particularly important benefit can be walking's feasibility in the treatment of overweight individuals because cardiovascular functional capacities are likely to be poor, and other exercises such as jogging and aerobics may be hazardous. The Health Survey for England 2008 found that using self-reported survey data, only 39% of men and 29% of women met the government recommendations for physical activity (at least 30minutes per day of at least moderate intensity activity at least five times a week).[17] Only 32% of boys and 24% of girls aged 2-15yrs were active for at least an hour every day.[17] Using objective measurements of activity, only 6% of men, 4% of women, 33% of boys, and 21% of girls met their respective minimum recommended activity levels.[17] However, 10- to 16-year-old boys who cycle to school regularly are 30% more likely to meet the recommendations than other boys of that age, while for girls who cycle to school regularly that figure is seven times as likely. On average, they cycled 1.5 miles; half of those who were driven to school travelled less than two miles.[33]

The health, environmental, sustainability, and equity arguments for walking and cycling are very similar (see chapters 2, 3, 9 and 10). Many organisations are working together to promote active travel (see Box 14.1). However, some of the barriers to walking or cycling, and the strategies needed to promote walking or cycling, differ.

The Department for Transport (DfT) document issued by the Labour administration (1997-2010) *Delivering a Sustainable Transport System* had five goals[34]:

- To support national **economic competitiveness** and growth, by delivering reliable and efficient transport networks;
- To reduce transport's emissions of carbon dioxide and other **greenhouse gases**, with the desired outcome of tackling climate change;
- To contribute to better **safety security and health** and longer life-expectancy by reducing the risk of death, injury or illness arising from transport and by promoting travel modes that are beneficial to health;
- To promote greater **equality of opportunity** for all citizens, with the desired outcome of achieving a fair society; and
- To improve **quality of life** for transport users and non-transport users, and to promote a healthy natural environment.

Active travel can clearly contribute to all of these, although some benefits are more readily understood than others.

The other benefit of active travel is reliability: journey times are generally consistent for an individual, regardless of traffic conditions, unlike for motor vehicles.[35]

Box 14.1 The Travel Actively consortium

Travel Actively is a consortium of 11 of the leading walking, cycling and health organisations that share a common belief, that regular walking and cycling is beneficial for physical and mental health: www.travelactively.org.uk

- *British Cycling*, a membership organisation, manages most competitive cycling in the UK, specifically the BMX, Cycle Speedway, Cyclo-Cross, Mountain Bike, Road and Track disciplines: http://new.britishcycling.org.uk/
- *Campaign for Better Transport,* a transport NGO, influences national and local decision-makers and local activists, to secure transport policies and programmes that improve people's lives and reduce environmental impact: www.bettertransport.org.uk
- *CTC* (formerly the Cyclists' Touring Club), the national cyclists' organisation, provides leadership in cycling, including a comprehensive range of member services, activities, advice and protection for cyclists: www.ctc.org.uk
- *Cycling England* is the national body which co-ordinates the development of cycling across England: www.dft.gov.uk/cyclingengland
- *Living Streets* (formerly the Pedestrians' Association) is the national charity which campaigns for better streets and public spaces for people on foot: www.livingstreets.org.uk
- *London Cycling Campaign* works to promote cycling in the capital, bringing about change through community projects, local engagement, information provision, policy advice, advocacy and campaigning: www.lcc.org.uk
- *National Heart Forum* is a leading alliance of over 50 national organisations working to reduce the risk of coronary heart disease and related conditions such as stroke, diabetes and cancer: www.heartforum.org.uk
- *National Obesity Forum* was established by doctors in May 2000 to raise awareness of the growing health impact that being overweight or obese was having on patients and the NHS: www.nationalobesityforum.org.uk
- *Sustrans* is the UK's leading sustainable transport charity. Its vision is a world in which people can choose to travel in ways that benefit their health and the environment: www.sustrans.org.uk
- *The Ramblers* is Britain's biggest walking charity. It works to promote walking, to improve conditions and combat social alienation for everyone who walks in England, Scotland and Wales: www.ramblers.org.uk
- *Walk England* provides an online gateway for walking information for individuals and networking for professionals: www.walkengland.org.uk

14.3 Attitudes and barriers to walking

14.3.1 Introduction

According to the DfT National Travel Survey 2007, the majority of adults agreed everyone should be encouraged to walk for their health (97%), the environment (94%), and to ease congestion (92%).[36] The fact sheet then stated 37% of car users would reduce car use 'if there were safer walking routes', and 30% 'if pavements were better'. The British Social Attitudes Survey also asks respondents whether they agree or disagree with the statements '*many of my short journeys I now make by car I could just as easily walk or cycle if I had a bike*'. In 2006, 34% of people agreed that they could just as easily walk.[37]

Whether it is for leisure or utility purposes, the decision to walk is affected by the five 'C's which highlight the need for walking conditions to be:

- *Connected* - Extent of connectivity to key 'attractors' e.g. public transport, homes, and workplaces.
- *Convenient* – Ability to compete with other modes and options e.g. by creating, promoting and improving pedestrian priority, journey and route ambience.
- *Comfortable* –Quality of routes and surrounding spaces and features including maintenance, landscaping, conveniences including toilets and seating.
- *Convivial* – Pleasantness interacting with environment and other users of the spaces / routes.
- *Conspicuous* – Extent of invitation and safety e.g. signage, mapping, lighting, visibility, and surveillance.[38]

Barriers to walking are both physical - in terms of the built environment - and psychological, in terms of cultural and other normative value systems that may discourage walking.[39] These can partly explain the current decline in walking nationally. Additionally, the perceived *efficiency* and *effectiveness* of the journey are affected by both social and physical environments linking to the distance and time to make journeys by walking. Addressing these barriers should be the focus of the strategy for encouraging walking. Increasing car ownership and use have contributed significantly to the decline in walking through the substitution of journeys by car, including to public transport links, and in doing so contributing to a vicious spiral of degradation of the environment including perceived safety concerns as more people turn to car use to escape hostile environments.

There is a considerable literature on barriers to walking. For example, it is known that residents in a high walkable neighbourhood are likely to take more steps per day than those in a low walkable neighbourhood and the former also walked more for transport.[40] Walkability embraces the pedestrian permeability of the street system, whether walking routes are pleasant (so green neighbourhoods are more walkable than areas where streets are ugly), how safe walking is (so traffic, crime and antisocial behaviour diminish walkability) and how conveniently situated facilities are. Although it is possible that reverse causality is operating, with people who wish to walk choosing to live in areas where it is easier to walk, living in a highly walkable neighbourhood is associated with adults who previously had a preference for non-active transport and/or a low intention to walk or cycle taking more steps. In contrast, research suggests that for those not able to live in 'walkable neighbourhoods', often in low socio-economic status neighbourhoods, walking can be an unpleasant experience in areas that are 'neglected and depressed'.[41]

14.3.2 Physical Barriers

Pikora and colleagues have produced a framework for assessing environmental determinants of walking and cycling. These included the suitability of surfaces for walking/cycling; street width, kerb type and the presence of vehicle parking; traffic volume, speed and the presence of management and control devices; the nature of traffic crossings and crossing aids and verge widths; street design and the design and distance of intersections and other access points; issues of personal safety such as lighting, surveillance and path/lane obstruction; and aesthetic factors such as the presence of trees, street maintenance, cleanliness and pollution.[42] Others have found that the presence of heavy traffic and the absence of a pavement, shop or trees reduces walking.[43]

Because the time and effort required for pedestrian travel is immediately noticeable, pedestrians as a group are highly sensitive to deviations in routing. This means that deviations from the walking desire line (as the crow flies) caused by physical features such as bridges, overpasses, staggered pedestrian crossings and large urban block sizes can significantly reduce the attractiveness of walking as a transport mode. This is often not appreciated – diversions of 150 or 200 metres will be proposed in the belief that they are short, yet they are in fact substantial.

As a society, we have effectively spent 60 years designing walking out of our towns and cities. We are now just starting to design walking back in, and facing objection from drivers as a result. Pedestrian underpass replacement schemes, at-grade crossings, and shared spaces are seen in some areas as an inconvenience to motor traffic passing through the city centre. However in some cities, such as Sheffield and Birmingham, pedestrian routes are now given more priority.

- In addition to direct barriers, the surrounding environment can present significant barriers to walking: lack or poor maintenance of facilities and furniture including: bins, toilets, seating and signage
- Footway condition and quality including: width, gradient, maintenance and drainage
- Obstructions including: street/path clutter (e.g. signage, equipment, vegetation) and parked cars
- Safety / security provisions including: adequate lighting, CCTV and passive surveillance
- Cleanliness including regular street cleaning, graffiti removal, and vandalism repairs
- Motor traffic speed and resulting severance
- Land use policies allowing developments and obstacles to prevent / restrict direct access between walking destinations (e.g. residences, employment, leisure and service areas) including: diverting routes, large block sizes, and private spaces.
- Lack of specific walking policy documentation, and monitoring / reporting successes, planned and required improvements.
- The weather (e.g. hot, cold, wet, foggy), unforeseen human/natural incidents.

The design of neighbourhoods affects their ‘walkability’; a walkability index has been developed in the USA.[44] In an international comparison, the existence of shops and/or public transport stops near homes, pavements, cycling facilities, and low-cost recreational facilities each affect the proportion of local residents meeting the physical activity guidelines, with the presence of more of these factors having a greater effect.[45]

Studies have demonstrated that people are more likely to be heavier, overweight, or obese if they live in less walkable areas.[46 47] Such environments are more frequently found in poorer communities, where large roads with higher vehicle speeds predominate, access to local parks and quality green space is limited, and human and social capital least developed (although one particular cause of low walkability – the circuitous walking routes necessitated by loop and lollipop cul de sacs without pedestrian passages – is suburban in nature and therefore has some associations with increasing affluence). Rural roads with fast-moving traffic are other examples of less walkable areas. US research reports that land use mix has the strongest association with obesity, with increases in the mix being associated with declines in the likelihood of obesity. Each additional kilometre walked per day is associated with a 4.8% reduction in the likelihood of obesity, whereas each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity.[48] Pedestrian-permeable street designs are associated with 6lb lower mean population weight than pedestrian-impermeable environments.[49]

It s therefore a matter of concern that a department of the UK Government is commending as good practice closure of alleyways, without distinguishing between closure of back alleys (which may well have beneficial effects without adversely affecting pedestrians) and closure of cross alleys, which is very likely to diminish pedestrian permeability and hence cause deaths.. Unfortunately, local and national government officers are not fully informed of the health benefits of walking and of the detrimental effects on walking levels of such closures. Planners should ensure that there is a pedestrian grid so that developments are not isolated from walking routes or accessible on foot only by circuitous routes.

The fact that people will walk further if the walk is pleasant is often ignored. Diversions from tree lined passages onto parallel routes alongside busy main roads have been carried out in the name of alleygating and field footpaths have been replaced with a narrow passage through a housing estate in the belief that if the actual route of the right of way is preserved there can be no objection. Even if these diversions do not affect the distance they still diminish walkability.

14.3.3 Social Barriers

Because people do not walk as often, they overestimate the time taken to walk between locations. At the same time they underestimate the time taken to do the same journey by car. (Congestion, traffic lights, not allowing for time to park, time to get a parking ticket, time to return to the car and put the ticket on, time to find a parking space back at origin location, cost of the parking ticket –if you take a chance!)

Other social barriers to walking include:

- Crime and Disorder hotspots, and socially deprived or excluded areas are uninviting or create danger for some groups or individuals. This includes perceptions of a neighbourhood as being unattractive or unsafe.[43]
- Media image creating general attitude or perceptions of walking as dangerous, unpopular, or difficult, with a bias against certain groups or individuals e.g. attractive young women and men.
- Peer influence creating negative appeal to walking: considered less attractive than other modes; intimidation for certain groups or individuals; and cultural attitudes among some ethnic groups.
- Perceived to be less effective or efficient than other modes such as car, public transport or cycling.
- Lack of understanding or knowledge of available resources, including existing routes, information (eg maps), and personal support (eg Walking groups).
- Difficulty of carrying heavy or bulky items required, e.g. textbooks or shopping.
- The mistaken belief that walking alongside a main road increases the exposure to air pollutants. In fact, although the exposure is greater than when walking along a road with less traffic, the pollutant levels are far lower than they are inside a car, and somewhat lower than inside public transport vehicles (see section 14.4.7), so it is not a significant factor. However, it adds to the caution about diversions.

14.3.4 Journey time / distance

For all except the shortest journeys, physical and / or social barriers plus journey time and distance make a walked journey perceived to be less effective or efficient than other modes.[50] The combination of barriers with time and distance mean that walking either becomes unsustainable for daily requirements, as a specific or preferred option, or is completely removed from consideration.

14.4 A national walking policy – overdue and apposite

The promotion of walking requires a strategy like any other mode, and a walking strategy should be a key element of national transport policy. Yet, walking has been the Cinderella of transport policy for many decades with promises of strategies since 1980 rarely having materialised.[51] Local and regional government have more recently developed these, eg Transport for London,[52] while the DfT published a 'walking action plan' in 2004[53] but did not appoint an implementation team. Walking is consequently very much taken for granted among transport decision-makers. As Tolley noted in 1990:

> *'The implicit view is that walking is irrelevant to city transport problems because it does not cause pollution, or accidents, or noise, or congestion: it is not a problem as such. The notion that it is extremely relevant precisely because it does none of these things seems to go unappreciated in official circles.'* [54]

In the subsequent two decades since Tolley wrote this the case for walking is stronger than ever before, from large cities to small settlements. The obesity epidemic, climate change, acknowledgement by the Department for Transport of the need for low carbon transport, and concerns about energy security as well as peak oil[55] all send the same clear message. Walking has a bigger role to play in future transport planning policy and practice. Like cycling, this virtually zero-carbon, health promoting mode of transport will become a much more significant element of transport planning in the years and decades ahead. This is beginning to be recognised within Local Development Frameworks and recent rounds of fifteen year Local Transport Plans.[56] Similarly, walking is set for a greater priority within forthcoming policies and programmes elsewhere in the other principalities of the UK.

Promoting walking can be effective. For example, the WoW (Walk Once a Week scheme), part of the Walk to School campaign run by the national charity Living Streets, has raised walking levels in primary school children in some areas by 19% and walking rates are overall 8% higher in WoW schools compared with non-Wow schools.[57] Natural England also has a Walking for Health programme.[58]

In 2010, the government published an *Active Travel Strategy*, covering both walking and cycling.[1] The focus is on integrated walking and cycling programmes in Local Transport Plans, with action by local authorities supported by the NHS and third sector organisations.

14.5 A Cycling Renaissance – how to unleash pent-up demand for cycling

14.5.1 Introduction

Cycling has great potential to assist public health programmes and reduce road danger. Segregation in many circumstances does not improve safety but compromises it, due to increased danger at junctions. The Hierarchy of Provision is available to guide the development of cycle-friendly infrastructure. Conflict between the desire by novice or non-cyclists for segregation and the poor safety record of these facilities needs to be resolved, ideally through wider appreciation of the Hierarchy of Provision. Local Authority support is critical for cycling programmes to succeed. Cycling can be a major factor in public health programmes.

14.5.2 Historical factors

Virtually every cyclist who visits European cities such as Copenhagen, Amsterdam or Groningen comes back with the nagging question: "how do they do it?" Levels of cycling are so much higher than in the UK, and cycling is an accepted part of daily travel. Is this a 'cultural issue'? Is the national culture the most important influence on the popularity of cycling?

We have to recognise starting points: the popularity of cycling is set, more than anything else, by heritage. Ironically, the United States was once the greatest bicycle manufacturer in the world,[59] accounting for nearly half of global production of 2.3 million units at the peak in 1896. The US "car culture" stems from the combination of enormous domestic oil resources and exceptionally innovative manufacturing industry. In contrast, the plains of northern Europe, largely devoid of oil and backward in manufacturing technique, naturally embraced and sustained the Victorian bicycle revolution to a far greater extent. This is obvious in data of car and bicycle ownership from 1928 (Table 14-2).[60]

Table 14-2. International comparison of travel modes in 1928[60]

	Inhabitants per car in 1928	Inhabitants per bicycle in 1928
The Netherlands	208	3.3
Germany	245	5.8
France	71	6.0
England	60	7.1
United States	6	70.0

So even as early as 1928, car ownership in the USA was already as high or higher than bicycle ownership was in many European countries.

After the Second World War, the ‘car culture’ spread throughout the industrialised world as an essential element of the ‘showcase economies’ of the West, along with consumerism and changing attitudes to personal debt. All countries experienced the same large move away from the bicycle that had happened in the USA 30 years earlier.

However, countries that had evolved a grand culture of cycling had further to fall. Thus both the UK and the Netherlands experienced up to 75% declines in cycling levels between 1945 and the first Oil Crisis in 1973. The big difference was that the Netherlands fell to a level that was still greater than it had ever been in the UK, on a per capita cycling basis,[61] so there was still a significant culture of utility cycling upon which a renaissance could be based. The pattern of transport during the last hundred years is thus a major determinant of the condition of cycling today in a given country. This is especially noticeable in France, where, despite decades of political indifference and the general absence of special facilities for cyclists, the bicycle still enjoys a healthy level of use and respect.

14.5.3 UK Public interest in cycling – evidence of pent-up demand

Figure 2-2 showed that there has been decline in cycling for the last twenty-five years. Might this be because the population has simply lost interest in cycling? Surveys show that this is not the case. A survey by MORI for the Commission for Integrated Transport found that 47% of people would cycle more if problems (as perceived) were addressed.[62] The principal barriers are expressed in terms of the percentage who said they would cycle more if the issue was addressed:

- Better / Safer cycle routes: 32%
- More cycle routes: 31%
- Better bicycle parking: 28%
- More considerate attitudes from drivers: 26%

Thus there is evidence of substantial pent-up demand for cycling. Achieving a cycling renaissance will involve releasing this pent-up demand through removing obstacles, as well as active measures like cycle-friendly infrastructure and the marketing of cycling as an appealing choice.

Schemes such as Sustrans’ Safe Routes to School and Rural Safe Routes to School and the work of Bike It! officers in local schools have radically changed pupils’ travel patterns, with walking buses, cycle training, and engagement of parents resulting in reduced car use and increased walking and cycling. For example working 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 proportion of pupils driven to school fell from 64% to 49%, with cycling to school increasing from 5% to 7% and those walking increasing from 20% to 33%. Parents also reported that the project had made them reconsider their own travel modes.[63]

14.5.4 Public Policy – Continental model

It would be a grave error to underestimate the importance of public policy. In European cities that have growing numbers of cyclists, clear policy decisions have been taken to prioritise cycling as a mode of urban transport. This includes a few British cities; there *are* success stories in Britain. Whether motivated primarily by environmental, health or transport considerations, successive city (and national) governments have decided that prioritisation of cycling – and associated restrictions on private car travel – offer the greatest potential for improving quality of life.

Dutch, Danish and German cities that have seen success in increasing cycling have a number of similarities[64 65 66]:

- the provision of separate cycling paths along busy roads and junctions;
- traffic calming of most residential areas;
- ample bicycle parking;
- full integration with public transport;
- comprehensive traffic education and training of both cyclists and motorists;
- a wide range of promotional events intended to generate enthusiasm and public support for cycling;
- policies that make driving expensive as well as inconvenient in central cities, through a host of taxes and restrictions on car ownership, use and parking; and
- strict land-use policies that foster compact, mixed-use developments that generate shorter trips.

There is a widespread belief, especially amongst non-cyclists, that the high levels of cycling in some European countries have followed installation of segregated facilities. This is a myth. As pointed out in Section 14.5.2 above, these have been cycling countries for nearly a century. What we see today results from factors of the 1920s and 1930s. However, it surely can be said that these old cycling cultures have been preserved, and to some extent enhanced, by modern support.

Previous European national cycling demonstration towns have established traffic planning models which re-prioritise cycling within traffic policy. This includes a recognition of the amount of short trips by bicycle, not reflected in traffic counts.[67] Best practice case studies highlight the degree to which cyclists can participate in traffic safely and without obstructions. This is epitomised in the phrase 'continuous and integral'. Of the top ten cycling cities in Europe, six have separate cycle facilities as standard and seven have bicycle parking as an important cycling policy theme.[65]

The 2009 VeloCity Conference launched the Charter of Brussels.[68] Cities can sign up to the Charter to declare their commitment to invest in active travel and achieve significant shifts to cycling and walking. Of the 26 cities that had signed it at the time of writing, only one is in the UK (Edinburgh).

14.5.5 Guidelines on official promotion of cycling

It is vital that official promotion of cycling presents attractive images. These must acknowledge diversity amongst cyclists and support factual evidence regarding the low risk in cycling. Promotion must not exacerbate myths. Recent successful campaigns have shown the following styles:

- Use attractive models (aspirational but not intimidating);
- Present a range of bicycle types (folding, traditional roadster, fixed gear, town bikes, etc);
- Riders wearing normal everyday clothes, not high fashion but aspirational;
- Feature clothes that are non-seasonal, could be worn in most seasons;
- Present a range of settings (parks, on roads, urban);
- A mixture of riders with and without helmets, to reflect neutrality and individual choice.

14.5.6 Obstacles remedied by re-engineering[69 70 71 72]

Lack of secure cycle parking, fear of crime, and poor integration of cycling with public transport have been discussed elsewhere.

Natural England and CPRE have also done much to promote Quiet Lanes and Greenways. Quiet Lanes are on-road routes which give priority to pedestrians, cyclists and horse riders and Greenways are off-road routes between and through urban areas.[73]

14.5.7 'Factors of the Mind'

The obstacles in this section are inherent in the culture of Britain. They must be addressed by assertion of the facts and public relations work, and through enhanced status of cycling. Doctors, celebrity cyclists, politicians and utilitarian cyclists in their daily lives all have their role to play in addressing the following factors.

Fear of Pollution

Many people believe walking or cycling along a road increases their exposure to air pollution.[74] In congested roads, cars take in air from behind the exhaust of the vehicle in front.[75] Pollutant levels other than particulates are in general double inside cars compared with the pavement, so are lowest for pedestrians and cyclists. Bus users have an intermediate exposure. For exposure to a given concentration, cyclists have a higher dose because of breathing faster or more deeply. However, as they are usually riding at the side of the road, the concentration to which they are exposed is lower so overall their dose is similar to or lower than motorists.[76] An Austrian study showed that nitrogen dioxide and carbon monoxide from vehicles had more harmful effects on motorists than on cyclists.[26]

Risks of activity need to be weighed against the risks of inactivity, which leads to a progressive reduction in the capacity for physical exertion. Greater effort becomes necessary for shorter and slower activity, with fatigue developing faster. Both muscle strength and cardiovascular fitness are affected by prolonged or habitual inactivity.[77] Much of the deterioration of function attributed to increasing age may actually be due to decreasing activity, leading to a worsening in capacity to exercise. A vicious spiral develops.[78] Hillman calculated that the benefits of regular cycling outweigh the years of life lost in fatal injuries by around 20 to one.[26]

Fear of Motor Traffic

Perceived danger emerges as a major factor in reasons cited for not cycling, or for not cycling more. Active cyclists also often cite fear of traffic as a major issue. As discussed in Section 7.2, the fear is not justified by the actual risk of serious injury, but there is an important caveat. Some country roads become alarming commuter 'rat runs' in peak hours, whilst other roads carry so much heavy traffic as to practically exclude them for cycling. If there is no safe alternative to such routes then the network is broken at that point. The utility of a network is proportionate to the square of its size,[79] so if three gaps of this kind break a local network into four they reduce its utility by 93%. It is in these situations that off-highway cycle routes are most relevant. However, in most urban settings, the low actual risk makes segregation superfluous and probably counter-productive, as discussed above. Experienced cyclists must be influential in securing the correct solutions for the circumstances. Cycling PR must foster an accurate perception of risk in the public mind.

For example, ischaemic heart disease accounts for 33% and motor-vehicle traffic collisions for 1.4% of all deaths among commuters. The latter figure is lower for cycle commuters (albeit not to a statistically significant degree), indicating that they are not at undue risk. and gain the benefits of reduced risk of ischaemic heart disease from their regular exercise.

National culture unsympathetic to cycling

It has long been observed that helmet use began earlier, and is today far higher, in countries with low levels of cycle use. This would tend to suggest a strong link between the amount of cycling in a country and the perceived danger in cycling. Efforts to promote cycling from low levels encounter cultural resistance. This point is well summed up by one study[71]

> *"Bicycling... is impeded by the lack of tradition of cycling for utilitarian purposes and by the marginal legal, cultural and infrastructural status of cyclists in automobile based transport systems."*

A fine example of this in the UK arises when insurance companies attempt to adjust their loss down by accusing injured cyclists of contributory negligence for not wearing a cycle helmet, or not using a sub-standard cycle path, or not wearing a high-visibility vest. These cases are never brought against pedestrians or drivers, despite the very similar levels of actual risks faced by these road users. These cases have not been successful, and informed legal opinion is that they should not be.[80] This does not stop insurance companies attempting to save money through accusations of contributory negligence.

Official documents like the Highway Code, and official policies such as helmet promotion programmes, confirm caricatures about cycling being 'dangerous', and separation from traffic being necessary to improve safety. The media also contribute heavily. Coroners' Court reports on deaths of cyclists get extensive coverage, especially concerning whether a helmet was worn or not. Deaths of pedestrians in falls, which are actually far more common, rarely get mentioned in the press.

Official promotion of misleading perceptions

If official bodies perceive cycling to be unsafe then they may permit the issuing of messages which reinforce that view. That in turn may discourage people from cycling, and hence accept a serious reduction in life expectancy in order to avoid a risk that is well within the bounds of risks normally borne in everyday life. Two recent cases are worthy of mention.

The first is the case of Smith versus Finch (2008).[81] This was a contributory negligence counter-suit against a cyclist severely injured by a motorcyclist, on the grounds that the cyclist was not wearing a helmet. The case failed and full compensation was paid, but in his summing up, the judge opined *obiter dicta* that *"it must follow that a cyclist of ordinary prudence would wear one [a helmet]... I am satisfied on the balance of probabilities, that the cyclist who does not wear a helmet runs the risk of contributing to his/her injuries.."* Such a conclusion does not stand against evidence of the low risk in cycling and the problematic effectiveness of helmets. It was made by an official of the state having no known qualifications to make such a judgement, in the absence of a process by which he could be called to account. It may have legal force in future cases. There is clearly a flaw in the judicial system, that individual arbitrariness can be magnified up to affect a national issue.

The second case is of a television advertisement in which the singer Duffy takes a quick ride to a supermarket on her bicycle (the advertisement can be viewed on YouTube). She did not wear a helmet or fluorescent visibility aid. Rather more to the point, her bike was not fitted with lights. Eighteen complaints were made to the Advertising Standards Authority (ASA), which proceeded to investigate. In the end, the complaints were not upheld.[82] Future advertisers however will be wary of portraying cyclists without helmets.

Of course, both of the above cases rest upon the ignorance about the actual risk in cycling. This ignorance is, unfortunately, fed by official discussions of cycling safety as a problem.

Lack of utility cycling tradition

It is noted that the modal share of cycle use is high only in countries with high levels of utility cycling. ‘Utility cycling’ means using a bike in the course of the trips of daily life. This may include riding to work, to the shops, or to see friends in the evening. This is in contrast to leisure cycling, which is strictly a past time, not travel for economic purpose. Leisure cycling may actually increase car travel, if riders drive to an off-road or distant cycle route. For instance, in one survey by Lancashire County Council, 73% of mountain bikers used a car to reach places to cycle [83] This is a problem in some parts of Scotland, notably Callander. In contrast, utility cycling will most likely substitute for car use or public transport and therefore is the most desirable from the active travel perspective.

Utility cycling must be the backbone of any revival of cycling. Cycling programmes that ignore this will not succeed.

Through providing better workplace facilities for cyclists, the Cycle to Work Guarantee aims to boost the numbers of people who commute by bike.[84] It is aimed at employers, to encourage the provision of cycle storage; changing facilities for cyclists; reduced price bicycles through the Cycle to Work Scheme[85]; easy access to bike repairs; and incentives to encourage and help employees to cycle.

14.6 Cycle-friendly infrastructure for the UK

14.6.1 Hierarchy of Provision

In Britain, the development of cycle-friendly infrastructure best practice has necessarily been tailored to the urban layout as built to date. The Cyclists' Touring Club and the Department for Transport have developed the *Cycle Infrastructure Design Guidance*.[86] This integrates with the development of the National Cycle Network by Sustrans.[87]

The guidance is based around a ‘hierarchy of provision’:

- Traffic reduction
- Speed reduction
- Junction treatment, hazard site treatment, traffic management
- Reallocation of carriageway space: bus lanes, widened nearside lanes, cycle lanes
- Cycle tracks independent of road network
- Conversion of footways/footpaths to shared use cycle tracks for pedestrians and cyclists

This hierarchy recognises the inherent better safety of cyclists sharing urban road space with other traffic, rather than using shared pavements or road-side paths. It was developed after experience in the 1990's with the installation of cycle facilities of appallingly low standard.[88] Doubtless we all have seen the cycle lane sweeping across a footpath to collide with a telephone box. The British experience has been that, where segregated facilities are added to an established road system, they almost always create more problems than they solve.[89 90]

Interestingly, the hardest evidence against the efficacy of roadside paths or pavement cycling comes from countries where these are common. Research in many European countries shows a surprising consistency of result: roadside cycle paths increase risk by three to four times relative to sharing space with traffic. A substantial literature of European experience is available.[91] Non-cyclists generally say they would start cycling if segregated infrastructure were available, but even this apparently simple promise turns out to be confounded by reality. Experience in new towns like Stevenage and Milton Keynes, which were built with extensive segregated provision for cyclists, have not fostered cycling cultures. A study of the Milton Keynes Redways[92] found that cycle ownership was higher than the national average, yet the rate of cycle commuting was low at 3% of trips, lower than in nearby towns that had no infrastructure. It was noted that half of local cycling distance was still on the public roads, and further, that for adult cyclists the rate of injury accidents was almost twice as high on the Redways as it was on the public roads. During an eleven year period after 1987, there were six deaths on the Redways but only one on the public roads, for about the same amount of cycling on each. Despite this, surveys noted that the Redways were perceived to be safer.

It would be an error, though, to dismiss all segregation, or to suppose cycling infrastructure is a dispute about segregation versus sharing roadspace. *Any* effective infrastructure must:

- ***maximise*** speed, comfort and efficiency (i.e. reduce stop-starts to a minimum); and
- ***minimise*** delay, diversion and danger (perceived as well as actual).

These may be achieved on- and off-highway, but they must be achieved to draw the cyclists. Ideally, no obvious measures like cycle lanes are required. This is known as ‘invisible infrastructure’. The requirements have been gathered into the ‘5 Core Principles’[93] [94] upon which the Hierarchy of Provision is based:

1. Convenient: Networks should allow people to go where they want. Routes should usually offer an advantage in terms of directness and/or reduced delay compared with existing provision. Cyclists should not face long detours or constant giving way along their route.

2. *Accessible:* Cycling routes should form a network linking key destinations including public transport access points. The routes should be continuous and as direct as possible. Routes should be provided into and through areas normally inaccessible to motor vehicles such as parks and shopping centres, as this may help to encourage modal shift.

3. *Safe:* Not only must infrastructure be safe, it must also be perceived to be safe. Motor traffic volumes and speeds should be reduced to create the desired conditions. Opportunities for redistributing space within the highway should be fully explored. The potential for conflict between pedestrians and cyclists should be minimised. 20 mph should be the maximum speed limit for all residential streets. It is ranked the most anti-social behaviour by residents as reported in the British Crime Survey.[95]

4. *Comfortable:* Infrastructure should meet design standards for width, gradient, and surface quality etc, and cater for all types of user.

5. *Attractive:* The cycling environment should be attractive, interesting and free from litter, dog mess and broken glass.

The Hierarchy of Provision thus aims to thread a pragmatic course towards a cycle-friendly infrastructure that will draw new cyclists, making as full as possible use of existing roads. It has been applied in modest degrees in several British cities, notably Edinburgh, London, York, and more recently in Cycling Demonstration Towns in England (Aylesbury, Brighton and Hove, Darlington, Derby, Exeter and Lancaster with Morecambe). The Cycling Demonstration towns report an average 27% increase in cycling over five years, or about 4% growth per year. This may appear modest, but it compares favourably with growth recorded on the Continent in the 1980's and 1990's. For instance, cycle use in Netherlands grew 30% in the ten years 1980 to 1990, with slower growth since. There is ample evidence that even in the cycling demonstration towns, priority for cycling is still compromised.[96] This is the fundamental problem; lack of real prioritisation of cycling by local authorities even when investing at ten times the national average rate per capita in 'showcases'.

Nevertheless a steady growth rate of 4% per year compounds to 50% growth in ten years. If this could be achieved at the national level, it would bring 1.5 million people the benefits of cycling. It is worth noting that to double cycle use in the UK would only require getting 5% of the population on their bikes. This does not appear overly ambitious, spread over, say, five to seven years.

14.6.2 Cycling infrastructure – arguments for and against segregation

Cycling infrastructure has a sizeable literature[89] and often provokes intense debate.[97] An international review of 14 city-level bicycle programmes[98] shows that success followed implementation of a range of measures, sustained over many years by a high-profile, co-ordinating authority. These measures were described in Section 14.5.4. Thus, on-road cycle lanes and segregated paths have been major factors in programmes that worked, irrespective of the safety arguments. Studies of segregated paths specifically reported mixed success, however. With reference to the British experience, shared bus/bike lanes were popular with cyclists, as were cycle lanes, cycle routes on tow paths and former railways, high quality surface maintenance, secure cycle parking, and bicycle boulevards. It must be stressed that the cycling network evolves over many years and must reflect feedback: from local cycle groups; surveys of stated and revealed preferences; as well as safety audits. Progress will be hampered if the programme alienates experienced cyclists, who tend to make up the local cycle groups.

The priority for public health must be to attract non-cyclists onto the bicycle. A 2009 Sustrans survey of 1,000 women asked what would encourage women to cycle more, and suggested four answers. Two-thirds agreed that separate cycle lanes with vehicles excluded from using them at all would encourage women to cycle more, compared with one-third if cycle lanes were clear of all traffic except buses; one fifth a strictly enforced 20mph limit in local residential areas; and one-sixth cycle training locally.[99] Women who cycle several times a week but not every day were a little more positive about each suggestion. There was a marked social gradient: separate cycle lanes were desired by 72% of women in social classes I and II, falling to 54% in social class V. Women in manual groups thought locally available cycle training was more important (20% in classes IV and V) than other women did.[100] Thus there is a dilemma between measures that could attract non-cyclists onto bicycles while making cycling as safe as possible.

It is not clear whether cyclists who gain proficiency through training schemes like *Bikeability* are still as interested in separate paths. One presenter at the VeloCity 2007 conference summed up the solution to the conundrum:

> *"The best and safest cycle path is, ultimately, the one that is not needed because of the traffic structure and the traffic proficiency of the road users."*

Cycle routes may also be completely off-highway, using canal tow paths or former railway lines. These routes can offer both established and novice cyclists excellent alternatives to city streets, avoiding traffic lights and large junctions. Provided they are well surfaced and have good sight lines, these are a valued complement to the road network. These traffic-free sections of the National Cycle Network and the increasing local links to this may be the solution to the dilemma above between non-cyclists' wish for segregated cycle paths and experience cyclists' awareness of the disadvantages, particularly the greater hazards these pose at junctions. 6% of cyclists using the National Cycle Network are novice cyclists, or returning after many years of not cycling (a fifth of women cyclists surveyed nationally, and 22% of male or female cyclists at the Cutty Sark survey point).[99] Traffic-free sections of the Network account for about a third of its length, but 65% of its usage by cyclists.[101] This proportion is affected by low traffic levels on long distance routes, of course. It will be interesting to discover whether these new cyclists, once they have developed confidence in their cycling ability and enthusiasm for cycling as a transport mode, then transfer to on-road cycling.

The closure of rat runs to cars, leaving them open to cyclists, or the linking of quiet streets by cycle paths can also create continuous cycle routes attractive to established and novice cyclists alike.

Some high speed heavily-trafficked roads are very difficult to make safe for cyclists and a segregated alternative is the only option.

Where a combination of the above types of route could be turned into a segregated network by relatively short lengths of additional route it may well be worth completing the network.

The CTC (also known as the Cyclists' Touring Club) has further information and best practice case studies on its web site.[102] In addition, Cycling England presents a substantial range of advice on its web page *Infrastructure for Cyclists.*[103] The Scottish Executive guidance *Cycling by Design*[104] is also based on the Hierarchy of Provision and provides comprehensive guidance on the development of a cycling infrastructure, integrated with the National Cycle Network.

In summary, there is still a mismatch between what non-cyclists say they want and what experience shows is actually safer. As our objective is to increase cycle use amongst non-cyclists, the demand for a separate network is of fundamental importance. However, the new towns, and other examples, show that providing the segregation does not necessarily bring the cyclists. The demand for segregation follows the negative image of cycling in traffic. If that negative image were altered by enhanced status and role models, would there still be the same demand for segregation? Factually, cyclists, and especially beginner cyclists, are usually more at risk when using segregated facilities parallel to existing roads.

14.7 Promoting safety for cyclists

Many myths abound about the risks of cycling and the promotion of safety for cyclists. The actual underlying evidence was presented in chapter 7. Section 7.2 began with a profile of risk in life-long cycling. It pointed out that the actual risk is exceedingly low. Messages from reputable agencies must respect this. At present they generally do not, although the 2010 *Active Travel Strategy1* commented that

"..the actual risk of cycling is tiny. There is one cyclist death per 33 million kilometres of cycling, while being sedentary presents a much greater risk. Over 50,000 people die in the UK each year due to coronary heart disease related to insufficient physical activity, compared to around 100 cyclists killed on the road."

Fair comparison proves that the risks of cycling are within the range to which drivers and pedestrians are exposed (section 7.2), neither of which groups use helmets. A most effective measure does improve cyclists' safety: more cyclists. More cycling means safer cycling, in accordance with the 'safety in numbers' effect (section 7.3). Since an increase in cycling is in any case desired to improve public health, the objective analysis provides a distinct conclusion: promote cycling. As regards cycle helmet effectiveness, there is a diversity of evidence. Section 7.4 presented a comprehensive review of the conflicting evidence; the diversity is explained in terms of confounding factors and confusion with secular injury trends. The most careful long-term studies do not reveal evidence of noticeable prevention of serious head injuries with rising helmet use but there is good evidence that compulsory helmet use decreases cycling substantially. Calls for helmet legislation, and extant helmet laws in other countries, and indeed, even the promotion of cycle helmets, must be discredited from the evidence.

14.7.1 Safety in numbers

Safety in Numbers is a potent method to cut risk by creating an environment in which serious crashes are less likely to happen. The greater the number of pedestrians and cyclists, the lower the rate of collisions and injuries, such that the absolute numbers as well as the rates of injuries may fall. The evidence is reviewed in more detail in chapter 7, section 7.3. The focus of cyclist safety should centre on programmes to boost the number of cyclists. Unfortunately the caricature that cycling is dangerous and *"more cycling therefore means more danger"* is ingrained in many public sector decision-makers. This misperception needs to be counteracted vigorously.

'Safety in Numbers' also applies to pedestrians: the more people walking, the safer it is and it is perceived. In Hart's study (section 5.3), some residents of the quiet street reported a reluctance to use the foot/cycle path at the end of the cul-de-sac at certain times of day - or at all - because of muggings that had occurred, preferring to walk the long way round.[105]

14.7.2 Cycle helmets

The Transport and Health Study Group does not support legislation compelling the use of helmets. This is out of line with the current position of the British Medical Association, which supports helmet legislation. This issue is unusual in the range of advocacy offered by different organisations. At one extreme is the Association of Paediatric Emergency Medicine, which has called for compulsory helmet-wearing by cyclists under the age of 16.[106] The British Medical Association supports an all-ages law,[107] but only when helmet use is common enough that legislation would not adversely affect cycling rates. On the other hand, the Royal Society for the Prevention of Accidents and the Parliamentary Advisory Group on Transport Safety[108] oppose legislation, although they do recommend use of cycle helmets. Organisations that represent cycling, such as Cycling England, the Cyclists' Touring Club[109] and Transport for London[110] prefer that informed individuals should make up their own mind, in the absence of official promotion. The UK government promotes helmets but has no plans to introduce legislation.

The review of cycling in chapter 7 showed that the actual risks do not justify even the promotion of cycle helmets. However, helmet promotion was not based on risk assessment. The helmet commentary in chapter 7 concluded that the studies used to justify helmet promotion were unreliable and that mass helmet use has not prevented serious injuries, either in collisions or falls, to any noticeable degree in populations that took up helmet use. This evidence has been available for ten years. Yet in those ten years, mainstream medical opinion has actually hardened towards compulsory use of helmets.

The BMA originally opposed helmet legislation, following a quite thorough 1999 study.[111] Then in 2005 it reversed its stance after a single study in Ontario claimed that compulsory cycle helmet wearing would not reduce cycling levels, therefore legislation should follow. However, in the Ontario study the levels of voluntary helmet wearing was already high and the law was not enforced, so it is extremely questionable what was actually proved. The overwhelming weight of evidence is that enforced laws suppress cycling. The Public Health Committee of the BMA protested against the 2005 decision on this basis. The BMA changed its stance to conditional support for law, once voluntary helmet wearing levels were high.

The THSG is convinced the BMA was wrong to abandon opposition to helmet legislation. The current BMA stance of conditional support for legislation does not consider the consequences of the cultural factors required to achieve high levels of voluntary use. Nor can there be certainty as to whether the high levels of existing voluntary helmet wearing was indeed the reason the Ontario study was different – it might equally have been the fact that the law was not enforced or some other unknown factor. However, the BMA position does at least recognise there is a dilemma; helmet promotion and laws deter cycling and damage public health. It is a matter of concern that some other medical organisations, such as the

Association of Paediatric Emergency Medicine (APEM), are calling so vigorously for compulsory helmet-wearing for cycling without any acknowledgement of this issue.

If we are opposed to compulsory helmet wearing, would we therefore advise individuals to wear a helmet?

Two authors of this chapter see helmets as mainly relevant in off-road cycling and do not use one for road riding. Two editors are cycle helmet wearers. The other editor is a non-cyclist who has periodically considered taking up cycling and would wear a helmet if he did so. As these differences in personal choice imply, there is a range of evidence and experience on which to base one's view, and of course, most of us know someone who smashed a helmet in a crash. We may or may not be influenced by such anecdotes. The question is; which is the most reliable evidence? Chapter 7 presented a comprehensive review concerning cycle helmet effectiveness, acknowledges conflicts of evidence, and seeks to explain those conflicts.

To evaluate the effectiveness of cycle helmets was never going to be an easy task. The risk in cycling is low, so the number of injuries is low. Those who wear helmets are self-selected, therefore they do not represent a randomised sample. The early studies on cycle helmet use were case-control studies (explained in section 7.4). Case-control studies based on self-selected behaviour are vulnerable to confounding by socio-economic factors that are related to both helmet-wearing and to injury risk, which can lead to an association between helmet-wearing and injury risk that is spurious. Close inspection of the most highly cited helmet study shows ample evidence of serious confounding. The most careful population level studies, examining injury and fatality rates in relation to general level of helmet use, have not shown noticeable benefit. Population studies are not perfect either, but could hardly miss a consistently high level of protection. What population studies have demonstrated clearly, however, is the deterrent effect of compulsory helmet-wearing on cycling levels. (References for these statements are provided at the end of chapter 7 to avoid duplication in the reference lists).

It is particularly notable that interest in cycle helmets has turned out to be an inverse function of the popularity of cycling in a country. The issue began – and laws were first passed – in countries with the lowest levels of cycling. In the classic cycling countries (Denmark, Belgium and the Netherlands), interest in helmets has stirred only quite recently, and has attracted limited credibility. This is perverse: countries with the lowest proportionate number of cyclist casualties have the greatest interest in helmets. This pattern is revealing of the social and political inconsistencies driving helmet promotion. Evidence showing lack of effectiveness of helmets, or even harm, is ignored. Evidence of the low risks of cycling has also been ignored. Risk assessment prior to the introduction of helmet laws in Australia showed pedestrians faced higher risks than cyclists, and car occupants equal risk.[112] This did not stop the laws being passed, nor did it start the promotion of helmets for the other groups.

It is clearly unacceptable to present opposition to even the voluntary wearing of cycle helmets as wrong-headed and beyond the pale. There is evidence upon which such opposition can legitimately be founded. It is also wrong to present helmet wearing to the public as if it were undoubtedly a good thing. There are doubts of which they should be aware. It is important to recognise that the actual risks of cycling warrant helmet programmes to no greater extent than the risk of high speed crashes warrant the wearing of helmets by drivers or the risks of falling down steps warrant their wearing by pedestrians. There is just as strong a case for wearing helmets when playing football or rugby The real harm of helmet promotion is that it exaggerates the risk of cycling. But when all that has been said, personal choice must be respected by all. The fact that many cyclists will choose to wear a helmet is not to be criticised any more than it is to be taken as evidence in support of legislation. Cycling is not a hazardous form of travel – that is the bottom line.

14.8 Conclusions relating to cycling: "Myth shall prevail if the wise remain silent"

The British government has long stated it would like to increase cycling. The National Cycling Strategy aimed to quadruple cycle use on 1996 levels by 2012. As this review has shown, the decline in per capita cycle use has been halted but not reversed.

The perception of cycling as unsafe is the central reason for the failure of this policy. Almost a third of non-cyclists are discouraged from cycling by this perception.

14.8.1 Summary of main conclusions

Cyclists using the roads bear everyday risks little different from walking or driving, and those risks fall as cycling gets more popular. This is known as the Safety in Numbers (SiN) effect. There is no known case in the post-war period when an increase in cycling caused an increase in serious casualties. Further, an increase in cyclists may be expected to reduce road deaths, due to the negligible harm cyclists impose on others. This would be especially so if more young men took up cycling. In most cases, the safest way to cycle is to share road space with other traffic, behaving in line with the principles of 'cyclecraft'.[113] Considerately driven cars pose very little risk for cyclists.

The health benefits of cycling are substantial, conferring a reduction in mortality similar to giving up cigarette smoking. The bicycle is judged to be amongst the most effective means to increase physical activity in daily routine. This is because it suits the sub-five-mile trips that make up the bulk of personal travel. When combined with the train, the bicycle could challenge the flexibility and convenience of car travel even for many longer trips.

It is evident that re-education of official, media and public attitudes must be a prerequisite to any renaissance in cycling, even back to the levels seen twenty years ago.

14.8.2 Conclusions on the safety of cycling

1. Considering the impact upon both users and third parties, cycling is comparable to car use in its overall safety.

2. As the figures for driving are diminished by the inclusion of motorway journeys, which are much safer than all purpose roads, and as the figures for cyclists are increased by the greater proportion of cyclists who are inexperienced, young males, or untrained, it can safely be concluded that for the kinds of journeys which will in fact be made by cycle, cyclists who have undergone proficiency training and ride regularly have an overall safety impact significantly less than that of comparable motorists on similar journeys.

3. As a much greater proportion of the safety burden of cycling falls on the user rather than on third parties, in some cases the risk to the cyclist may be higher than the risk to a comparable motorist. The risks of driving span a range greater than an order of magnitude, according to age and sex of driver, the road class, and the national driving culture. The risks of cycling lie well within this range - in the UK, roughly in the middle of the range. There are other countries, notably France, the Netherlands and Australia, where the comparison is more clearly favourable to cycling. It is fair to say there is no evidence that the long terms risks of cycling are systematically greater than driving. It should be noted that drivers travel much further than cyclists. This makes comparison of risk on a distance travelled basis misleading. It should also be emphasised that pedestrians face higher fatality rates per unit distance than cyclists The higher average risk of cycling at the population level in Britain, relative to driving, is not enough to indicate with certainty that a given individual would be exposed to meaningfully greater risk when cycling, compared with driving. This is particularly true when cycling is combined with public transport.

4. Even if there is an additional risk, it is small and is of an order comparable to many risks that are taken without thought in everyday life, such as driving on an all purpose road rather

than a motorway, driving at night, or travelling by car rather than by train. The UK drivers' safety record is the best in the world. The UK cyclists' safety record is still better than drivers in some other industrialised countries.

5. Even if there is an additional risk, it is outweighed many times over by the health benefits so that overall cycling enhances life expectancy.[114] Any difference in risk between cycling and driving is fractional relative to the health benefits and some of this difference relates to not comparing like with like.

6. Not cycling therefore gives up a huge health benefit with considerable calculable impact on life expectancy in order to avoid a small risk, comparable to many risks that are taken without thought in everyday life, the impact of which on life expectancy will be negligible.

14.8.3 Conclusions regarding cycle helmets

Of particular concern is the prominence given to cycle helmets. This emphasis has for 30 years presented cycling as an especially risky mode of travel, akin to motorcycling. It is notable that UK bicycle use has declined by 30% in that time. In New Zealand, bicycle use collapsed by 55% following years of helmet promotion and enforced legislation.

A fair statement of the position regarding cycle helmets is as follows:-

1. The case for a cyclist to wear a helmet is no greater than that for a driver or pedestrian and certainly less than that for a footballer or rugby player.

2. It may be a rational decision for a driver, cyclist, or pedestrian to wear a helmet, but on the other hand individuals must keep a sense of perspective about how much effort they invest in avoiding small risks.

3. In the case of cycle helmets there is an added problem, which potential users should be made aware of, that there is scientific evidence suggestive of a possible adverse effect which may even outweigh the benefits, although the nature and extent of that effect is ill understood and the evidence is not conclusive.

4. The wearing of cycle helmets should not be made compulsory, for three reasons. The most important is that -it has been shown in a number of different jurisdictions that compulsory (and enforced) helmet-wearing reduces cycle use and therefore has a negative effect on the population's health. Secondly, the risk which is being averted is sufficiently small that compulsion is disproportionate. Thirdly mass helmet use has not reduced serious head injuries to a noticeable degree relative to general improvements in road safety seen for other road users (i.e. secular trends).

5. It is a plausible argument that vigorous promotion of cycle helmet wearing does more harm than good by presenting cycling, wrongly, as a dangerous activity.

6. As the level of risk involved in not using a helmet falls within the range of everyday risks contributory negligence claims against cyclists based on not wearing a helmet should not be permitted. The same is true of reflective clothing - it is common sense for both pedestrians and cyclists to wear such clothing in unlit streets at night if they can but only in an unreasonably risk averse society would it be thought to be "negligent" not to. Since the Highway Code is a legal instrument which can be used in court cases on the issue of liability Highway Code Rule 59 should be amended to remove reference to cycle helmets and reflective clothing, unless it is legally possible to replace them with more balanced statements drafted in such a way that they would not be usable in court.

Discouraging healthy travel is much like cigarette advertising in the harm it inflicts. Public health professionals must recognise the hazard of unintended consequences from well meaning helmet campaigners, and be prepared to speak out against exaggerations of risk and distortions of data. *"Myth shall prevail if the wise remain silent."* This should in no way be intended to undermine the principle that individuals may choose for themselves to use helmets, following realistic advice about the protective value, as is also the case with helmets for drivers and pedestrians.

It may seem strange for public health professionals to express reservations about safety campaigns, but public health is always concerned with priorities. A risk-averse society is different from a safe society. In a safe society, those who climb mountains take the right equipment, check the weather, ensure that people know their route and expected time of return, know their limitations, and contribute to the funding of mountain rescue teams. In a risk-averse society, people do not climb mountains. Ultimately, a risk-averse society is an unsafe society because people lose the capacity to handle risk sensibly.

14.8.4 Conclusions regarding cycle-friendly infrastructure

The issue of cycle-friendly infrastructure presents a significant dilemma. The following is a fair statement of the position.

1. There are strong grounds for arguing that segregated provision is not the best way to make provision for cyclists in the UK road system.

2. In particular, there is concern that badly designed segregated provision will make cycling inconvenient and unsafe, especially by loss of priority at junctions. Past experience shows that this does not encourage new cyclists but it discourages existing cyclists. .

3. However, segregated provision is wanted by a large proportion of those who are open to persuasion to take up cycling, but have little, if any, personal experience of cycling. This presents a fundamental dilemma. Should public health professionals accept that it is easier to work with the myth and develop segregated facilities in order to encourage people to cycle and hence gain the health benefits? Or should they correct the myth through favourable messages about cycle training, well-equipped road bikes and the directness of the existing road network?

4. Good quality off-road cycle paths, such as those that can be established on old railways or canal tow paths; cycle paths linking quiet streets into through cycle routes; and long continuous quiet routes formed by closing rat runs are popular with established and novice cyclists alike and should be a high priority for cycling investment.

5. There are some roads – generally major rural routes - which are inadvisable to cycle on and where segregated provision is necessary either on the road or avoiding it. It is particularly important that such provision is then funded and implemented to enable cycling. Where such routes would provide direct links between nearby towns or suburbs, they should be a priority.

6. Where the above measures bring into being significant cycle-friendly networks , it would be foolish not to create segregated links to fill gaps in the network (in line with Point 5). These must be of acceptable quality, as advised by experienced cyclists, or they will not be used.

7. Subject to the above, the present Hierarchy of Provision should continue to apply. It is the most pragmatic guideline, and has achieved significant increases in cycling levels where it has been applied. The main problem is that too few local authorities have active cycling programmes.

8. It must be stressed that investment in cycling infrastructure will be largely wasted if it is not supported by official endorsement of cycling as a priority mode of transport.

It can be seen that this list places the emphasis on measures that would be seen as positive by novice cyclists and established cyclists alike. This is crucial, since badly designed cycle facilities will discourage existing cyclists, rather than encourage novices. Adequate priority for cyclists must be achieved in all cases. Poor quality segregated provision must be discouraged and that is the reason that the Hierarchy of Provision was developed. Our emphasis on circumstances where segregated provision is appropriate coupled with continued support for Hierarchy of Provision recognises the concerns of experienced cyclists by clarifying the settings in which segregation is appropriate, whilst recognising that the priority must be to get people onto bikes. The competent provision of cycle-friendly infrastructure is vital to this objective. We cannot ignore the views of that one- third of the population who want quieter streets or cycle paths so that they can take up cycling.

14.9 The Cycle / Public Transport Combination

14.9.1 Introduction

Cycling is the healthiest transport mode for journeys of about 1km to 15km. Below 1km, walking is an alternative. Above 15km, the cycle starts to be too slow. One of the difficulties faced by all those who try to get people out of their cars is that no other transport system is seen as having the same universal flexibility. Public transport may be good for some journeys at certain times of the day but it does not reliably take people where they want to go at the time they want to go. The combination of the cycle and the train is however a transport mode which is capable of matching the flexibility and speed of the private car.

There is one transport mode that has the potential to be as flexible and universal as the car and yet it has been neglected to the point of virtual disappearance – the train/cycle combination (or indeed cycle/bus, cycle/coach or cycle/tram combination). People cycle to a railhead, take a train to another railhead, and then cycle to their destination They either take their cycle with them, or they keep another cycle at the other end for a regular journey, or they hire a cycle at the other end.

14.9.2 Cycle / public transport combinations

Options

There are four types of public transport / cycle combination:

- carriage of ordinary bicycles,
- folding bikes
- parking plus bicycle hire, and
- parking plus additional bicycle.

All of these are useful. The major improvement most higher-cycling countries, such as the Netherlands and Japan, have made is in terms of parking (cheap, safe, secure, plentiful). Caltrain, in the USA, has focussed on increasing cycle carriage on trains, but this is a less common approach (see section 14.9.3 below).

The advantage of folding bicycles is that a designated cycle carriage is not required, as they take up no more space than a medium size suitcase. Although not suitable for long-distance or hilly/difficult terrain cycling, they are perfect for cycling relatively modest distances to and from railway stations. They have the added advantage that instead of having to risk abandoning the bicycles somewhere outside, they can be brought into buildings where they can be kept more safely. However, they can be heavy and awkward to carry, particularly up and down stairs. Some railways would carry these only when in a bag or other container, but this now applies only to Eurostar.[115]

Rationale

The opportunity to combine cycles with trains or other forms of public transport is very important for the following reasons:

(a) cycling to and from railway stations could contribute substantially to meeting daily exercise requirements for individuals and hence help meet public health objectives on exercise, obesity and heart disease. Calculations in the BMA publication "*Cycling and Health*" show how substantial such measures could be.[114] At the time of that publication it was possible to meet the entire Government target on heart disease prevention by shifting a proportion of car journeys under five miles from car to cycle or foot. This is not a peripheral issue – it is a way of saving lives in substantial numbers.

(b) over the last 20 to 30 years, the country has developed a spatial distribution of industry and economic activity which is much more distributed than in the past and therefore much less easy to serve with public transport. Until the public transport system starts to address this problem it will be conceding a large proportion of journeys as not susceptible to modal shift. The average commute is about 9 miles which is just about cyclable but for this to be the average, many commutes must be more than this. Conceding them to the car will entrench the position of the private car as the main mode of transport and make it impossible to reduce congestion or traffic pollution. The combination of the cycle with the train offers as much flexibility as the car – and potentially more reliable journey times - and is the only mode of transport which exists now and is able to compete with the car across the whole spectrum of journeys.

14.9.3 Current status

Trains

A strategic commitment to the promotion of the combination of cycling and trains is lacking in many countries, including the UK where the railways' current approach to this issue sees cyclists as a minority group to be catered for in small numbers on off peak services, while the government has failed to require train franchises to support cycle train combinations.

So completely has this mode of transport been neglected in the UK that most train operators find it difficult to accommodate more than one or two cycles on the same train and many operators ban cycles from trains at the very times when most people want to travel. Many local light rail operators ban non-folding bicycles entirely, such as the Docklands Light Railway (DLR) in London.

The emphasis in the UK is still on accommodating a few cyclists rather than on promoting a major transport mode. In Holland and Germany, the matter has been approached more positively in terms of cycling to stations and a large proportion of passengers now cycle to the station (for example 40% in the Netherlands[116]). This still leaves the journey at the other end not catered for but this may not matter if people then use local public transport or walk to their destinations, or have another bike parked at the destination station if necessary. The Association of Train Operating Companies (ATOC) considers that this 'two-bike market' is currently constrained by a lack of available cycle parking spaces.[117]

Cycle parking at stations is also under-provided. 70% of respondents to a London Assembly Transport Committee survey considered that cycle facilities at Tube stations are inadequate, and 62% considered cited National Rail stations as providing inadequate facilities.[118] Addressing this lack of provision is not currently a priority, as exemplified by TfL whose plans to improve cycle parking at outer London tube stations extend to only six of the 60 stations without cycle parking.[3] This contrasts with towns in the Netherlands, where up to 40% of rail users access railway stations by bicycle and cycle hubs at station provide top of the range faclities for thousands of cyclists.[1]

The experience of Cal Train in California has shown that a vigorous promotion of the rail/cycle combination is commercially and politically viable. As a result of the increase in onboard bicycle capacity, Caltrain's fare-box revenue increased over $350,000 in 2009, and the payback period was less than six months[119]. Cal Train has generous cycle provision on its trains: at least one cycle van on every train, and two vans on the most popular commuter trains, with capacity for 80 cycles. Cal Train measures the success of its promotion not in terms of the percentage increase in cyclists carried but in terms of the percentage increase in total ridership attributable to cyclists. It has faced the embarrassment of success outstripping provision and it has introduced a scheme whereby it offers regular users incentives to buy a second bike and have one at each end of their journey instead of taking the cycle on the train. From 2003 to 2006, walk-on passengers increased 16%, whereas bicycle passengers increased 41%. From 2006 to 2008, walk-on passengers increased another 16%, but bicycle passengers increased only 5% due to limited space for bicycles on trains.[120]

Buses

Bicycles are accepted on some inter-city coaches with an under-floor hold, notably Oxford-London services. However National Express, the UK's main inter-city coach provider, do not permit non-folding bikes in the hold.[121]

Carriage of bicycles on local bus services is not widespread in the UK, although there are some examples: on the Pembrokeshire coast, a bike-carrying tourist bus service was provided with the specific aim of allowing car-free holidaying, and in Sheffield, rural minibuses have been fitted out to accept cycles onboard and carry approximately 30 bicycles per month.[122] Bicycle carriage on local buses by means of a rack attached to the front of the bus is common practice in some overseas locations, notably many U.S. and some Australian cities.

14.9.4 Promoting the train / cycle combination

In evidence to the Strategic Rail Authority in the UK in 2004, the Transport & Health Study Group advocated a programme to be linked to an active promotion of the train/cycle combination: The European Committee of THSG in 2009 went further in evidence to the European Commission, calling for a Trans-European Train/Cycle Network. The following proposals are based on, but not identical to, these two sets of proposals.

Between these two proposals our thinking had moved forward on the issue of cycle hire and cycle storage versus cycle carriage and more confidence in advocating the cycle/train combination as a separate transport mode rather than simply debating how the railways should cater for cyclists.

Recommended UK measures

- Adequate and secure cycle parking at all stations for the benefit of those whose journey requires a cycle only at the origin end.
- Arrangements similar to those operated by Cal Train whereby passengers whose regular journey requires a cycle at each end are provided with secure cycle parking at both their origin and destination if they buy two bikes.
- Introduce compulsory requirement for rail refranchising tenders to address rail-cycle combination as a mass transit mode
- The addition of a cycle van to all trains.
- The introduction of cycle hire at selected rail heads from which cycles could access various non-rail-served destinations. This will soon be implemented in London through the new cycle hire scheme to be introduced in summer 2010.
- Promotion of cycle routes to stations

Further developments are then feasible once the initial approach has shown the viability of the combined travel mode:

- The introduction of through ticketing for journeys in which the cycle could fill a missing link
- The introduction of cycle hire at selected missing links.
- Construction of new cycle routes to stations
- Consideration of station re-openings where a station could serve as a cycle rail head, or where new journey opportunities could be created by a short cycle connection.

A Europe-wide approach

A European cycle / train network would be created by ensuring that the whole of Europe was:

- within reasonable cycling distance (perhaps 5km in urban areas, 10km in rural areas and 15km in remote areas)
- over a safe cycle route
- from a cycle-Metro station with cycle hire, cycle parking and cycle storage. If long term cycle storage could not be provided at every station cycles which were being left for more than two days could be moved on trains with spare capacity to a central storage point until the date they are needed again;
- each such station being served by a cycle-carrying public transport system (typically a train but in rural areas it could be a cycle-carrying bus or a ferry);
- operating frequently (typically with a scheduled service every 15 minutes in urban areas, every 30 minutes in rural areas or every hour in remote areas, but where this is not economically viable demand-responsive services could be provided);
- these local services feeding into the European network of interurban, interregional, intercity and international trains, all of which should have a cycle van attached for the conveyance of bicycles; and
- with proper provisions for cyclists to change trains at major interchanges in significant numbers without obstructing classic passengers.

The trains which provide this network would in most cases also function as part of the classic network and would also serve stations which are designed to be accessed on foot over shorter distances. However, for the cycle/train mode to be promoted as a viable alternative to the car, the additional provision needed will be more than just a small modification of the rail network. It will need additional rail vehicles, additional facilities at stations, additional stations, and additional cycle links to stations. It will be in many senses a new network for a new mode.

Cycle Carriage or Cycle Parking & Hire

We have advocated cycle carriage as well as cycle hire and cycle parking.

There are some who would argue that if cycle carriage is universal, it is less important to focus on cycle hire and cycle parking. However it is wasteful and environmentally costly to carry cycles which are only needed at one end of the journey. The experience of CalTrain in California is that cycle carriage becomes overwhelmed if not supported by cycle hire and cycle parking.

Conversely there are those who would argue that if cycle hire and cycle parking are universal and if there are facilities to move bicycles which are being left for several days from the station at which they were deposited to some central store (perhaps, for cost and environmental reasons, timing this transfer to use a train that would otherwise be lightly loaded) cycle carriage is not needed. However we believe that if everybody who was going away for several days had to deposit a cycle at one end and hire one at the other it would overwhelm hire and storage facilities.

14.9.5 Conclusions

One important point that we did not make in either of the documents, but which should be borne in mind, is the significance of cost. The costs of cycle carriage, cycle hire and cycle parking must reflect the need to make this option attractive. In September 2009, the DfT announced a programme of investment in cycle parking at stations, having noted that 50% of the population own a bike and 60% live within 15 minutes ride from a train station, but only 2% of train passengers travel to the station by bike. In contrast, cycling accounts for a third of all trips to and from the station in the Netherlands.[123] The THSG welcome the DfT investment but note that more will be needed to achieve levels of cycling comparable to the Netherlands.

If the bicycle did not exist and it was invented tomorrow by a railway company as its answer to the car, there would not be a railway in the world that was not clamouring to have it.

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15 Revitalising Public Transport

S Watkins

15.1 Increased use of public transport

In chapter 4 we discussed injuries. Buses, trains and aeroplanes are much safer than motor vehicles, for all other road users. They also cause less noise, congestion and pollution per passenger journey (see the discussion in chapter 3) – in this respect trains are better than aeroplanes. An improved public transport system could meet most of the transport needs presently met by private motor vehicles. Promoting the use of public transport instead of private motor vehicles would benefit all road users, including essential car users. In chapter 2 we discussed the importance of physical activity. For the majority of public transport users, for whom the bus stop or rail station is within a mile but not directly outside the home or destination, travel to and from public transport can contribute to regular physical activity. For example, those who regularly travelled on light rail transit were thinner and less likely to become obese, even after adjusting for personal characteristics.[1]

Private transport is an example of "the tragedy of the commons" – the situation where everybody tries to buy an advantage and, as a result, destroys the advantage they were trying to buy whilst making things worse for everybody else. The usual example of "the tragedy of the commons" is the overgrazing of a common because it is in everybody's interest to graze as many cows as possible. A situation in which one travels slowly in traffic jams made up of cars which people bought to travel more quickly, and which they cannot now dispose of because the bus no longer runs, is probably an even better example. The solution, for the common and for the road, is a collective decision to exercise restraint.

In chapter 9 we discussed social exclusion. A key element of this is the transport poverty of those who cannot afford (or are unable to use) a car in a society which is increasingly car-dominated and in which public transport is in decline. In chapter 8 we saw the inequity of the travel trends that are deepening this problem.

Examples of measures to increase the use of public transport include the following:

- Improved reliability of services
- Increased service frequencies
- A comprehensive system (see chapter 8)
- Cheaper fares
- Better marketing provision of information to passengers
- Individualised journey planning
- Better integration of public transport services, between different modes and different operators, by such means as timetabled connections and through ticketing arrangements
- Reduced risk of assault on passengers by such means as bus conductors, and staff supervision of stations
- Improved accessibility of buses and trains for people with restricted mobility (see sections 9.3.2 and 13.5)
- Provision of secure parking for bicycles and cars at major public transport access points
- Park and ride schemes
- Provision for taking bicycles on trains (see chapter 7)
- Planning to ensure that facilities are easily accessible by public transport (see below)

Much could be achieved if there were more local control over public transport services by, for example, franchising rather than deregulation. In conjunction with the other strategies proposed in this document, higher levels of subsidy to operators may not be required. (Concessionary fares are a subsidy to passengers).

It is important that public transport is a comprehensive network. At present, each service is considered in isolation. But the decision to buy a car is often taken because of the perception that certain individual journeys are only available if a car is owned.

New developments, such as light rail networks and people mover systems (personalised rapid transit using small vehicles), have great potential for improving public transport.

15.2 The Importance of Networks

In chapter 10 we drew attention to the work of Mogridge, who used London data to test the Downs-Thomson Corollary of Pigou's Theorem, which says that only investment in public transport will ease congestion because in a saturated road system congestion rises until it becomes an obstacle to the life choices which create traffic. Public transport investment helps because it provides an additional alternative and thus raises the trade off point. Mogridge's time trend analysis showed that congestion in London was affected by the quality of rail services more than by anything done on the roads. However, we asked why then congested roads still exist parallel to good quality rail services and we gave as an example Cheetham Hill Road in Manchester, which parallels the excellent tram route from Bury to Manchester. Congested roads exist parallel to good quality railway lines because the cars are not going where the railway is going. Most of the cars on Cheetham Hill Road are not travelling from Manchester to Bury. Taking cars from Manchester to Bury off the road (as the tram service has been shown to do) simply eases the congestion for cars making other journeys. The road fills. It is the network that needs to compete not the individual route.

This strikes at the root of our current methods of financing public transport. *'Making the best use of the fleet', 'not paying operators to carry fresh air'*, *'focussing on the most popular journeys'* make sense if to the aim is to make a profit from a public transport investment. However, if the aim is to achieve modal shift, they miss the point. People do not travel to work by bus if there is no bus home. People who could easily travel to the pub by bus drive instead (despite the inconvenience and risk) because their bus is not running when they have finished their evening. If there is no train or bus to their destination, people generally do not take the train or bus to the next village or suburb and then walk – they take their car. In section 10. we pointed out the absurdity of the Serpell Report's recommendation that the railway line from Glasgow to Oban and Fort William should be closed after Crianlarich, a tiny remote village which happens to be where the line divides. We pointed out that this was simply the extreme of a way of thinking which considers the economics of public transport journey by journey or even part of journey by part of journey instead of looking at the whole network. We concluded that there needs to be a new way of thinking which focuses on creating comprehensive alternatives to car use. We advocated comprehensive public transport networks and active travel networks coupled with more opportunities to avoid travel (such as working from home) and road charges. We are aware that some transport planners will find this package controversial and we would refer them to chapter 10 for the justification. This chapter merely examines the practical implications for public transport of the conclusion reached in chapter 10.

15.3 Can we have a National Integrated Transport Web?

Applied on a national scale, a National Integrated Transport Web would imply a high frequency, high quality integrated network of stopping trains, trams, ferries, limited stop rail link buses and (where high frequency scheduled services cannot be justified) demand-responsive services reaching close to every place of work, residence, business, recreation or public recourse. By high frequency, we mean for example at least every 20 minutes in urban areas, a little less in rural areas but at least hourly even in remote areas. By close, we mean within 1 km in urban areas, a little more in rural areas. The term "National Metro" has been used to convey the implication of a frequent network with a rail base at its core but we prefer the term National Integrated Transport Web.

In describing such a network as rail based we are not in any way rejecting the considerable contribution that buses can and should make to it. We discussed in chapter 1 the significance of the European evidence that trains and trams compete better with the car than buses to such an extent that there is more bus usage in cities with rail-based public transport systems than in cities with bus-based systems.[2] We pointed out that it was one of a number of conflicts where providing best for existing users might lead to different solutions than those which are needed if our aim is competing with the car and growing usage by incremental shift. We pointed out that buses often compete with walking and cycling rather than the car. However we also stated that there was evidence that investment in trolley buses could have the same effect as investment in trains and trams3 and so it was the permanence, visibility, speed and quality of the network that was important not the precise configuration of the link between the wheel and the ground. Buses operating in a comprehensive network to high quality, free of the constraints of road traffic and road speeds, could be as effective as trains. However buses operate on roads and that is indeed their main advantage. The simple practicality is that the rail system is the only existing reserved track network free of road congestion and the 30mph road speed limit and it is simply not imaginable that busways and bus priority on congested major roads could reproduce that network at an acceptable cost.

Such a national web would require:

1. Operation of Integrated Transport Web frequency stopping services over most of the rail network with the reopening of the closed wayside stations on lines that remain in use

2. New and reopened rail lines and busways

3. Motorway coach and bus services

4. Allocation of road space to tramways and bus lanes

5. Links of various kinds from settlements to the main corridors

6. High quality bus services on corridors where the roads are sufficiently uncongested that reserved tracks are unnecessary

7. Demand-responsive services in remote areas

The Commission for Rural Communities has published a series of documents setting out options for rural transport and the implications for both social inclusion and sustainability. Schemes described include flexibly routed bus services; car clubs; community transport schemes; and travel plans. Accessibility partnerships are proposed as a positive way of improving rural accessibility, but these need to be delivered in an effective way. The report lists key features that help to make up a successful partnership, but lack of funding, inadequate joint working across organisations to deliver services, and poor engagement with communities are barriers to sustainable rural accessibility.[4]

15.3.1 Reintroduction of railway stopping services

Railways throughout much of Europe and all of the Americas have removed or restricted stopping passenger services from the main lines (and in Britain and the Americas often from local lines as well) in order to clear the way for freight trains and fast passenger trains. The time has come to reverse that policy and put them back. The railways are a source of reserve track routes that it would be impossible to replicate with new systems. They must play their role in the National Integrated Transport Web.

Rail capacity is the problem. In most cases, 'tram/trains' (light rail vehicles capable of operating on the heavy rail network so that they may run on both light and heavy rail systems) are the solution. Rail capacity is restricted by:

- the number of trains a line is signalled to carry (which can be 30 trains per hour (tph) although most lines are signalled less intensively)
- station dwell time (the length of time a train waits in a station obstructing the train behind it – which usually reduces the theoretical 30tph to somewhere between 18tph and 24tph unless separate platform faces can be provided),
- speed differentials (the time a fast train gains on the slower train in front - another slow train cannot follow the first train within this time unless it can be switched to a different line – a passing loop - for the fast train to pass it),
- junction capacity (the time that a train crossing a junction obstructs trains on the main line in the opposite direction unless the junction can be grade-separated)
- station capacity (the time trains spend waiting for a platform at a big station)

Tram/trains have the following advantages:

- they can be signalled more intensively entering a section when the train ahead of them is only half way through and thereby taking up only half a path
- they can enter a station under line of sight behind a train that is waiting in the platform
- it is easier to provide separate platform faces for them
- as they accelerate and decelerate from stations more quickly than heavier trains they can operate stopping services faster than ordinary stopping trains and so have less of a speed differential
- it is easier to arrange passing loops for them – they can turn in and out of the main line more easily and can run on street tramways on parallel roads
- it is often possible to grade separate for trams a junction which cannot be grade separated for trains because trams may be able to use a street tramway to pass over or under the line
- at major stations tram trains may leave the railway and join the city's tramways instead of needing to participate in the platform allocation.

For all these reasons we believe that a combination of tram/trains, signalling to maximum intensity and replacement of slow lines where they have been removed will in most cases allow tram/trains to restore stopping passenger services to the railways.

There may be difficulties:

- on lines with very intensive services of 18tph or more (although it may be possible to serve wayside stations on a skip stop rotating basis)
- on lines with very intensive services of freight trains (although freight trains may be able to contribute to carrying passengers and serving wayside stations – the reasons freight trains and passenger trains have traditionally been kept separate are largely historical and the differences in speed and safety that once applied often no longer do)
- on single track lines (although the capacity to use parallel roads for street tramways would facilitate establishing new crossing loops.)
- on high speed lines where the speed differential would be very great and there is no slow track or room to put one in (this may well be an insuperable obstacle although in urban areas where the situation justified it a monorail could be built above the railway)

15.3.2 New and reopened rail lines and busways

There is undoubtedly scope to reopen many closed railways. especially if street tramways can help bridge gaps or bypass obstacles. The cost of railway reopening has risen much faster than other construction work because of bureaucratic problems at the planning stage and unrealistic safety requirements. These should be removed.

Many disused railways have been incorporated into cycle ways or footpath systems. Walking and cycling is more important than public transport and they should not displace these routes. However we should explore whether they can share the formation. Is there perhaps scope for the technology which created high speed trains to be applied to miniature railways – if a 4ft 8½in gauge train can run at 160mph can a 1ft 2in gauge train run at 40mph? If so, then not only could such railways be established alongside existing “railway paths” but the construction of such railways and a parallel cycle path along disused railway formations could be a way of expanding cycle networks and public transport at the same time.

Sometimes busways may be more useful than rail reinstatement if this allows services to run out onto linking roads without the cost of installing street tramways. However it is important that when the bus approaches the city it is able to operate under rail signals into a junction station before it is dumped into the city traffic.

15.3.3 Motorway coach and bus services

Motorways are high speed reserve track routes and there is no reason why they cannot convey a passenger service or have stations. There has been much talk of the possibility of high frequency (perhaps every five minutes) motorway coach services serving coach stations which local buses and trams would reach out to. Although this is an express service rather than a Integrated Transport Web service there is no reason why a coach service running every five minutes and stopping on average about once in ten miles cannot serve a coach station every 20 miles AND provide a 20 minutely express service to a smaller station every four miles on a rotating skip stop basis. At the same time a stopping bus service running every ten minutes and stopping on average about once every two miles could provide a ten minutely service linking all the smaller stations AND provide a half hourly service on a rotating skip stop service to one station every mile.

15.3.4 Allocation of road space to tramways and bus lanes

To provide a comprehensive network, many of the links will need to be provided by buses on ordinary roads. To meet Integrated Transport Web standards these buses will need to be very high frequency or limited stop or both, to operate with tickets purchased at stops or from conductors not from drivers and to have priority over other traffic in times of congestion. Counter-intuitive though it may seem, the logic of the Downs Thompson Corollary of Pigou’s Theorem is that taking road space away from cars and giving it to trams or buses will increase traffic speeds for cars as well as buses, provided it forms part of a comprehensive network. There is only so often that people will watch the bus speed past them before deciding to try it.

15.3.5 Links of various kinds from settlements to the main corridors

Branch lines have gone out of fashion but a comprehensive network requires the linking of settlements to the main corridors, whether the corridors are railway lines, tramways, motorway coach services, busways or bus services on main roads. There are a variety of mechanisms for this – minibus links, people-movers, travelators (moving pavements), gondelbahns (gondolas suspended from continuous cables like chair lifts), and demand responsive shared taxis. Traintaxi is a database available to subscribers that provides information about the availability of taxi ranks or minicab offices at every station nationally and provides contact details for up to three local taxi firms.[5] Parry People Movers are low carbon, tram systems for small towns and light rail systems for larger cities.[6]

15.3.6 Bus Services on Uncongested Roads

On good quality. high speed. uncongested roads, like many rural roads, there is no reason at all why the Integrated Transport Web service cannot be provided by a bus.

15.3.7 Ferries

Ferries will have a role in extending the National Integrated Transport Web to islands, to coastal, lakeside or riverside settlements which are best reached by water, and also in filling in links where water offers a faster route than either road or rail. At the moment, ferries are often not fully integrated into the transport system. Where they contribute to the National Integrated Transport Web, they must be integrated.

15.4 Demand Responsive Services

A demand-responsive service is a public transport service which operates only in response to the needs of its passengers. It may be a scheduled service with a fixed route which only operates if required. It may be a semi-fixed route which operates between a fixed origin and destination but varies its route according to bookings. Or it may be a dial-a-ride system covering an area. A Good Practice Guide was published in 2006, with the assumption that although individual locations and services differ, positive features of successful demand responsive transport (DRT) can be identified and disseminated.[7] A recent review assessed DRT across Scotland.8

Demand-responsive services are increasingly being used in the following settings

- in dial-a-ride services for disabled people
- in feeder services to specific destinations
- in rural areas.

Their use for disabled people is dealt with in the section on disability and encumbrances (section 13.6). A dial a ride system should not be just for disabled people – people may need demand-responsive services when they are encumbered with heavy luggage or shopping.

A number of demand responsive services have been created by particular destinations such as industrial estates, shopping centres or hospitals picking up in a defined area (which should include an interchange point, such as a railway station or bus station, with high quality mainstream services).

Their use in rural areas has been to extend the bus network into areas where journey needs are too diverse for scheduled services to be effective.

There will be areas where traffic is too light for a mainstream service to operate. Demand-responsive links into those areas will enable the network to be comprehensive. Some areas such as remote, thinly-populated areas may need a demand-responsive solution at all times. Other areas may need demand-responsive services for part of the day whilst being able to sustain scheduled services at other times. Most areas outside cities will revert to demand-responsive services overnight. The National Integrated Transport Web will hence be able to operate for 24 hours and to all areas.

15.4.1 How should a national system work?

A demand-responsive system will sometimes use buses, sometimes minibuses, sometimes taxis and sometimes it will transfer its passengers onto mainstream services. Table 15.1 compares it with a taxi service and a bus service.

Community transport is addressed in chapter 20, section 20.4.

Table 15-1 Comparison of a demand-responsive service with bus and taxi services

	Bus	Demand-responsive service	Taxi
Where does it pick you up?	At the bus stop	At home if you are disabled or encumbered or a long way from a bus stop. Otherwise at the bus stop.	At home
Where does it take you?	Where the bus goes	To your destination or to a point of interchange to another service	To your destination
Does it carry other passengers?	Yes	Yes	No
Does it stop at bus stops?	Yes	Yes if there is no bus due	No
What kind of vehicle does it use?	Bus or minibus.	Bus or minibus or taxi	Minibus or taxi.
When does it run?	To a timetable	To a time quoted to you by the system reasonably close to the time you request	To the time you request
Who arranges interchanges?	The passenger	The system	There are no interchanges
What does it charge?	Bus fares	Usually it charges a price intermediate between bus fares and taxi fares. We suggest that in a national scheme it should charge these intermediate fares unless (a) you are disabled or a long way from a bus stop or there is no bus service at this time in which case it should charge bus fares. Or (b) You insist on using it even though it can offer you a satisfactory mainstream bus alternative in which case it should charge taxi fares.	Taxi fares
Can it carry level 1 transport impaired passengers	Increasingly yes	Yes	Increasingly yes
Can it carry level 2A transport impaired passengers	No – they get lost	Yes	Yes
Can it carry level 2B transport impaired passengers	No – they can't reach it	Yes	Increasingly yes
Can it carry level 3 transport impaired passengers	No	Most vehicles no, but we suggest the proposed national system should have links with the ambulance service to allow it to meet this need	No

15.5 References

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16 Rethinking Streets

Original chapter by J Hanna, S Morton, S Watkins;
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16.1 Introduction

The arrangement of streets is a matter which strikes at the roots of several of the issues that we have identified in the scientific section of this book.

We have seen that active travel has declined and that this has contributed to the development of the obesity epidemic. We have seen that the shifting of short journeys from the car to the bicycle or walking could dramatically reduce heart disease, osteoporosis, obesity, diabetes and mental ill health. We have seen that such a modal shift of these short journeys is also an essential part of a strategy for congestion. Streets form part of the walking and cycling networks and they form a large proportion of the route for the short journeys that have such potential.

We have seen that people will walk further in walkable neighbourhoods and that a correlation can be seen between pedestrian-permeability and a substantial impact on obesity.

We have seen that in streets which have heavy levels of traffic, social interaction is reduced and we have seen that the strength of social networks is a powerful health determinant correlating substantially with total mortality in a pattern which makes it likely that the correlation is causal.

We have seen that sight of trees (and presumably also of other greenery or flowers) can improve health, possibly by a tranquillity effect. Some streets provide that view but most do not. We have seen that such pleasant street settings increase walking.

Streets are the space between houses. They represent space that could be given over to a wide range of functions. The decision to use that space for traffic and car parking has opportunity costs – it is not, therefore, used for other things.

For all of these reasons, it is time to rethink the way we design and use streets.

16.2 What Are Streets For?

In the overwhelming majority of British communities, the answer to this question is simple. They are the roads which take vehicles, pedestrians and cycles to the houses in the street and they are the parking spaces for the cars that are based at, or are visiting, those houses.

Streets are also places where people meet. They have in the past been places where children play. Some streets still fulfil this role but this use is in serious decline because of the pressures of traffic, because of the declining independence of children (itself partly a result of traffic but also partly a result of exaggerated perceptions of the danger of abduction), and because of a declining toleration in which children playing in the street are likely to become the object of complaint.

Streets can provide greenspace, they can accommodate trees, they can accommodate planters for floral displays. Only a minority of streets have ever fulfilled these functions. They are readily sacrificed to the use of the street for traffic and parking (as when a grass verge is removed to provide a parking space), to cost (as when floral displays are removed to save the cost of maintenance), and to other pressures (such as the cutting down of street trees in response to pressures from insurance companies concerned about their impact on house foundations).

A small number of streets, especially crescents and squares, contain public gardens. Another small number of streets achieve the effect of a garden by the use of hanging baskets and plant pots at the front of houses. A larger number of streets, but still a minority, especially those arranged with an open plan design, display private gardens in a public display which has the same effect as a public garden. In most streets, however, front gardens are walled off in a way which reduces their public impact. In an increasing number of streets, many front gardens have been turned into car parks. In some terraced streets with small front gardens and little other space, the proliferation of dustbins for recycling has turned the front gardens into bin stores.

A street therefore should be seen as

- the vehicular link between the road system and its end users
- a major part of the walking and cycling network
- a play area
- a car park
- a garden
- a meeting place.

All of these functions are legitimate and important. No one of them should be allowed to predominate.

16.3 Limiting motorised vehicular through-traffic

16.3.1 Distinguishing roads from streets and lanes

Vehicular traffic in streets diminishes the potential for using the street for other things. From the work of Appleyard & Lintell[1] and of Hart[5] it can be seen that it has a serious effect on social networks. It should therefore be minimised.

The THSG believes that a distinction should be drawn between ‘roads’, which provide the linkages that allow people to travel from one area to another, and ‘streets’, which allow people to travel from the origin or destination of their journey to the road system. The distinction should be partly one of design but also one of legal status. The road system should be defined (class I, II and III roads and other roads designated by the highways authority) and what is left should be defined in rural areas as quiet lanes and in urban areas as streets. In quiet lanes and in streets the primary vehicular right should be the right to use the street or lane for access. There should be no public right to use streets or quiet lanes for through motorised vehicular journeys except to the extent that this is permitted by the highways authority. This would reverse the current presumption in which legal action is needed to close a route to through traffic and replace it with one in which permission is required.

16.3.2 Quiet Lanes

In rural areas, quiet lanes should be seen as providing important opportunities for enjoying the countryside and also for providing important links for cyclists, walkers, equestrians, and horse drawn vehicles. Preventing motor vehicles from using them except for access would protect these uses and protect their tranquillity. It would be reasonable to allow them to be used as through routes by agricultural vehicles and they should certainly be so usable by invalid carriages, mobility scooters and motorised wheelchairs so that disabled people may share the benefits of them. There is a legitimate pleasure in a country drive and it would be wrong to prevent this totally, so it might be appropriate to allow some rationed usage of quiet lanes for this purpose, but the aim should be for only a handful of vehicles an hour to use the lane.

Buses serving a bus stop in a quiet lane are using the lane for access and this should be permitted, even if the prime purpose of the bus using the route is as a through route. However, unlike urban streets where we suggest this as a simple general principle, we believe that in the case of a quiet lane the proposed use should be notified to the highways authority which could consider whether the service could play any part of the management of the route and should be able to require extra bus stops situated where they will assist enjoyment or special arrangements for rides along particularly attractive parts of the route.

16.3.3 Urban Streets – Prohibiting Rat Runs

Urban streets are rarely used for the enjoyment of travelling along them so through traffic is taking short cuts or rat running to avoid congestion. This should not generally be permitted since it increases traffic in the street unnecessarily. Slow moving personalised vehicles, like invalid carriages, mobility scooters, motorised wheelchairs, lawn mowers and vehicles controlled by pedestrians, should be allowed to take short cuts. Highways authorities should be able to permit the temporary through use of streets during diversions. Otherwise, urban streets should be closed to through motorised vehicular traffic. It should of course be possible to use a street to access other streets that lead off it if they do not directly access the road system themselves; highways authorities should authorise some specific through uses to avoid particularly circuitous routes to streets which do access the road system directly but have traditionally been accessed via another street.

Buses serving a bus stop in a street are using the street for access and this should be permitted even if the prime purpose of the bus using the route is as a through route. This is also true of delivery vehicles such as milk floats, mobile shops, ice cream vans etc: provided they are serving the street (or another street accessed through it) they should be permitted to pass through.

16.3.4 Enforcement

Undoubtedly some motorists will break the prohibition. It may even, like speeding, become something that most motorists do sometimes. This only becomes harmful when it occurs to a degree that threatens the nature of the street. A few vehicles an hour illicitly nipping through a shortcut can be tolerated on a "live and let live" basis. A vehicle every few minutes nipping through a shortcut means the vehicular use of the street has been increased to a degree that has an opportunity cost.

Where it becomes necessary to enforce the prohibition, this could be done either by legal methods or physical methods. Evidence of rat running should not be difficult to obtain. A timed photograph of a vehicle entering a street and a timed photograph of it leaving is all that is needed to show that the vehicle passed along the street without stopping there for any length of time and should pass the burden on to the motorist to show in what way the vehicle "accessed" premises in the street. If the vehicle dropped off a passenger or package or simply took a wrong turning it should be possible for the driver to give that explanation. On the first suspected offence the explanation could be accepted. On subsequent occasions proof could be called for. The evidence to be gathered is sufficiently simple that it ought to be possible to allow residents' groups to carry out the enforcement.

Physical methods could include the use of rising bollards or barriers part way along the street. Buses, emergency vehicles, dustbin vans and street cleaning vehicles, and residents should have cards to open the barriers. Other vehicles would have to leave the street by the same route that they entered.

A simpler and cheaper method would be to allow residents to gate the street and close the gates at any time that they could arrange for somebody to staff them to allow legitimate traffic through. Traffic turned back could be prosecuted. Unlike bollards and barriers, this would not work all the time but it is not necessary for it to work every time provided it works often enough to deter regular use of the street as a rat run.

A self-closing gate will in itself be an enforcement mechanism, even if unmanned, because it will slow traffic down and reduce the attraction of the rat run.

16.3.5 Implications for Development Control

Development which depends on overuse of streets should not be permitted. We discuss this further in sections 12.11.3 and 20.1.1.

There should be a strict limit on the number of new buildings that can be accessed from streets or quiet lanes so that their character is not changed.

16.4 Designing Streets

16.4.1 Roads, streets, and lanes

In section 16.3.1, we distinguished between ‘roads’ on the one hand and ‘streets’ and ‘lanes’ on the other. The THSG defines a ‘street’ as a highway which provides vehicular access to premises but on which through vehicular use is not necessary for the road system as a whole.

From that definition we have suggested in section 16.3 above that ‘street’ and ‘road’ should become different legal types of highway and that the public motorised vehicular rights on a street should be to use it for access with no through motorised vehicular rights except for small slow moving personal vehicles such as invalid carriages, mobility scooters or motorised wheelchairs, lawn mowers and vehicles controlled by pedestrians. For rural areas we suggest a third category – a quiet lane – where the rule should be essentially the same as for a street but where there should also be through motorised vehicular use for agricultural vehicles and perhaps a limited amount of ordinary through traffic –a handful of vehicles per hour – to permit a ‘country drive’.

Whether or not this legal change is introduced, the distinction between streets and roads should still become part of professional practice for highways engineers, architects and planners.

16.4.2 Good design

In designing a street, all the purposes outlined in section 16.2 should be accommodated.

A street is the vehicular link between the road system and its end users and so it should be possible to take a vehicle along it. However, that does not mean that the major part of the street should be designated as the carriageway to provide two clear straight uninterrupted lanes of traffic and that all else is peripheral. Two lanes of traffic may not be needed – one lane with passing places should suffice for most streets. Nor is a clear, straight ,uninterrupted lane necessary - there needs only be a gap between the obstacles sufficient that a vehicle can pass.

Usually a street is a car park. It may be that over time we can diminish the expectation that cars will be parked immediately adjacent to the house and that people may be willing to walk to and from the car park but at the moment the public expectation is that cars can be parked outside their houses. The traditional model of widening the carriageway so that cars can be parked parallel to the kerb without obstructing the traffic is a model which makes it difficult to design other uses into the street. An alternative model sets aside specific parking areas, often across the street rather than along it, and sometimes arranged to provide an obstacle, creating a chicane or protecting an area serving some other use.

A street can be a major part of the walking and cycling network. Removing a through route for vehicles but leaving a through route for cyclists and pedestrians opens up a network of safe routes for pedestrians and cyclists. Such a network of safe routes could link places, including public transport access points, with each other but have minimal contact with main roads carrying a high volume of vehicles. This would not only have safety benefits for pedestrians and cyclists but would also encourage walking and cycling as healthy modes of travel. In such a network, investment in aesthetic features such as trees and flowers is important because it encourages people to walk further. Such features should be seen as essential elements of the engineering, not as an optional extra.

Streets should be gardens giving joy to residents, visitors and passing walkers. Residents should be encouraged to plan the street and their own gardens as a communal display and could be allocated parts of the street as extensions of their own garden. Street trees should be encouraged, not just at the edge of the street but also as clumps in the middle of it. Fruit trees might also contribute to the residents' nutrition. Where the gap between houses is not wide enough to lay out formal garden structures, hanging baskets and plant pots can create an equally delightful effect.

Where multiple wheelie bins have come to disfigure small front gardens a series of communal bin stores along the street should be built into the street design and concealed behind living walls of flowers.

Play areas should be provided.

Visually impaired residents should be involved in the design so that they can have confidence that they know where they are protected, although they will also benefit from the street being restricted to their neighbours, from the reduced speed of traffic, and from the greater awareness of pedestrians that the arrangement will enforce. It is also essential to involve blind and partially sighted people in the design and location of features such as bollards, plant pots and hanging baskets to ensure that they are not tripping hazards.

Meeting areas should be provided, perhaps by placing seats round trees or by setting picnic tables in the street.

Other more unusual uses of the street should not be ruled out. If residents wanted to set out a barbecue area or tables for street parties, or set up a stage and seating for a street amateur dramatic society there is no reason why they should not.

These other uses should not be seen as obstructions of the highway. Provided there is a convenient and direct route through for cyclists and pedestrians and a sufficient gap between obstacles for the passage of vehicles the street should be for its residents to use as they wish.

16.4.3 Designing out fear

Fear of injury has been addressed in chapters 2, 4, 5, 7, and 14. Another major fear affecting active travel and use of streets for social purposes is of crime, described in chapter 5, section 5.2.2. The Street Environment Index (SEI) and the Prospect Refuge mapping tool have both been developed to help local authorities identify locations where pedestrians are afraid of crime and target these with effective improvements, reducing social exclusion. The SEI uses the likelihood of being observed (eg window counts, with graffiti and fly-tipping as evidence for the location being unobserved for much of the time); the Prospect Refuge Tool considers how open a location is and how many hiding places there are for potential attackers. Either tool can identify nearly half of the areas identified by local residents as locations where pedestrians have fear of crime. However, local knowledge, such as rowdy pubs or where local gangs hang out, are more significant factors than either of these.[2 3]

16.5 Traffic Management

16.5.1 Traffic Management in Streets

We have drawn a distinction between streets and roads. As streets are highways which do not need to be used for through motorised vehicular traffic and which should be closed for that purpose, with motor vehicles being permitted only for access, traffic management in streets should be handled as part of the street design process discussed above.

From a health standpoint the best form of street design is the 'living street'. They are often called by the Dutch name woonerf (plural woonerfen) as it was in Holland that these were first developed.[4] In a living street the purpose of the street is not simply access to premises. It becomes a place of community interaction. Space in the street is occupied by gardens, trees and communal furniture such as picnic tables, play equipment and seats. We have discussed the design of such streets in the preceding section. In traffic management terms, motor vehicles are not banned from the street – indeed parking spaces are laid out, usually set nose to kerb so that they add to the obstacles that vehicles face as they pass along the street. The carriageway is simply the gap between the obstacles and is arranged in an irregular lay out so that chicanes are created. The obstacles in a living street, including the plantings, parked cars, trees, communal space and play areas, serve as a method of traffic calming. Equally important in reducing speed is the sense that the street does not seem like motor territory: the car seems like an intruder into territory that is communal space and this sense leads drivers to slow down.[4]

Woonerfen are good for health in a number of ways. Like all forms of traffic calming they slow down vehicles and hence protect pedestrians from collisions with vehicles. Like all forms of green environment they help create tranquillity and well being. In addition, their role in promoting social interaction is the reverse of the problems described by Hart[5] and by Appleyard & Lintell.[1]

There are, however, concerns about the impact of such arrangements on people who are visually impaired and who may rely on the guidance that the features removed previously provided in order to avoid wandering into the path of cars or bikes. Although there is relatively little evidence of collisions involving blind or partially sighted people, many perceive them as stressful and dangerous. A survey carried out on behalf of the Guide Dogs for the Blind Association indicates that the vast majority of blind and partially sighted people interviewed (91%) had concerns about using shared surface streets.[6]

Of course, visually impaired and other disabled people also have much to gain from streets in which pedestrians take priority; such individuals may be benefited more than average by a street design that requires drivers to be more aware of pedestrians and other non-car road users. However, any plans should be carefully and thoroughly discussed with visually impaired and other disabled people to ensure that proper safeguards are included in the design and management of the scheme.

16.5.2 Traffic Management on Main Roads

The primary function of main roads is to facilitate travel.

Even on heavily trafficked roads, more account should be taken of the needs of pedestrians and cyclists. This is dealt with elsewhere in this book (see, for example sections 12.3 and 12.5 and chapter 14.)

There will be some main roads which have residential premises or shops on them. These will be deprived of the benefits of the kinds of street designs that apply to streets. The implications of this need to be considered carefully.

Where it is impossible to avoid the use of a shopping street as part of a main road, the "high street" system described in section 12.8.6 should be used.

One recent approach has been so-called 'naked streets', in which guard rails and other street furniture previously installed to protect pedestrians from traffic has been removed. The rationale is that these physical barriers resulted in drivers 'owning' the road and taking no account of pedestrians, who were herded into confined areas. By removing these barriers, and sometimes signs, road markings, kerbs, and/or pavements, it becomes less clear to drivers where 'their' space is, so they travel more slowly and are more aware of other road users. For example, in Kensington High Street, removal of guard rails and positioning of cycle parking on islands in the middle of the road achieved a much improved street environment. It has been reported that this resulted in traffic collisions reducing to one-third their previous level[7] although the attributable effect was in fact less than that as reductions also occurred on other similar roads in London. Similar approaches have been taken in New Road Brighton and the ring road in Ashford, for example.

Highways authorities should have a duty to provide facilities for tranquil open air social interaction to residents of houses on roads. On lightly trafficked roads this may not be difficult but on heavily trafficked roads it will be. Sometimes it could be achieved by turning part of the roadspace into an access road and designing that part of the road as a street. Sometimes it could be achieved by accessing the premises from the back and creating a street out of the back alley. Noise can be cut back by screens. At a housing estate in Dordrecht in Holland, a main international motorway passes through, sometimes only metres from houses, but with a high thick translucent plastic barrier providing such an effective noise screen that the estate remains tranquil. Hedges can have a similar effect and are more attractive.

Where highways authorities cannot discharge this duty within a reasonable transitional period (perhaps ten years), they should have a legal obligation to offer to buy the property at a market rate not depressed by traffic conditions and to pay the cost of residents moving. There may be some exceptions to this, for example large properties set back from the road with extensive gardens. There should be no compulsion on residents to move but when they choose to do so the property should be bought by the highways authority and should not thereafter be used for long term residential purposes (again there could be exceptions for highly distinctive or historical properties where there might be countervailing advantages). Close to established district centres they could be reused as offices. Further from the town centre they could be used for short term purposes, such as bed and breakfast accommodation or visitors' accommodation. In this way we would gradually bring into being a situation in which housing is no longer immediately adjacent to heavy traffic.

16.5.3 Traffic Management on Residential Minor Roads

Intermediate between major roads and streets there will still be some minor roads – roads which provide too important a link to extinguish the right to through vehicular traffic but which need not carry the kind of heavy traffic flows which preclude their enjoyment as a street.

These roads should be designed with essentially the same principles in mind as we advocated in section 16.5.1 but it may not be possible to use some of the more radical solutions. On roads where through use remains possible and many drivers will be unfamiliar with the street, it may not be possible to say simply that the carriageway is the gap between the obstacles. There is also the problem that strangers may not appreciate the situation of visually impaired people. More conventional engineering measures will be more appropriate.

On lightly trafficked roads, there should be 'area-wide engineering measures' to reduce traffic speeds and volumes and give pedestrians and cyclists priority over motor vehicles. Streets are for people and cars enter them on sufferance and must defer to pedestrians and community use. Minor roads are not streets, in terms of the legal distinction we are proposing, but an element of this kind of thinking is still justified.

Speeds should be controlled not just by laws, but by engineering measures which actually make high speeds impossible and which create a psychological environment in which the driver feels an intruder.

Examples used in the past have included:

- speed control humps
- road narrowings, including one way systems that narrow the carriageways to just a single lane
- chicanes
- textured surfacing
- the breaking up of long undisturbed lines of sight
- useful obstacles - such as meeting areas, gardens, trees, play spaces – similar to those we advocate for streets but perhaps more formal and protected by kerbs

Such measures are self-enforcing, permanent, and build safety into the environment. They also improve the residential environment by reducing traffic and adding attractive features such as shrubs and seats. These measures are most important in inner city areas where rates of pedestrian injury are highest. Implementation should be in consultation and agreement with the local community.

It requires a significant shift of thought in many highway departments to build streets which limit traffic speeds. Past assumptions have been that streets should either be traffic free or should be designed to maintain unobstructed traffic flow. Most streets should be neither of these things.

For children, there should be safe outdoor play space close to home. This is particularly relevant to inner city areas where roads are busy and houses often lack gardens. In streets, this can be provided as part of the street design. For residential roads, it may be necessary to provide it elsewhere.

16.5.4 Traffic Management in Quiet Lanes

The purpose of traffic management in quiet lanes is to ensure that motorised traffic flow does not interfere with the enjoyment of the lane by its prime users: local residents using it as the final access to their house and cyclists, pedestrians and equestrians using it as a through route or recreational route. The principles of 'naked streets' described in section 16.5.2 have also been used on rural roads.

The principle is similar to that of a street: there is no general right of through motorised vehicular traffic. We have suggested two differences: there should be a through right for agricultural vehicles and there should be a limited right, limited to say six vehicles per hour, to incorporate the lane into a country drive. There are a variety of ways that this limited right could be enforced – sometimes it may be unnecessary to enforce it because the demand does not exceed that anyway, sometimes obstacles, gates and speed limits may suffice by making it less convenient, sometimes a formal token system for access may be needed with token machines dispensing only one permit every ten minutes, and sometimes country drives could require licences purchased on the Internet before the drive.

Special arrangements are needed when quiet lanes are used to access fields in which country events are held. Occasional use in this way may be permitted on a 'live and let live' basis but regular use needs to be planned and controlled.

16.5.5 Speed Limits

There is now a strong consensus that 20mph should be the default speed limit in residential settlements. Over 100 organisations from public health, transport and environment have jointly called on governments at all levels to *"Make 20mph or lower speed limits the norm for residential streets and those used by shoppers, tourists and others, close to schools or public buildings, or important for walking and cycling or children's play."*[8] In urban areas, only the busiest strategic traffic routes should now qualify for higher speed limits.[8]

- The speed limit in 'streets' should never be greater than 20mph. Many with shared space or Home Zone status will have a limit of 10mph.
- Traffic in residential minor roads and quiet lanes should be slowed to 20mph or even 15mph to avoid pedestrians being seriously injured in collisions with vehicles – above these speeds pedestrian fatality rates in collisions increase sharply.
- Where a residential road is allowed to have a speed limit above 20mph, this would normally be 30mph unless the residential area had been so treated that it is effectively separated from the traffic and there are adequate safe crossings.
- Residential road should never have a speed limit higher than 40mph, and even this level should be permitted only in unusual circumstances.

Hull introduced 20mph zones in many residential roads from 1994 onwards. By 2002, more than 100 zones were in place along one-quarter of its total road length. A 2002 report estimated that in the previous eight years, at least 200 serious and 1,000 minor injuries had been prevented, saving more than 10 times the £4m costs. A reduction in deaths and serious injuries of >40%, particularly among pedestrians and cyclists, occurred at a time when the national rate changed by 10-15%.[9] Road casualties from 1986 to 2006 fell by 42% in areas of London that introduced 20mph zones, after adjusting for underlying secular trends. Casualties in adjacent areas fell by 8%, arguing against displacement of hazard to other areas. The fall in the 20mph zones was higher for those killed or seriously injured (46%) and for child pedestrians (46%, compared with 32% for all pedestrian casualties in the 20mph zones.) There was a 17% reduction in cyclists injured in the 20mph zones, with a fall of 38% in cyclists killed or seriously injured.[10]

If the 20mph speed limit is applied only to residential side streets then few journeys will be affected for more than two miles, since few people places are more than a mile from the main road, so few journeys will involve more use of residential side streets than a mile at each end. The difference between travelling two miles at 20mph and travelling it even at 40mph (itself in excess of the speed limit) is three minutes. Local 20 mph zones therefore can be justified by pointing out that drivers are killing children for three minutes off their journeys.

Traffic calming policies were reviewed in 1991.[4] Traffic can be slowed by speed humps (bumps in the road which cars have to slow down to pass over comfortably), chicanes, or speed tables (elevated lengths of road which cars have to slow down to ascend on to and to descend from). Speed humps are the cheapest of these methods but they can cause problems for disabled people, cyclists, buses, and emergency vehicles, as well as discomfort from noise, rattle, and vibration; they are illegal in many areas of Germany, where ramps, plateaux, raised 'tables' and 'cushions' are used instead.[4] Chicanes are better and, whilst engineering chicanes by building out the footway is expensive, a much cheaper form of chicane can be created by limiting parking to one side of the road and varying this every 25metres or so. Whatever form of obstacle is used, it is important that the interval between obstacles is not too great or vehicles will speed up between them, which not only undermines their speed-limiting effect but also increases air and noise pollution as vehicles accelerate and brake repeatedly.

There is therefore a move towards introducing 20mph speed restrictions without engineering measures.[11] While area-wide 20mph 'zones' require engineering measures for enforcement, rather than the police, area-wide 20mph speed limits ('Total 20') are enforceable by the police in the same way as any other legal speed limit.[12]

Portsmouth introduced a town wide 20 mph speed limit in 2008. Traffic engineers have previously expressed doubts about compliance with 20 mph speed limits in the absence of self-enforcing engineering measures but it may be that compliance is better when the limit is applied across a larger area. Preliminary results from the Portsmouth experiment have been highly successful.[13] Although average speed overall fell by only a small amount, the speed on those roads where speeds had previously been greatest fell by the most, with the result that most drivers were driving only slightly above the 20mph speed limit. However these are preliminary results and it is important to await final results before forming a definitive opinion.

Of course if the limit is applied outside side streets the 'three minutes' calculation referred to above no longer holds.

The Scottish Government has also encouraged and funded specific initiatives to protect child pedestrians, including a scheme to implement 20 mph limits around schools. Nearly £50 million was made available to local authorities between 2003 and 2008 for the introduction of 20 mph schemes at schools. By March 2008, 20 mph speed limits were in place at 83% of Schools. The Scottish Government continues to support and encourage children walking and cycling to school in safety through provision of funds to the Sustrans School Run Team and cycle training resources from RSS and Cycling Scotland [7]

The Scottish Government has encouraged the use of 20 mph speed limits in residential areas and around schools. Local authorities are well placed to decide on 20 mph speed limits in their areas and whether they should also be accompanied by speed calming measures such as road humps.[7]

During the implementation of 20 mph limits around schools in East Ayrshire a questionnaire survey was undertaken during the consultation on the Local Transport Strategy indicated that 92% of residents of East Ayrshire supported reduction in speed in residential areas.[7]

Evaluation of traffic calming measures remains unsatisfactory. Injuries are generally the primary outcome, but rates not numbers should be used: for example, if the number of pedestrians doubles and injury rates halve, the number of casualties will remain unaltered. Broader benefits have typically been considered in other countries. A road scheme in Denmark resulted in a nine second increase in average journey time for motorists, while 72% of residents reported that the town was easier to move around in, while a scheme in the Netherlands resulted in two-thirds of residents having a more positive attitude to 20mph (30kph) zones after than the before the scheme came into effect, with 60% believing such measures should also be introduced elsewhere.[4]

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17 Driving less but driving better

Original chapter by J Hanna, S Morton, S Watkins;
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17.1 Economics of private motoring

Section 8.4 in Chapter 8 raised the interesting idea of people buying cars because they are seen as relatively cheap, but then finding it increasingly expensive to run them. However, despite the increase in vehicle running costs, the perceived marginal cost of travelling by car, especially when used by several people, is still probably below that of using public transport. Nonetheless the more the cost of motoring falls on marginal costs rather than the cost of purchasing the vehicle, the more likely people are to mix their use of the car and of public transport. It is important that the marginal costs of use of a car should continue to increase faster than public transport costs. If there is no political will to increase motoring costs overall then at least marginal costs should be increased even if politicians feel subject to pressures that compel them to offset this by reduced ownership costs through fiscal policy changes moving some of the tax burden from car purchase to mileage charges, whether through fuel tax, road charging, or a combination of the two.

Employment-related subsidies of private motoring encourage excessive car use. Ending them requires taxation of the true value of benefits to employees arising from employer assisted motoring and curbing of excessive mileage allowance. This has advanced since the first edition of *Health on the Move* but it still remains an issue. At present employers can be reimbursed for journeys at the full average cost of car travel but taxation should encourage use of the marginal cost of travelling by car or the avoided public transport cost (whichever is the lesser) with anything more being viewed as a taxable benefit. Public sector employers should encourage their workers to use public transport wherever this is a practical alternative. Cycle mileage rates should be set at rates which offer realistic incentives.

The present system of payment for car use, which is a high purchase price and high standing charges with low running costs, encourages car owners to use their cars for all journeys. In effect, high mileage car users are subsidised. If cars were cheaper to buy and own but more expensive to use, this would enable more people to own cars, for use when essential, but encourage all of them to use other modes of travel wherever possible.

Examples of measures to achieve this include:

- transfer of car purchase tax and licence fee to petrol tax or road charges
- mileage-related insurance
- charging for road use by, for example, toll roads and electronic means

Such measures might stimulate development of a lightweight, low speed personal motor vehicle for use on short journeys, (the local runabout).

To achieve a major shift from ownership to reducing use it would probably be necessary to use fiscal policy to shift the tax burden toward use rather than ownership of cars, removing some of the fixed costs of car ownership and recouping the cost by road charges (to reduce use) and fuel duty (to reduce emissions). However this raises the question of whether the government should be encouraging the buying of cars for them to stand idle in the drive and whether it would not be more sensible to invest in developing car clubs. It may be sensible to look at products that are focussed on mixed use – such as combined public transport season tickets/ car insurance/road tax products.

However, while public transport provision in rural areas is notable more for its absence or limited nature, moving charges from car ownership to use would severely disadvantage rural dwellers. Any such move would need to be accompanied by investment in rural public transport provision.

Road charges undoubtedly play an important part. At present it is possible to make a car journey without perceiving any cost but this is not true of public transport except for season ticket holders and people with senior citizen concessions. Road charges would balance this. Road charges can also be flexible, applying at different rates in different areas, days and times so can be low where other options are limited and progressively increase where other transport choices are adequate. We concluded in chapter 10 that road charges form an essential element of a four-strand strategy for reducing congestion.

Road charges in the form of tolls formed an important part of funding the improvement of highways in the 18th century through Turnpike Trusts; in section 20.7 we suggest that they could play a part in funding comprehensive future transport infrastructure.

The London congestion charge, implemented in 2003 at a cost of £5 per day which was raised to £8 in 2005, shows a maintained reduction of 21% on traffic entering the original zone. This has been accompanied by a 66% rise in cycling in the same area. In the Western Extension zone, cycle journeys increased by 12% and bus passenger numbers increased by 6% in charging hours.[1]

A six-month congestion charging trial in central Stockholm found that traffic passing into the charge zone reduced by 22%. A public transport ridership increase of 4.5% was attributed to the congestion charge.[2]

Congestion charging is not the only potential method of road charging – the use of GPS positioning systems would make it possible to be much more sophisticated.

17.2 Smarter Choices - Travel Planning and Personalised Travel Planning

17.2.1 Smarter Choices

Sustrans' 2010 campaign *More haste, less speed* called on the UK governments to invest in doubling the number of journeys under five miles made by walking, cycling, or public transport to 80% by 2020. This would include reducing car journeys from 54% to 20% of such journeys, as well as increasing public transport from 8% to 20%, walking from 34% to 40%, and cycling from 2% to 20%.[3]

Traditional transport planning and engineering have concentrated on the 'hard' infrastructure measures that we can all see and touch: roads, pavements, signs, vehicles and so on.

Smarter Choices is the transport discipline dedicated to measures that encourage people to shift towards more sustainable forms of travel, with associated benefits for health, the environment and the economy. It concentrates on influencing people's travel behaviour but may be associated with infrastructure improvements. For example, marketing campaigns may publicise new cycle paths or bus services.

Smarter Choices incorporates travel plans, Personalised Travel Planning (also known as Individualised Travel Marketing or Personalised Journey Planning, see section 17.2.3 below), public transport information and marketing, travel awareness campaigns, car clubs, car sharing, tele-working, teleconferencing and home shopping.[4] Altogether, an intensive application of Smarter Choices measures can see a reduction in traffic of up to 21% depending on the area they are applied. Smarter Choices are cost-effective. It has been estimated that for every £1 spent on Smarter Choices, £10 worth of benefit is achieved.[5]

The Department for Transport funded three Sustainable Travel Towns, Darlington, Peterborough and Worcester, where Smarter Choices were implemented on a large scale between 2005 and 2008. Research by Sustrans and Socialdata shows that across the three towns there was an overall 9% relative reduction in car-as-driver trips during the Sustainable Travel Towns period, a 13% relative increase in walking trips, a 43% relative increase in cycling trips, and an 18% relative increase in bus trips. The Sustainable Travel Towns programme shows what sustained investment in town- or city-wide smarter choices measures can achieve.[6] Individual effects within the three towns included a 12% increase in cycling in Peterborough[7] and a 19% increase in Worcester,[8] whereas Darlington, which received extra funding for cycling as a Cycle Demonstration Town, saw levels of cycling more than double, although from a low base.[9] The long term effects depend upon sustaining a Smarter Choices programme which helps embed travel behaviour change towards active travel over the longer term. The evidence supports behavioural interventions when people are at points of change in their lives and habits are broken.[10] This is likely to be most cost-effective given the importance of habit in travel behaviour.[11]

The rest of this section concentrates on the first two elements of Smarter Choices referred to above – travel plans and Personalised Travel Planning – which are of most use to health professionals and in achieving healthy outcomes.

17.2.2 Travel Planning

Travel Plans bring together many of the different elements of smarter choices. A Travel Plan is a package of measures aimed at encouraging a shift away from single-occupancy car use either through use of alternatives or more efficient use of cars that are needed for travel. Studies demonstrate that car use can be reduced by between 10% and 25% through use of a Travel Plan.[5]

Usually Travel Plans are site-specific and aimed at certain groups, for instance aimed at staff in a workplace or at pupils (and their parents) in a school (all schools in England must have a Travel Plan by 2010[12]). Occasionally, Travel Plans will combine with others in a local area, be aimed at various groups, or even be dedicated to a whole area or residential scheme. As it is effectively an approach for delivering better information, improved facilities and increasing the attraction of non-car modes, it need only be limited by the imagination of those responsible for its delivery.

There are stages that need to be worked through but a wealth of material is available to assist.[13] [14] Whether a Travel Plan is requested by a local authority as a condition of planning permission or if an organisation is entering into a Travel Plan on a voluntary basis, assistance is at hand – usually from the local authority but also from national organisations and groups. Frequently, the Travel Plan will request partnership working with local health professionals in order to realise the full benefits of the sustainable modes of travel. Section 19.3 (chapter 19) discusses Travel Plans further in relation to NHS sites, particularly hospitals.

17.2.3 Personalised Travel Planning

Personalised Travel Planning (PTP) is also known as Individualised Travel Marketing (ITM) or Personalised Journey Planning (PJP). It is an intensive application of the smarter choices approach. It explores individuals' travel needs and, based on dialogue to understand their particular circumstances, identifies and supports options for using alternatives to the car. Attention is focused on those modes that provide most benefit to the individual and on helping people to understand the options available to them. In many cases people are unaware of some of the travel choices they have. For example, Sustrans' 'TravelSmart' Individualised Travel Marketing[15] projects provide participants with stop-specific timetables for bus stops near their homes, and feedback indicates that prior to this people often do not know where buses from their local stops go or when they run. By mid-2010, TravelSmart had been delivered to a quarter of a million households. It achieved a 10-14% reduction in car use in areas it has been delivered. With increase in walking, cycling, and public transport use. The benefit to cost ratio was 7.6:1.[3]

PTP is labour intensive as it requires conversations with people to understand their travel habits and their specific needs for information and/or other support. However, it can achieve impressive results. A number of methods have been developed and implemented in the UK and elsewhere. Those that are professional, consistently applied and well-organised have a greater chance of effecting change. But there have been instances of PTP not achieving modal shift results, such as in Oldham and at Addenbrookes Hospital in Cambridge, pilot sites in a 2002 study.[16] However, overall, the DfT estimated that at the 14 pilot sites, PTP cost 8p per car km saved.[16]

One method that has proven effectiveness is TravelSmart, delivered in the UK by Sustrans in partnership with Socialdata.[15] [17] Since two early pilots in 2001, all 23 subsequent UK TravelSmart projects (targeting a total of more than 230,000 households) have achieved relative reductions in car-as-driver trips of 10% or more, with associated increases in walking, cycling and public transport use. These changes are measured using detailed travel behaviour surveys right across target populations, including those who cannot be contacted during the TravelSmart intervention and those who choose not to participate. (The same method was used in the Sustainable Travel Towns research described in section 17.2 above). By increasing the number of trips made by sustainable modes, TravelSmart also increases the amount of time people spend travelling actively, typically by an average of between one and five minutes per day. TravelSmart is also cost effective, with a benefit:cost ratio of greater than 7:1. This compares very favourably with many transport infrastructure projects.[17]

There is evidence that the biggest shifts away from car use are to walking, followed by cycling and public transport. This is borne out by research in the Sustainable Travel Towns.[6] One of the main factors underlying the potential for increased use of active and sustainable travel modes is that people typically overestimate the time that journeys will take by these modes, and underestimate the time that journeys will take by car.[18]

While large scale Personalised Travel Planning projects – like those in the Sustainable Travel Towns – have often been implemented with the aim of reducing single-occupancy car use and congestion, some health professionals are realising the benefits this approach can bring in

health terms. Indeed this has been a major focus of the Scottish equivalent of the Sustainable Travel Towns programme, known as 'Smarter Choices, Smarter Places'.[19]

The following case study shows how an active travel project which draws on the personalised journey planning approach can improve the opportunities for increased physical activity (see Box 17.1).

Health professionals should realise the benefits of smarter choices in their own work as well as in the way they work. Not only is it an effective approach for increasing participation in more healthy forms of travel such as walking and cycling and also help reduce pollution, travel plans can also improve access and tackle site-specific traffic problems.

Improving choice for staff can also have the knock-on effect of improving choice for others such as patients and other service users. Through demonstrating and increasing demand for alternatives, private operators are attracted to offering services – either new ones or improved ones. Increased demand for more sustainable modes of travel such as walking and cycling places greater pressure on the engineers and planners responsible for delivering infrastructure, to improve the walking and cycling experience, thereby creating a virtuous circle.

Box 17.1 Active Travel Wigan – a case study

Walking and cycling are collectively known as "active travel". This also includes walking and cycling to and/or from public transport (see Chapters 2, 5, 7, and 14).

The joint Wigan Council and NHS *Public Health Strategy*, adopted in December 2007, had a core objective of promoting healthy lifestyles by supporting people to manage their own health and well-being. A one-year project *Preparation for Personalised Travel Plans* was funded from April 2008 to March 2009. The result is **Active Travel Wigan**, which includes the following components:

1. Web portal www.activetravelwigan.co.uk

The Active Travel Wigan website is a journey planning portal. The site contains a page for each of the 9 major towns in the borough. At present, each "township" page contains four sections: libraries, health, leisure and schools, plus "other".

Active Travel Wigan helps people to produce their own personalised travel plans on the internet and get leaflets about walking, cycling and public transport sent directly to them by post. However, it was chiefly designed to be used by "intermediaries" who would guide people through the process.

Box 17.1 ctd.

2. Behaviour change "intermediaries"

Traditionally, Personal Travel Plan (PTP) interventions have come from the world of Transport, not the world of Health, and have used temporary staff specifically trained to deliver the intervention, with recourse to local information and incentives such as reduced rate tickets. The campaign has been run as a one-off in a geographical area.

Active Travel Wigan is different – it is borough-wide, on-going, and is available to those people who want to change their behaviour for health purposes. Staff in several public sector settings can act as intermediaries. The role of "Health trainer" started in the NHS in 2007, and the purpose of the Health Trainer service is to help people change their behaviour. "Exercise on prescription" and a variety of referral services for physical activity have staff who undertake an initial assessment with the client, and often an "exit interview". As the initiative develops we hope that schools and college staff will use it with their existing pupils/students/parents and when registering young people for the following academic year.

Typically, the clients want to adopt a healthier lifestyle, often lose weight, and get fitter. The Health Trainer or other intermediary asks people about their daily routines, journeys made, and what things they enjoy doing. From this they work out a plan together gradually increasing the amount of travel they undertake using active modes.

3. Walking routes mapped

The Active Travel Wigan website is a portal to www.Walkit.com/Wigan. The borough of Wigan has been mapped using satellite and other means, to identify walking routes. A gazetteer was produced in consultation with local people to get local names, including all the alternative names by which locals refer to places they wish to visit.

It can use it to plan walking journeys anywhere in the borough. Walkit tells you how long it takes to walk somewhere and how far it is. It gives detailed directions, handy shortcuts and a route map which can be printed. It even shows calories burnt.

4. Public transport link

The Active Travel Wigan portal also directs users to the www.transportdirect.info site, where up-to-date journey information is presented for different modes. This compares time taken, and CO_2 produced by each option.

Box 17.1 ctd.

5. Bespoke information (leaflets)

Existing travel leaflets simply did not provide comprehensive information that the traveller needed to know. Wigan is on the periphery of Greater Manchester, and information produced by Greater Manchester Passenger Transport Executive tends to stop at the border. People living or working in Wigan would commonly travel to St Helens, Warrington, Ormskirk, Liverpool and beyond. There was no source of comparative information on the various discounted ticketing options available. Several new leaflets were produced and printed to fill this gap.

6. Leaflet stock, ordering and distribution centre

The Active Travel Wigan stock includes the bespoke leaflets, bus and train timetables, and leaflets about local leisure walks. Rather than set up a separate system, we have formed a partnership with the Keep Britain Tidy group, which has their headquarters in Wigan. They hold these leaflets with their stocks of their own posters and publicity material. Staff there receive the on-line generated and the paper order forms, and post out the packs to the address given by the user.

The preparation for Active Travel Wigan is complete. Unfortunately recurrent funds dedicated to this initiative have not been forthcoming, therefore the roll out (awareness raising, training and promotion) can progress only as quickly as those who commissioned the work can manage within the constraints of their existing jobs.

17.3 Other ways to reduce the need for travel

Congestion, overcrowding and transport emissions could all be reduced if people travelled less. Draper & Watkins[20] have described the concept of 'poisoned lifeblood' – things which are essential to life but which are also harmful. Society should use 'poisoned lifebloods' as much as necessary but no more. The description was originally made with reference to energy but motorised transport is clearly 'poisoned lifeblood'. Reducing the need for motorised travel is partly due to its direct health impacts, described throughout this book, and partly because of the practical issue of reaching 'peak oil'[21] and the diminishing availability of fossil fuel, as well as carbon reduction reasons for avoiding its use.

In chapter 1, we described a lifestyle in which travel was reduced without restricting benefits of travel, and in association with increased health and well-being. Reducing the need to travel therefore forms part of a healthy transport policy. In chapter 10 we developed an analysis of the cause of congestion which concluded that it could only be addressed by a combination of a comprehensive public transport network (dealt with in chapter 15), active travel (dealt with in chapter 14), road charging (dealt with in section 17.1), and reduced need to travel. Reducing motorised travel has three components: reduced number of trips (eg home-working, see sections below); reduced distances, dealt with primarily by spatial planning (see chapter 20, section 20.1.1); and modal shift to active travel (see chapter 14). The alternative approach is to increase the financial costs of travel to reduce 'consumption' of travel.[22]

The Netherlands has introduced targets to reduce travel, including halving the rise in road traffic; reduce the use of cars for short journeys; increase active travel; and reduce the growth in average trip distance.[22]Reducing the need for freight transport

Local sourcing of supplies reduces the need for transport of freight. Much work is being conducted currently to identify food producers in England and help them find local markets, including sale through local supermarkets.[23 24] This will be beneficial provided it is not carried to the point at which efficiencies are lost to such a degree that the transport emissions are outweighed by the extra emissions from inefficient use. For example it may use less carbon to ship fruit from countries where it grows naturally than to make arrangements to grow it in greenhouses. Reducing energy requirements for freight transport is discussed in section 20.6.1.

17.3.1 Reducing Business Travel

Business travel is a major component of aviation growth and as it is more time-sensitive than leisure travel, the trade off point beyond which high speed rail ceases to be a viable alternative occurs earlier. Potentially all leisure journeys across land masses could be made by high speed train rather than plane if an adequate international network existed. Therefore if it were not for business travel the public transport need for aviation would be very limited.

Travel is an extremely inefficient way of conducting a meeting or making a presentation. Many organisations, including the Transport & Health Study Group, already conduct most of their internal business by electronic means or by telephone conference. The potential for this is enhanced considerably if video-conferencing is added to the repertoire of meeting modes. Many video-conferencing facilities are relatively unsophisticated – in principle there is no reason why images from a number of sources cannot be arranged into a virtual committee table. Indeed it is possible to move beyond video-conferencing and to hold meetings in virtual reality. Teleconferencing can also be conducted via computers, allowing participants to see the same documents, presentations, or calculations in real time. Some business is already transacted in Second Life, a virtual reality Internet site, and Sweden has opened a trade mission there. Second Life is subject to the problem that people cannot be seen in their normal form – they are represented by images called "avatars". It is likely however that, in the near future, virtual realities will be created in which people can use more lifelike images so that they seem to be personally present. Virtual reality conferencing is likely to require high quality webcams, high speed broadband connectivity, development of appropriate software and the creation of virtual conference sites in cyberspace. This is an area of technological development which ought to take place urgently – business should articulate the need to drive the process.

17.3.2 Reducing Leisure Travel

Earlier in this report we have already advocated the development of high speed international rail links making it possible for aviation for leisure purposes to be limited to flights across water and polar ice cap and local journeys in remote trackless wilderness. Apart from this modal shift the THSG has no particular wish to reduce international holidays– it is good that cultures should mix and that people should have the opportunity to enjoy the wonders of the world. More ephemeral international leisure travel such as flying in an executive jet to have lunch in a distant city are less justifiable but not yet particularly common.

As far as possible leisure facilities such as cinemas and gyms should be as local as possible so that people do not need to travel as far to use them. However other types of facility, such as restaurants, are by their nature distinctive and will inevitably generate travel.

Home entertainment can be a substitute for leisure travel but there are health disbenefits to this because of weakening of social support networks. Downloading films rather than going to the cinema reduces social interaction. The UK is experiencing an epidemic of alcohol usage stimulated by drinking at home cheap alcohol that has been purchased at the supermarket. This occurs simultaneously with falling sales of alcohol in the traditional English pubs, leading to many of them closing. Whilst this produces benefits in connection with violence, nuisance, drink-driving and the pressure to drink more to “stand your round”, it also reduces social networking – closure of the pub, the corner shop and the post office can between them take the heart out of a community. The balance between these benefits and disbenefits of a closure may be difficult to draw and may depends on whether the pub is managed responsibly as a community facility for a local clientele.

Travel to meet family and friends is important for the maintenance of social networks and should be encouraged and facilitated rather than reduced. However it may be possible to reduce the separation that necessitates such travel if planners aimed at diminishing the geographical mobility that is currently expected by many companies in the name of “flexibility”.

Some individuals have been able to maintain significant social networks over the Internet. This reduces the need for social travel and allows links to be maintained between people in different countries. On the other hand, precisely because it strengthens links between countries it also generates international leisure travel as these friends do ultimately want to meet.

Natural England has produced guidance on encouraging sustainable leisure travel,[25] such as by developing travel plans.[26] [27]

17.3.3 Reducing commuting

Commuting can be reduced by

- working on fewer days
- living closer to work
- homeworking.

Working a 40 hour week over four ten hour days rather than five eight hour days reduces commuting by 20% and gives three recuperative weekend days rather than two.

People are encouraged to live further from their work because of assumptions that geographical mobility is efficient, because of consolidation of small local units into larger centralised units, and because of spatial planning which adopts a more highly distributed layout (see section 16.1).

The ultimate in living closer to work is homeworking. If instead of coming to the office 9 to 5 five days a week people worked three ten hour days and then worked a further ten hours at home commuting would be reduced by 40%. There are however dangers in homeworking. It may not be possible to provide the full range of work equipment at home, and even if it is provided it may take up too much space. Health and safety regulation is difficult. Work is a social activity but homeworking is isolated. Local neighbourhood workstations that could be used by a number of employers who happened to have employees living locally would overcome all these problems.

17.3.4 Shopping trips

The travel involved in routine shopping can be reduced by maintaining local shops. There is a problem that local shops cannot maintain the same range of choice as supermarkets but choice can be broadened if the local shop takes orders for goods which it doesn't stock and obtains them to order. Links between local shops and supermarkets can help operate such a system. Shopping cooperatives are also a solution as is Internet shopping.

Many people make shopping trips by car rather than by public transport because the car is a convenient way to carry the goods home. Delivery systems could overcome this problem but only if they were organised efficiently on a common carrier basis instead of a shopping trip resulting in a stream of delivery vans from each shop visited. Similarly, online shopping can reduce travel by consumers but can increase delivery van mileage considerably.

17.4 Low emissions zone

17.4.1 What is a low emission zone?

A Low Emission Zone (LEZ) is a geographically defined area or set of roads from which the most polluting vehicles are excluded . Vehicles may be banned or in some cases charged if they enter the LEZ when their emissions are over a set level. LEZs are also know as Environment Zones (Umweltzonen in German).[28] Some LEZs only allow low- or zero-emission vehicles; some have emission standards that must be met by all vehicles within the zone; and some limit the restrictions to particular classes of vehicles. All LEZs affect heavy good vehicles (HGVs); some affect diesel vans; others also affect diesel and petrol cars. In Italy, motor cycles and three-wheeled motor vehicles are also included.

The purpose of an LEZ is to improve the air quality of the area by reducing vehicle emissions. This is why LEZs tend to be instituted in city centre areas, where air quality is often worst and where road traffic vehicles are amongst the most important contributors to air pollution. Apart from LEZs in Italy, LEZs operate continuously (unlike congestion charging, which is limited to certain days of the week and/or times of day).

As was demonstrated in chapter 3, section 3.1, air pollution is a significant cause of premature morbidity (ill health) and mortality, particularly in the very young, the very old, and those with pre-existing heart or lung disease. Air pollution results in 310 000 premature deaths in Europe each year,[29] more than caused by road injuries. The damage to health caused by air pollution is estimated to cost the European economy between €427 and €790 billion per year.[29]

17.4.2 Examples of existing and planned LEZs

Worldwide

One of the earliest low emission zones was instituted in Tokyo in October 2003. There has been a low emission zone in the centre of Berlin since 1st January 2008, restricted to vehicles meeting Euro II standards, but since 1st January 2010 tighter limits on emissions limited the LEZ area to vehicles meeting Euro IV standards only.[30] An additional 39 German cities have an LEZ, including Cologne, Hanover, Stuttgart and Mannheim; a further two cities have an LEZ planned. Many existing ones are, like Berlin, gradually raising the emission standards for vehicles being driven within the zones.[28]

In Sweden, Gothenberg, Helsingborg, Lund, Malmö, and Stockholm are amongst each has an LEZ (called an environmental zone), the first of which were introduced in 1996. In Sotckholm, 30% of the population live within the LEZ. An assessment of the air quality benefits of the zone in 2000 by Johansson and Burman found that NO_x and particulate emissions from HGVs within the zone had fallen by 10% and 40% respectively. These led to falls in air pollution levels of 1.3% for NO_x and 3% for particulates, compared with levels predicted in the absence of the LEZ. Despite the small effect on air pollutant concentrations, they concluded that the effect of the LEZ was large compared with other actions open to local government to implement.[31]

Italy has 80 towns of cities with an LEZ but the emission standards are generally lower than current restrictions in German LEZs or the 16 Dutch cities with LEZs.[28] Other European countries with existing low emissions zones include Austria, the Czech Republic, Denmark, and the UK.[28] A guide to cities with a LEZ, their start date, and the standards required of vehicles within the LEZ is available at www.lowemissionzones.eu/emission-standards-table.

United Kingdom

In the UK, the Environment Act 1995 put a duty on local government to carry out a programme of Local Air Quality Management to review current air quality, assess likely future air quality, and take steps to meet EU air pollution regulations. There are currently two LEZs – in Norwich and London – with one planned in Oxford if voluntary measures are insufficient.

In Norwich, local buses, except those services with fewer than five departures per week from the LEZ area, are required to meet Euro IV standards for NO_x emissions. A graded compliance was instituted from 1st April 2008; by 1st April 2010, all buses run by operators based within the LEZ and 50% of buses run by operators based outside the LEZ must comply. In addition to the emissions standards, Norwich requires all drivers to switch off their engines when parked or waiting at the kerbside, and has offered ‘eco-driving’ courses to bus drivers to improve fuel efficiency.[32]

Oxford currently has a voluntary system, agreed with the bus companies. By 1st January 2013, all buses with a route into the city centre are expected to meet Euro V emission standards.[28]

London’s LEZ is the largest in the world, covering all of Greater London and a few major roads leading to/from the area.[28 33] Central London’s air quality is amongst the worst in Europe. with half the particulate PM_{10} and NO_x emissions in London coming from road transport. The London LEZ has focussed on older diesel engines in heavy good vehicles, vans, buses, coaches, and minibuses. Cars, motorcycles and small vans (under 1.205 tonnes unladen weight) are not affected by the London LEZ.[28] It has been estimated that the effects of the London LEZ on emissions would probably be less than the effects found in Stockholm because of the improvement in emission standards in the 12 years between the Stockholm and London schemes being impoemented.[31]

The LEZ started on 4th February 2008, with lorries over 12 tonnes required to meet Euro III standards for particulate emissions. From 7th July 2008, lorries of 3.5 to 12 tonnes and buses and coaches over 5 tonnes and with more than eight passenger seats were also required to meet Euro III standards for particulates. Those that do not meet the standards are subject to a £200 daily charge, though this is reduced for vehicles that are registered with Transport for London. The original proposal applied the same emissions standards to large vans (LGVs) and minibuses from October 2010, with a £100 daily charge for non-compliant vehicles, but this was suspended in 2009 and postponed until 2012 due to the economic situation, as the Mayor considered that the cost of compliance for operators was too high at a time of economic recession. From 3rd January 2012, lorries over 3.5 tonnes and buses and coaches over 5 tonnes will be required to meet Euro IV standards for particulate emissions. The restrictions and exemptions are applied according to the class of the vehicle and not whether it is being driven for commercial or private use.[33]

17.5 Education of drivers

17.5.1 General

This should be used in conjunction with, not as a substitute for, the other measures being suggested. It should encourage responsible driving and counter the 'macho' image of fast driving. This is a formidable task as it challenges many social and commercial values.

- education on pedestrian priority at side roads, parking regulations, and the effects of speed
- making the driving test more relevant to everyday driving
- stricter control of advertising which promotes performance cars as desirable.

Fast driving gives young people a sense of adventure. This should be diverted into harmless activities.

17.5.2 Use of mobile phones and other conversations

Any conversation taking place in a car is a major distraction,[34] with drivers' concentration level still reduced for 10 minutes on average after the end of the conversation.[35] Among experienced drivers, using a hands-free mobile affected performance substantially more than carrying out an in-car conversation.[34] There are two critical differences between most mobile phone conversations and most in car conversations. The first is that mobile phone conversations are often serious work related conversations which use up more concentration – whilst driving it is important to keep most of one's attention for the road so it is unwise to have serious conversations. The second is that it is important to be able to switch 100% of concentration to the road whenever it is needed - a passenger will see the road and will realise why the driver has paused the conversation, but somebody on a phone will not. Using a hands-free set while driving increases driver reaction time, such as the time taken to apply the brakes or steer away from danger, by 30% more than driving while over the legal alcohol limit (see section 17.6.2 below).[36] 10% of drivers surveyed admitted to reading text messages while driving.[37]

Drivers – and legislators - need to understand the risk of using hands-free mobile phones, or of using conversations on car journeys for serious distracting discussions of complex matters although both are currently legal while driving in the UK.

17.6 Traffic legislation and enforcement

17.6.1 General

Many of the regulations regarding use of the roads are concerned with safety yet the risk of prosecution for an offence is low. The most important needs are to enforce the laws regarding drinking and driving, and speeding. This is particularly relevant to young male drivers.

Improved enforcement of legislation could be achieved by the use of automatic control and surveillance devices.

Examples include:

- automatically triggered video cameras at signalled junctions
- devices capable of detecting travel over centre lines
- speed monitors
- GPS based systems of tracking vehicles
- vehicle speed governors, with external identification, which have to be switched on for the appropriate speed limit(s)
- ignition interlock device which immobilises the ignition until the driver completes a negative breath alcohol test
- aircraft type 'black boxes' in vehicles

Three beneficial changes in the law would be:

- the introduction of random breath testing and a lower blood alcohol limit of 50mg/100ml (see section17.6.2 below)
- suitable roads could be designated and signed as 'residential'. Pedestrians would have legal priority so for pedestrian injury on these roads, motorists would be presumed negligent unless proven otherwise. This would not require enforcement and could be complementary to the engineering and traffic management measures suggested above. In effect, such a road would be treated as a large pedestrian crossing
- lower speed limits in residential streets.

17.6.2 Drink driving – evidence for a lower alcohol limit

In 2008 there were an estimated 430 drink drive deaths and 60 reported drug drive deaths in England and Wales, in addition to others dying as a result of crashes involving drivers impaired by alcohol but below the then current limit of 80mg/100ml.[38]

The current legal limit for drink driving is still 80mg/100ml, despite well-known adverse effects on driving ability at levels well below this level. There is an increased risk of collision for every category of driver from a blood alcohol level of 10mg/100ml upwards,[39] so every driver should assume that they are safer not drinking at all.[40] The evidence for a beneficial effect on road traffic injuries and fatalities was summarised in 2005.[41] The current legal limit of 80mg/100ml was set in 1967, on the basis of the research evidence available at the time, principally the Grand Rapids study,[42] which provided evidence of increased risk of involvement in road traffic collisions after drinking alcohol that was unprecedented and incontrovertible in terms of sample size and experimental design, in a way that has since been replicated only in the study by Blomberg et al.[40] The Grand Rapids study indicated that average collision risk was at least doubled – and therefore, by implication, the risk of injury or death was at least doubled – at this level, with this risk being statistically significantly raised above the risk for no alcohol.

Over the intervening 40 years, further scientific evidence strongly supports a reduction in the legal limit to prevent drink driving. Alcohol intake that produces breath alcohol levels of half the current legal limits for driving result in substantial impairment of judgement when driving, when combined with only a moderate reduction in sleep.[43] The large study by Blomberg et al in the USA in the 1990s found that accident risk doubled above a blood alcohol level of 70mg/100ml.[40] Considering only road traffic collisions which result in personal injury, the relative risk of involvement in an injury accident is estimated from British data to be 2.9 at a blood alcohol concentration (BAC) of 50mg/100ml and 5.6 at a BAC of 80mg/100ml compared with the risk with zero BAC; the similarly estimated relative risks of being killed in a collision are 5.0 and 12.4 respectively.[44] Drivers' risk of involvement in or death from injury accidents at a BAC of 80mg/100ml are respectively nearly three and more than six times the doubling that informed the setting of the limit at 80mg/100ml in 1967.[41] Indeed, it is now known that the risks at the lower BAC of 50mg/100ml are 1.5 and 2.5 times as high as the risk was estimated to be at 80mg/100ml in 1967. Re-analysis of the Grand Rapids dataset informed by subsequent studies demonstrating harm not benefit from alcohol in the blood has shown a statistically significant doubling of the risk of collision at 60mg/100ml.[41]

A report by NICE, the National Institute for Health and Clinical Excellence, published in 2010 concluded that there is strong evidence that someone's ability to drive is affected if they have any alcohol in their blood. Drivers with a blood alcohol concentration of 20-50mg/100ml have at least a three times greater risk of dying in a vehicle crash. This risk increases to at least six times with alcohol levels of 50-80mg/100ml, and to 11 times with blood alcohol levels of 80-100mg/100ml.[45] A driver with a blood alcohol level of 160mg/100ml has 30 times the risk of causing a road crash than a driver who has not been drinking.[46]

In 1998, the DETR estimated that about 50 deaths and 250 serious injuries annually would be prevented by reducing the legal limit to 50mg/100ml.[47] It has been estimated that for years in which about 550 deaths occur in collisions in which a driver is over the existing 80mg/100ml limit, reducing the limit to 50mg/100ml would lead to a short-term reduction of 40 deaths annually among those with current BAC 80-110mg/100ml and 23 deaths per year among those with current BAC 50-80mg/100ml. In addition, there would probably be fewer KSI collisions among those who are already below BAC of 50mg/100ml if they reduced their alcohol intake further in response to the new lower limit, given that any alcohol is now known to impair driving, plus a longer-term cohort effect whereby older drivers who grew up believing drink-driving was acceptable are replaced by younger drivers who do not.[41] Subsequent evidence to the Transport Select Committee[54] included a corresponding estimate that 119 deaths per year would be prevented by reducing the limit to 20mg/100ml.

More recently, it has been estimated that if British drivers responded to a reduction in the legal limit as drivers in South Australia did to a similar reduction in 1991, then reducing the legal limit in England and Wales to 50mg/100ml would reduce fatalities by 6.4% (144 lives saved) and injuries by 1.4% (2,929 fewer people injured) in the first year after implementation, increasing to 13.8% fall in fatal and 3.1% fall in non-fatal injuries at six years (303 lives saved and 6,424 fewer people injured). Sensitivity analyses using different assumptions gave estimates of 77-168 fewer fatalities and 2,487-16,000 non-fatal injuries at six years.[48] Subsequent evidence to the Transport Select Committee[54] discussed these estimates in relation to the above-mentioned more conservative estimates of likely reduction in deaths and injuries. This evidence pointed out that the difference between the two sets of estimates stems largely from assumptions about the effect on drivers currently driving with BACs above 110mg/100m. The conservative estimates leave any such effect out of account because so much has been achieved in Britain since 1967 in reducing driving with BACs over 80mg/100ml that it now represents only 0.3 per cent of all driving, whereas the higher estimates assume an effect proportional to the effect found in South Australia when as much as 2.5 per cent of driving took place with BACs over 80mg/100ml.

The European Commission recommended in 2001 an overall legal limit of 50mg/100ml, with a limit of 20mg/100ml for novice drivers.[49] Lowering the legal limit from 80 mg/100 ml to 50 mg/100 ml in several countries elsewhere in Europe has been estimated to have been associated with an estimated fall in fatalities of 3.3-7.4%.[50] In 2008, the Transport Select Committee proposed a 20 mg/100 ml limit for new drivers, but consultation on compliance advanced the view that raising the limit after the probationary period would send the wrong message.[51] The alternative is to reduce the legal limit for all drivers to 20mg/100ml, on the grounds that there is evidence of impairment above that level. Another option may to be have a graded set of penalties with a £60 fixed penalty notice at 20mg/100ml, a £60 fixed penalty notice and 3 penalty points at 35mg/100ml, compulsory disqualification at 50mg/100ml and the option of imprisonment at 80mg/100ml. One advantage of a graded system is that it removes the idea that it is safe to drive at just below the limit and that people have been "unlucky" if they exceed it very slightly. The reality is that people are passing the current breath test after a combination of drinking and driving that is wholly irresponsible.

At the end of 2009, the government commissioned an independent review of drink and drug driving laws, led by Sir Peter North.[52] The report was submitted to the newly elected government in May 2010 and published in June 2010. It made 51 recommendations, including reducing the legal blood alcohol limit for driving to 50mg/100ml for drivers of private vehicles (25µg/100ml for breath alcohol levels); giving police wider powers to test drivers for alcohol; stronger penalties for exceeding the new legal limit; and recommendations about drug use that impairs driving. Although the report explicitly recommended *not* reducing the legal limit to 20mg/100ml for drivers of private vehicles, HGVs, PSVs taxis or private hire vehicles, and also not reducing it to 20mg/100ml for young or novice drivers, they recommend reviewing the latter decision after five years of a legal limit of 50mg/100ml if the expected fall in casualties among young or novice drivers has not occurred.[53]

On 2nd December 2010, the Transport Select Committee published it first report to the new government. It recommended working towards an 'effective zero' threshold of 20mg/100ml but felt the public was not yet ready for this. The Committee recommended greater enforcement of the current 80mg/100ml legal limit but decided not to recommend reducing this limit to 50mg/100ml as it would send 'mixed messages'.[54] The THSG commented publicly on this decision in a letter to The Times:

> *"A 'canny state' protects its citizens from hazards they cannot control themselves. Reducing the legal limit in England and Wales to 50mg/100ml would save around 144 lives and result in almost 3,000 fewer people injured in the first year, and more than twice that at six years. While we welcome improved enforcement of current legislation and the ultimate aim of a 20mg/100ml ('effective zero') limit, motor vehicles are potentially lethal weapons and should be driven only by people in full control of their faculties. How many more people will be killed unnecessarily before the Select Committee and Parliament act?"*[55]

Although this letter quoted only the very highest of the wide range of estimates of lives to be saved and injuries to be prevented, the challenging question with which it ends is wholly consistent with the unequivocally clear evidence to the Select Committee: to delay reducing the limit to 50mg/100ml, even if in the hope of eventually making the greater reduction to

20mg/100ml, is in the mean time to say of (at the very least) 40 or 50 people each year, and probably to a larger number, 'Let them die'.

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18 Preventing Injuries Caused by Transport

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18.1 Preventing collisions between vehicles

18.1.1 Introduction

We presented a scientific analysis of transport injuries in chapter 4 with a specific discussion of cycle safety in chapter 7. This chapter focuses primarily on preventing road traffic collisions and injuries, as road vehicles cause by far the largest number of transport injuries and fatalities. It starts by describing the causes and prevention of collisions for rail and air travel in sections 18-2 and 18-3 respectively but also mentions these in subsequent sections to illustrate the different approaches and degrees of regulation and expectation in the different systems.

Modern forms of transport enclose passengers in high speed projectiles carrying considerable kinetic injury, and also carrying stores of energy that is used to power the vehicle. In the case of air travel, it also carries considerable potential energy and passes through an environment incompatible with life. Motor bikes and microlight aircraft do not even enclose the passenger but still accelerate the passenger's body to one carrying considerable kinetic energy (and potential energy in the case of microlight aircraft). If all goes well, the potential energy of aviation is dispelled gradually as the aircraft lands, the kinetic energy of vehicles is dispelled gradually as the vehicle brakes, and the propulsive power is used only in a controlled way. If, however, something goes wrong, the energy is released as damage and is capable of causing considerable, often fatal, injury to vehicle occupants.

Five things can go wrong. The vehicle may collide with another vehicle. It may leave its planned route and collide with an object (a train is derailed, an aeroplane falls from the skies, or a car leaves the highway). It may collide with an object obstructing its planned route. It may malfunction or disintegrate (a train divides, an aeroplane breaks up in the air, a tyre bursts on a car). Or the propulsive energy it is carrying may escape and, for example, explode. The last of these can happen on its own but most usually happens as a consequence of one of the first four types of incident, aggravating the consequences.

To prevent injuries occurring one can try to stop each of these five things happening. Vehicles are also designed so that if any of these things do happen, as much as possible of the released energy is absorbed by the vehicle and as little as possible is conveyed to the passengers. This provides six strategies for preventing injuries to vehicle occupants.

These six strategies are applied differently on rail, in the air and on the road. They have evolved differently. On the railway, many years of steady development of safety in response to crashes has led to an extremely safe system.[1] In the air, a system of meticulous risk analysis, investigation of incidents, and investigation of near misses has led to a similarly safe system which has indeed been cited as model to be copied in preventing medical errors.[2] Apart from its climate change consequences which threaten the survival of the species, air travel is extremely safe. Indeed, the episode in April 2010 in which safety concerns resulted in a ban by aviation authorities on any flights over large part of Europe and beyond demonstrate the 'safety-first' approach to aeroplane travel.[3] In contrast, arrangements on the road are haphazard and are still dependent on the vigilance and skill of drivers.

18.1.2 Rail

In the early years of the railways trains were sent out on a time interval basis and the prevention of collision relied on the vigilance of drivers. Following the Clayton Tunnel crash in 1861, signals were increasingly installed and the absolute block system introduced in which lines are divided into sections and only one train can be admitted to the section at any one time. However there were a number of crashes due to errors in the use of this system, such as that at Tamworth in 1870, where the Irish Mail ran under clear signals into a siding instead of the main line; those at Kirtlebridge in 1872 and Manuel in 1874, where expresses collided with goods trains shunting; and that at Norwich in 1874, where a head on collision between two passenger trains was caused by misunderstanding of verbal instructions. These incidents led to interlocking of points and signals so that they could not be set differently. The Abbotts Ripton crash of 1876 caused by snow depressing signal arms and signal wires so that the signals looked to be clear led to arrangements in which signals were fail safe and showed a stop aspect if there was a fault. Human error was still possible, as at Abermule in 1921, where a series of error led to a driver on a single line receiving a tablet which he thought (without looking at it) was authority to proceed into the next section when in fact it was the tablet he had already surrendered for the section he had just passed – this resulted in a head on crash on a single line. The worst British railway accident, at Quintinshill in 1915 which killed 225 people, resulted from a signalmen forgetting that he had shunted a commuter train onto the opposite track to let an express pass so that he accepted a troop train which ran head on into the commuter train just as the express approached to run into the wreckage. In response to incidents such as these, procedures were tightened and new devices introduced such as a collar to be placed over a signal lever in situations like that at Qunintinshill to prevent the signalmen forgetting the shunted train and moving the lever. The invention of track circuits made it possible for signalmen to see where a train was rather than merely infer it from the movements that had been permitted and this, together with computerisation, made it possible to centralise signalling across large areas. The absolute block remains the essence of the system for preventing collisions but it may in future give way to a system called moving block in which the train is allocated a sufficient length of track in front of it and this moves with the train – this system is more efficient but requires constant communication between signals and train.

As well as setting signals in a way that should prevent collision, it is also necessary that they should be obeyed. The second worst British rail disaster, at Harrow in 1952 which killed 122 people, resulted from an express running through signals at danger, colliding with the rear of a commuter train and then another express running into the wreckage. To avoid such SPAD crashes (SPAD means signals passed at danger), there has been much attention to ensuring signals can be properly sighted (the neglect of this caused the Paddington train crash) and that drivers are properly trained. Automatic warnings have been introduced to alert a driver if he passes a signal at danger but there is risk that a driver on a busy line may receive a succession of such alerts from distant signals (not warning him to stop but warning him that a signal ahead is at danger) and fall into a habit of cancelling them. Japanese railways require the driver to make a positive decision by pointing at the signal and saying "That is clear". However throughout the world there is an increasing use of Automatic Train Protection which stops the train automatically if it passes a signal at danger.

18.1.3 Air

The safety of the system on the railways evolved over many years of evolution in response to the crashes which occurred. The safety we enjoy today was achieved through learning purchased with the lives of those who died at Clayton Tunnel, Abermule, Quintinshill, Harrow and many other crashes. In contrast the aviation industry has emphasised safety from the outset and has used systems design to develop a system very similar to that of the railways. Just as railway signalling ensures that no more than one train can be in any section of track so air traffic control allows each aircraft an envelope providing a guaranteed minimum separation from other aircraft vertically, sideways and forwards. It is effectively a three dimensional version of continuous block. Mid air collision involving commercial aircraft is extremely rare.

It should be noted that not all of our skies are controlled by air traffic control and not all aircraft operate with such safety. Military and private aircraft are allowed to operate under line of sight in uncontrolled airspace. This system is much less safe.

18.1.4 Motor vehicles

The system for preventing collision between road vehicles is that drivers are advised to leave a sufficient stopping distance between themselves and the vehicle in front and are told what rules determine the priority at junctions.

After reading of the care which is used to avoid collisions in the air and on the railway, it seems incredible that we have no comparable system for preventing collisions in the transport system which is most used and which penetrates the neighbourhoods where we live and work.

Devices do exist for controlling the distance between a road vehicle and the vehicle in front and some cars are fitted with them. Guidance devices for road vehicles also exist and are used on guided busways. However their use is very limited. It seems unlikely that we will improve road safety to anything like the level of rail and air until we have similar systems of supporting drivers and overriding driver errors. We need automated highways, guidance devices, speed governors and devices to maintain adequate distances between vehicles. We can then bring to the road something akin to the moving block system on the railway or the envelopes used in air traffic control. As on the railway and in the air, this would not only achieve greater safety – it would also increase capacity.

Ninety percent of crashes are due to human behaviour. Speeding and drink driving are still the main contributing factors to crashes resulting in injury. Preventing road crashes requires action on the following:

- Safer speeds (safer speed limits, enforcement);
- Reducing drink driving;
- Improving the road infrastructure; and
- Graduated licensing.

The OECD report *Towards Zero* summarises trends in road fatalities, comparing these with current safety targets. It identified speed management, drink-driving legislation, and enforcement as the key areas to prevent road traffic fatalities.[4]

18.1.5 Safer speed

Speed affects the risk of having a collision by affecting the distance travelled in a given time. Increased speed reduces the time available both for reaction to a situation or potential hazard and the time available between initiating preventive action and the potential impact occurring. The distance travelled by a vehicle at different speeds is given in the Highway Code for dry conditions with good visibility[5]; in less optimal conditions, the stopping distances are greater. Table 18-1 lists safe speeds for various circumstances.

Table 18-1. Safe speeds for different combinations of road types and road users

Road types combined with allowed road users	Safe Speed (km/h)
Roads with possible conflicts between cars and unprotected users	30
Intersections with possible side-on conflicts between cars	50
Roads with possible frontal conflicts between cars	70
Roads with no likelihood of frontal or side-on conflicts between road users	≥100

Source: SWOV 2008.

18.1.6 Preventing Vehicle Malfunction

Rail and air vehicles are checked meticulously and regularly. Road vehicles are checked annually.

18.1.7 Preventing Vehicles Leaving their Planned Path

The most common cause of planes falling out of the sky is structural failure or instrument failure. These have been dealt with under vehicle malfunction. Severe air turbulence is another cause and is addressed partly by avoiding such turbulence and partly by training pilots in how to deal with it if they encounter it – including training on simulators. Abnormal weather conditions can also affect road vehicles but there is no substantial driver training, no use of simulators, and the majority of drivers have had no training in dealing with the most common such incidents – a skid due to ice.

On the railway, derailment has been caused by wheel defects, rail defects, and excessive speed, especially through curves. Similarly, wheel defects, road defects and excessive speed on curves are the main causes of cars leaving the highway. The rail system is regularly inspected for defects and trains are regularly checked. Car drivers are advised to check tyre pressures regularly but otherwise their vehicles are inspected only annually.

Automatic train protection can be used to enforce speed restrictions on the railway. Again, there is no similar form of speed control device on the road.

18.1.8 Preventing Collisions with Obstructions

Bird strikes have affected aircraft; rail crashes have occurred as a result of obstructions on the track including landslides, bridge collapses, and obstructions deliberately placed on the track. These can also affect roads. Cars can be the victim of items dropped from bridges as can trains.

Obstructions of the railway may become obvious to signallers due to obstruction of track circuits, drivers may report obstructions, and airports seek to monitor dangerous bird concentrations.

However none of the three systems has a really effective way of dealing with this hazard.

18.1.9 Preventing Explosions

Boiler explosions on steam locomotives played a role in some early rail crashes but are now of historical interest only. The same is true of the gas explosions from gas lights which caused the destructive fires and many deaths in some 19th century and early 20th century rail crashes, especially Quintinshill and Ais Gill.

Still current air are the fuel explosions which complicate air crashes, crashes of diesel trains (the cause of the fire in the Paddington rail crash), and road crashes. The most effective way to reduce this is the substitution of electric traction. This is best developed on the railways, is beginning on the roads, and is a long way away in aviation.

18.2 Preventing collisions between motor vehicles and other road users

18.2.1 Rail

Level crossings and falls from station platforms are the main points at which pedestrians can collide with trains. Some deaths do occur in these settings but they are not a significant problem. Most of the rail system in Britain is fenced off to prevent conflict between pedestrians and trains. This is not the case in all countries but even where people are allowed to walk close to the track, or trains run in the street (as they do, for example, in parts of Switzerland) the danger seems to be obvious to people and collision between trains and pedestrians is not a major problem. This is probably because it is unusual for railways to run along residential or shopping streets.

18.2.2 Air

Pedestrians are not allowed airside at airports. Collisions between aircraft and pedestrians is a negligible problem.

18.2.3 Road

Collision between road traffic and pedestrians is a major cause of injury and death and it needs to be addressed. In chapter 4, section 4.3.1, we presented a French analysis of the typology of these accidents by Brenac et al.[6] Based on this typology, a number of key issues were recognised:

- Slower speeds, to increase the time available to see potential problems and to react.

- Improved planning to:
  - ensure clear lines of sight, such as recessed stop lines at junctions and crossings, and parking restrictions near crossings and bus stops;
  - improve junction design;
  - reduce the road width to be crossed; and
  - provide visual clues that motor vehicles are not prioritized over other road users.
- Improved education of drivers and pedestrians to increase awareness of:
  - the need to perceive pedestrians and vehicles, respectively;
  - the barriers to visibility; and
  - the need to anticipate others' behaviour – and that other people may do the unexpected.

Five key principles for pedestrian's safety have been described by Wegman et al (Table 18-2).[7] Public spaces should be *functional*, i.e. usable by pedestrians for walking and as social spaces without threat from traffic or other dangers. *Homogeneity* means that pedestrians should not be exposed to traffic that is moving substantially faster than they can walk, allowing adequate time for driver and pedestrian to avoid each other. Pedestrian space should be *self-explaining* regarding where pedestrians can go and can stay and how to cope with threats. Pedestrian environments should be *forgiving* so that errors by pedestrians or drivers do not lead to injury. This requires speeds below 20mph (30kph). Falls should not have additional hazard de to drops, traffic, or sharp objects. Finally, pedestrians' environment should not require vulnerable groups to cope with risky situations that are beyond their capabilities.

Table 18-2. Sustainable safety principles

Sustainable Safety principle	**Description**
Functionality of roads	Mono-functionality of roads as either through
Homogeneity of mass and/or speed and direction	roads, distributor roads, or access roads, in a hierarchically structured road network
Predictability of road course and road user behaviour by a recognizable road design	Equality in speed, direction, and mass at medium and high speeds
Forgivingness of the environment and of road users	Road environment and road user behaviour that support road user expectations through consistency and continuity in road design
State awareness by the road user	Injury limitation through a forgiving road environment and anticipation of road user behaviour

Source: Wegman et.al. 2006[7]

18.3 Preventing injuries

Preventing injuries from road crashes requires action on the following:

- Safer speeds (safer speed limits, enforcement);
- Reducing drink driving;
- Increase seatbelt use;
- Promoting safer vehicles; and
- Improving the medical management after a crash.

Speed and use of alcohol not only increase the risk of a collision occurring, they also exacerbate the severity of an injury. Seatbelts are mentioned in section 18.4 below. Until recently, 'safer vehicles' was taken to mean designing vehicles to reduce the risk to occupants, but the impact on other road users, especially pedestrians, is now being taken into account.

There has been a policy in recent years towards centralising trauma services into fewer, better equipped centres, with greater numbers of staff with more expertise. This is discussed in chapter 11.

18.4 Protecting passengers in crashes

On any system, the key factor in protecting passengers is to absorb as much energy as possible in crumple zones, to ensure that the passenger compartment is a rigid shell that stays together, to hold the passenger securely in position, and to protect the passenger by padding items against which the passenger may be thrown.

For once, the road system is up with the other systems in its attention to these systems. Seat belts are used on the road and in the air but not yet in trains. Air bags are used on the road but not in trains or planes. Crumple zones are used in modern cars and in modern trains (although they are relatively new in each case) but not in planes. There is attention to padding dangerous internal obtrusions in cars probably to a greater degree than in trains and planes. In all three systems, attention is paid to ensuring the integrity of the passenger compartment. This has dramatically improved rail safety – the large number of deaths at Harrow in 1952 was due to the disintegration of the passenger vehicles and other crashes showed large numbers of deaths due to telescoping or to vehicles overriding the chassis of other vehicles and scything through them. The recent high speed crashes at Eschade in Germany and at Grayrigg in England showed a fraction of the deaths that would have been expected from high speed crashes in the past, and the same would have been true at Paddington but for the fire. Air crashes have also become more survivable. One simple measure which would improve air safety would be for seats to face backwards rather than forwards. It is hard to see why seat belts are not fitted to trains since they are fitted to other means of transport and their use is generally accepted. Unlike in cars, where there is some evidence supporting the theory that drivers take additional risks when using seat belts, therefore seat belts have had less effect on vehicle occupant safety than might be expected (see chapter 7, section 7.4.3). This is unlikely to be the case for trains.

The European New Car Assessment Programme, Euro NCAP, provides information about car safety in terms of adult and child occupants for most makes of car. EuroNCap has largely contributed to the improved safety of car occupants.[8]

18.5 Preventing injuries resulting from collision between vehicles and pedestrians

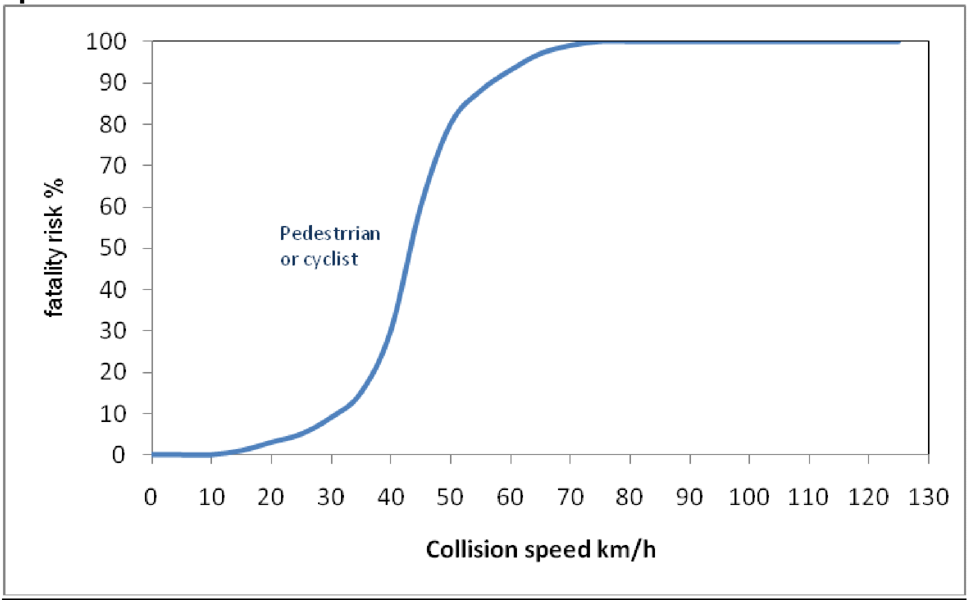
18.5.1 Pedestrian Friendly Design of Vehicle Fronts

It is possible to design the fronts of vehicles so that they scoop up pedestrians instead of knocking them down; so that they are padded where pedestrians are most likely to hit their head; and so that there are no sharp obtrusions to cause injury. Whilst European car safety bodies are now starting to look at this problem, the design of cars to protect pedestrians lags well behind the design of cars to protect their occupants. Euro NCAP, which also assess safety of cars for their impacts on pedestrians, believe that motor manufacturers could be doing more to change vehicle design to reduce injury severity to pedestrians.[8]

18.5.2 Speed

As kinetic energy increases with the square of the velocity, a collision at 30mph involves more than double the kinetic energy of a collision at 20mph, and at 40mph the amount is quadrupled. It is not surprising therefore that in collisions between pedestrians and cars travelling at 20mph only 5% of pedestrians are killed, whereas at 30mph about half are killed, and at 40mph only 5% survive (Figure 18-1).

Figure 18-1. Fatality risk of a pedestrian hit by a car as a function of the collision speed



Source: Wramborg[9]

Pedestrians are most likely to step unthinkingly into the road in front of a car whilst thinking of other things in a residential or shopping street and there is a powerful case for adoption of a 20mph speed limit in all such streets.

Speed management measures

A speed limit is only useful if it is obeyed. This is why 20mph speed limits are often reinforced by self-enforcing measures. Traffic can be slowed by speed humps (bumps in the road which cars have to slow down to pass over), chicanes, or speed tables (elevated lengths of road which cars have to slow down to ascend on to and to descend from). Speed humps are the cheapest of these methods but they can cause problems for disabled people, cyclists and buses. Chicanes are therefore better and, whilst engineering chicanes by building out the footway is expensive, a much cheaper form of chicane can be created by limiting parking to one side of the road and varying this every 25metres or so. Whatever form of obstacle is used it is important that the interval between obstacles is not too great or vehicles will speed up between them which not only undermines their speed-limiting effect but also increases emissions as vehicles accelerate and brake repeatedly. There is a debate as to whether 30kph or 20kph speed limits are effective without self-enforcing engineering measures. There are doubts about the effectiveness of such schemes in small areas and they seem to be more effective when applied to an entire town or city, presumably because in such a setting they alter normative behaviour.

From a health standpoint the best form of street design is the living street They are often called by the Dutch name woonerf (plural woonerfen) as it was in Holland that these were first developed. In a living street the purpose of the street is not simply access to premises.

It becomes a place of community interaction. Space in the street is occupied by gardens, trees and communal furniture such as picnic tables, play equipment and seats. Motor vehicles are not banned from the street – indeed parking spaces are laid out, usually set nose to kerb so that they add to the obstacles that vehicles face as they pass along the street. The carriageway is simply the gap between the obstacles and is arranged in an irregular lay out so that chicanes are created. The obstacles in a living street, including the plantings, parked cars, trees, communal space and play areas, serve as a method of traffic calming. Equally important in reducing speed is the sense that the street does not seem like motor territory - the car seems like an intruder into territory that is communal space and this sense leads drivers to slow down.

Woonerfen are good for health in a number of ways. Like all forms of traffic calming they slow down vehicles and hence protect pedestrians from collisions with vehicles. Like all forms of green environment they help create tranquillity and well being. In addition their role in promoting social interaction is the reverse of the problems described by Hart[10] and by Appleyard & Lintell.[11] [12]

20mph zones and Living streets are discussed in more detail in chapter 16, section 16.5.

Changing Normative Behaviour

It ought to be possible to change normative behaviour on the issue of the speed at which it is appropriate to drive in residential side streets. Few places are more than a mile from a main road so few journeys involve more than two miles in residential side streets (a mile at each end). Driving two miles at 20mph takes 6 minutes. Driving it at 30mph takes 4 minutes. Driving it at 40mph (which most drivers would accept to be too fast for a residential side street) takes 3 minutes. There is very little to be gained by driving faster than 20mph in residential side streets and we are killing our children for the sake of a few minutes on our journeys. This is a message which it should be possible to put across.

18.5.3 Crossing the Road

It is important that there are safe crossing points where pedestrian routes cross busy roads. These should be positioned where pedestrians wish to cross, not where it is convenient for traffic engineers to put them, and they should allow proper time for pedestrians to cross (see chapter 5, section 5.3.3).

Traffic control should reduce traffic volume (eg by routing away from busy pedestrian areas) and speed. Traffic lights should be pedestrian-friendly, with the average waiting time below 40 seconds; pelican crossings with push buttons should change to pedestrian right of way within a few seconds, except where such right of way has just ended. At junctions, traffic should not be allowed to turn when pedestrian lights are green.

Road width to be crossed can be minimised by curb extensions, or by dividing the width to be crossed by using central islands. Curb extensions also increase reciprocal visibility, while islands not only shorten the distance to be assessed and crossed but also limit pedestrians' exposure to two-way traffic. Reducing the number of lanes of traffic also benefits pedestrians.

As risk of injury is higher in the evening and at night, pavements and crossings should be well lit. Good reciprocal visibility for drivers and pedestrians requires an absence of clutter by street furniture, regular maintenance of trees and shrubs, parking restrictions that are enforced or are facilitated by build-outs, and recessed stop lines. At present the last of these is permitted (by the 1968 Vienna international convention) only at crossings with traffic lights.[13]

Due to former planning philosophies to reach the highest possible vehicle capacity, nowadays some roads have more travel lanes than necessary and are difficult to cross for pedestrians because of their width. Furthermore, the presence of moving visibility mask, a pedestrian being masked by a car and so no more visible for a car overtaking, has to be considered. Thus reducing the number of lanes on a multi-lane roadway can reduce crossing distances for pedestrians and may slow down vehicle speeds. Therefore, a traffic analysis should be done to determine whether the number of lanes on a roadway is appropriate. If it is inappropriate, a reduction of the number of lanes can be carried out, which would serve many purposes. Space for pedestrians, bicyclists and parked cars could be provided, the crossing time reduced and besides the social interaction and neighbourhood feel along the street improved.

18.6 Legislation and enforcement

18.6.1 Legislation

Legislation mostly originates from a need to permit traffic flow, and until recently has focussed almost solely on users of motorized vehicles. In some countries, pedestrians are not mentioned, nor defined, in road traffic legislation. A 2010 OECD report[13] recommends that legislation ensures greater equity for pedestrians, given their exposure to risks from motorized traffic. Two approaches are recommended regarding protection for pedestrians: financial protection and the precautionary principle. In many countries, such as France and Belgium, a Street code has been developed to balance the needs of different types of road users. It uses the precautionary principle, less vulnerable road users having responsibility for the safety of more vulnerable road users. Secondly, there is a presumption that a more vulnerable road user is unlikely to impose significant risk on less vulnerable users and therefore if a collision occurs, the more vulnerable road user is entitle to financial compensation. This can increase awareness among drivers that are not motivated by other concerns. The OECD also recommends that governments should encourage a critical review of traffic regulations to ensure they remain relevant and do not cause problems for types of road users not considered when the rules were written. Such reviews should include associations of the various types of road user.[13]

The review also considers the need for a robust definition of a pedestrian[i] and pavement, and where pedestrians are and are not allowed. The concept is also described of the street not only as where pedestrians walk but where they sojourn – where non-motorized activities predominate and should be allowed to take precedence. The OECD report recommends that legislation should forbid parking on the pavement and other pedestrian areas, or where it would cause pedestrians to walk on the roadway to avoid an obstacle. If pedestrians do need to qlk on the road, then drivers should be required to keep at least 1m away; if this is not possible, drivers should proceed only at a walking pace.[13]

Traffic regulations should also ensure pedestrians and drivers alike know their responsibilities regarding visibility, predictability, the need for pedestrians to cross by the shortest route (usually perpendicularly), and the need for drivers to moderate their speed when approaching a pedestrian crossing. [13]

18.6.2 Enforcement

Enforcement must occur, or legislation is pointless. There should be zero tolerance of speeding. This can be enforced through speed cameras, with higher penalties for breaking the law. Cameras can also be used to detect red light infringements. There should also be zero tolerance of drink driving. The evidence for reducing the limit for alcohol to 20mg/dl was given in chapter 17, section 17.6. Random testing is required as well as testing on

[i] Although at first glance self-evident, this may include children using toy transportation modes, handicapped persons using walking aids (walking sticks, crutches, wheelchair, three- or four-wheeled electric scooters) but may exclude some or all of those defined by speed (joggers, marathon walkers), location (mountains, woods), or those using scooters, Segways, or other equipment for fun.[13]

suspicion, to detect those above the legal limit. This can also act as a deterrent. The police should be required to test alcohol levels as part of all traffic-related police checks and all collisions attended by the police. Consideration is also needed of the problem of pedestrians being unsafe walking when intoxicated.

Enforcement needs to be reinforced by publicity and education of the public but also of officers. This should include awareness of pedestrian behaviour that can lead to collisions and injury. Speed cameras linked to signs can also be used to give drivers instant feedback of their speed, as part of an information campaign. Pedestrians should ensure they are visible (for example, not wearing dark clothes at night without something light or reflective), do not suddenly dart out into the road, . But although children can be taught these, drivers must always realise that children's behaviour can be unpredictable and that drivers should assume children will not obey this guidance.

18.6.3 Children

The annual number of child road deaths in OECD countries was halved between 1984 and 2000 but more could be avoided if practices known to be effective were adopted more widely.[14] The most effective strategies are holistic approaches that include changing the behaviour of all road users, not just pedestrians, combined with improving the road environment and modifying vehicle design to protect pedestrians if an impact does occur.

Education should be tailored to the child's age, increasing skills with increasing age and experience. Integration of road safety within other curriculum areas is more effective than occasional road safety lectures. Examples of best practice are:

- Including road safety at regular intervals within the national education curriculum at all ages from pr-school, with high quality teaching to develop children's knowledge, attitudes, skills, and awareness.
- Using education training and publicity to make drivers aware of their responsibility to other road users, including their own passengers, and of the unpredictability of children's behaviour.

Using publicity to change attitudes and behaviour, to inform about vehicle or other legislation and legal responsibilities towards other road users, awareness of children's behaviour, the impact of speed, and the correct use and fitting of child restraints in cars.

18.7 Preventing other types of injury

We have dealt fully with cycle safety in chapters 7 and 14, section 14.6. Maritime safety differs from air, road and rail safety in that the main transport-related risk is drowning rather than the release of kinetic and potential energy in collisions. All transport systems also show risks that are not specific to transport – a plane, train, ship, road vehicle, railway station, airport, car park or dockside is a place with all the dangers inherent in any place. Equestrian crashes can result from horses bolting. Falling can affect equestrians, carriage-riders and pedestrians as well as cyclists. Public transport safety is dealt with in chapter 20, section 20.2.

18.8 Avoiding Risk averse systems

In this chapter we have made the point that road safety attention needs to be raised to the levels used for public transport. In section 20.3 however we also pose the converse problem – of ensuring that transport safety does not become so risk averse that people lose the skills to manage risk, or lose patience with "health and safety" and therefore lose the sense of priority in attending to major problems.

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19 The roles of the NHS regarding transport policy and its own practices

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19.1 The case for reducing car use

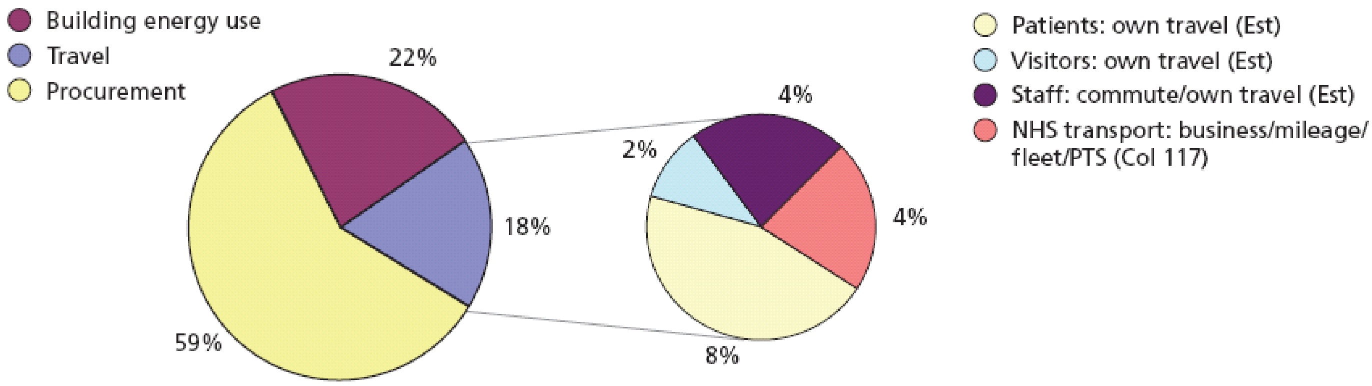
19.1.1 The health case

Section II of this report described in detail the adverse effects of motorised vehicles, occasionally on its users, such as by promoting sedentary behaviour (chapter 2), but mostly on the surrounding community through generating greenhouse gas emissions (chapter 3), injury (chapter 4), community severance (chapter 5), and noise (chapter 6). Private car use tends to increase health inequalities, as most of the benefits of access accrue to the more affluent, with the disbenefits falling disproportionately on the more deprived (chapter 9). In the case of air pollution, it affects both the car occupants and those outside the vehicle (chapter 3).

Obesity and climate change are possibly the two greatest challenges faced by the human race in modern society.[1 2] Passenger cars in the UK account for 13% of total carbon dioxide emissions[3], and increases in car mileage have been repeatedly linked with rising obesity levels.[4 5]

The NHS is responsible for producing 18 million tonnes of carbon dioxide every year. Whilst the majority of this comes from building energy use and procurement, 4% is a result of staff commuting to work and another 4% from NHS business travel (see figure one).[6] It has been estimated that 5% of road traffic in England is due to NHS activity.[7] The NHS generates one million trips a day. In 2001, 22% of the NHS ecological footprint came from the around 25 billion passenger km travelled by staff, patients and visitors on NHS-related purposes (excluding ambulance travel). Of these, only 17% were not by car or van.[8]

Figure 19-1. NHS CO2 emissions in 2004



The figure on the right relates to how NHS-related transport emissions are broken down, which as a whole account for 18% of the overall CO2 emissions from the NHS.

Converting any journeys made using cars made by NHS staff to a more sustainable method would bring about improvements in health as well as reductions in carbon emissions. For example, it has been shown that individuals using public transport accrue more physical activity compared to car drivers,[9] which may in turn reduce the risk of an individual becoming overweight or obese – indeed, it has been suggested that physical inactivity could be the single most important cause of unhealthy weight gain over time.[10]

19.1.2 The Case for Promoting Cycling and Walking to Work

Encouraging a modal shift from car to cycle use or walking will not only reduce the carbon emissions associated with an organisation, but will also create a healthier, more active workforce. For example, actively commuting to work:

- Reduces the risk of a number of diseases such as chronic heart disease and stroke.[11 12 13]
- Improves weight control when compared to non-active commuters[14 15] – one study found that for every hour an individual spends in a car, the likelihood of them becoming obese increases by 6%.[16]
- Reduces exposure to pollution when compared to car users.[17 18]
- Is potentially more relaxing and less stressful compared to driving.[19]
- Furthermore, international research evidence suggests that a healthy workforce will lead to improvements in business indicators such as sickness absence. For example:
- Both obesity and physical inactivity have been shown to be positively associated with sickness absence. Furthermore, individuals who are obese take longer to return from sickness leave compared to normal weight employees.[20 21]
- Presenteeism, which relates to decreased on-the-job performance, is higher in those with greater health problems and associated risk factors.[22 23]
- Obesity is positively associated with an increased rate of workplace injuries, which in turn leads to greater sickness and compensation claims.[24]
- Physical inactivity, a lack of cardio respiratory fitness and obesity have all been shown to be negatively linked to work performance, which includes the quality and quantity of work performed, overall job performance, the amount of extra effort exerted and interpersonal relationships.[25]
- Mental health problems, which can be prevented and treated through physical activity,[26] costs UK employers an average of £1,035 per year per employee.[27]

Despite the wide range of reported barriers to active commuting such as distance, a lack of changing facilities, fear of crime (which is often a perception but sometimes real) and appearance, it is possible to encourage a significant number of NHS staff to leave their cars at home. Results from the two Well @ Work pilot projects[28] that were based in an NHS setting (at Newham University Hospital NHS Trust [NUHT] and Telford and Wrekin Primary Care Trust) have shown that it is possible (see Box 19.1 below). Where a comprehensive approach to promoting active commuting was adopted at NUHT, the number of employees cycling to work improved from 4.2% in 2005 to 8.6%[i] in 2007, whilst walking increased from 44.3% to 52.6%[ii].

19.2 The NHS as an employer encouraging Active Travel

19.2.1 The Business Case for Promoting Active Commuting

Whilst the financial case for workplace wellness schemes is often deemed sound by academics and practitioners, one of the problems is that the savings that can be achieved are not easily 'seen' by an employer, mainly due to the difficulties in measuring business indicators (and any changes) such as presenteeism and then proving causation. Furthermore, any such changes may take years to materialise.

Costs to the NHS of providing car parking spaces

The financial case for encouraging active commuting to work is potentially easier. First,

[i] $p=<0.01$

[ii] $p=<0.05$

consider the cost of maintaining a car parking space; this has been quoted as being typically £300 in terms of revenues costs per year (this maybe higher if capital costs are included).[29] In addition, cost of car parking spaces can be much greater in town and city centres where car parking is at a premium. For example, in Stockport town centre the cost of purchasing a car parking permit for an employee of the local NHS is nearly £900 a year. While Trusts may offset such costs by charging staff to park, in many cases this is unlikely to cover the actual cost. For example:

- Addenbrooke's Hospital in Cambridge charged staff £1 a day in 2004, which, based on a 228 day working year[iii], equated to £228 annually. By 2010, the charge had been increased to £2.20 per day for staff, equating to £501 per year.
- Rotherham NHS Foundation Trust charged £120 a year in 2006.
- West Suffolk Hospital NHS Trust charged a maximum of £165.60 a year in 2009, based on hours worked.
- The Shrewsbury and Telford Hospital NHS Hospital Trust charged £90 or £120 in 2007, depending on AfC banding.

It is not surprising that when a comparison is made with public transport costs, many employees will choose to travel by car if they are provided with relatively cheap car parking.

Despite calls from many areas (e.g. The Nursing Times, Unison Scotland), car parking should be viewed as a perk not a right. If NHS organisations were to encourage more individuals to cycle or walk to work, savings could be made. For example, at Newham, the prevalence of any walking or cycling to work increased from 50% to 59%: potentially 198 fewer car parking spaces would be required (based on a total workforce of 2,200, assuming that 100% of these individuals previously drove to work alone). At £300 per car parking space per year, this equates to gross savings of £59,400 (although this would be reduced by the costs associated with interventions/facilities to support active commuting such as cycle storage and changing facilities).

It costs around £600,000 a year to run the car park at Raigmore Hospital in Scotland.[30] In many cases such parking costs are not reported separately and are hidden in wider budgets. If Trusts were required to report the costs of car parking, it might provide more impetus for alternative modes to be encouraged.

Reducing the price of bicycles

Secondly, in terms of cycling, employees can save money through the implementation of a salary sacrifice scheme for staff to purchase bicycles. Such schemes allow employees to access cycles and associated equipment through their employers as a tax-free benefit. Employees then pay back the employer via deductions from their gross pay, meaning that both parties pay less tax and national insurance contributions (NIC).For an NHS employee subject to standard rate income tax of 20% and NI employee contribution of 11%, the savings will be therefore 31% although for higher rate tax payers the savings will be higher. NHS employees unfortunately do not get the benefit of VAT savings that employees in the private sector or other public sector employers may benefit from, so they save less than for example local authority employees. The employer saves money through reduced secondary class one NIC (at up to 12.8%) on the part of the employee's gross salary that is sacrificed. The official Department for Transport guidance[31] gives an example whereby if an individual purchase through the scheme totalled £500 over eighteen months, then the employee would pay in total £500 of gross salary, generating employer's NIC savings of £64 per employee.

Using as an example University College London Hospitals NHS Foundation Trust, which

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[iii] The Chartered Institute of Personnel and Development suggests that the annual average working year is 228 days

employs approximately 6,000 people (and already offers the scheme), if 5% of staff took advantage of the scheme every year, the organisation could save £19,200 per annum (minus the costs associated with administration). Newcastle University Hospitals Trust in one year saved £26K through implementation of the Cycle to Work Scheme.

An additional benefit of encouraging sustainable travel choice in staff is that it can help free up more car parking spaces, which could then be allocated to patients/visitors. At Stepping Hill Hospital, Stockport and many other hospitals many patients often complain of difficulty parking. Patient parking can generate more income to offset the cost of management etc of car parking facilities. (Staff typically park all day in one space at a relatively cheap rate, whereas there could be three to five patients parked in that space per day generating more income. Issues about reimbursing some patients and visitors, and problems of not knowing the length of time they will be at the hospital are discussed in section 19.3.1 below.

19.2.2 Setting an Example – the Role of the NHS as an exemplar employer

The NHS is the biggest employer in Europe and the third biggest employer in the world, with only the Chinese Army and Indian Railways being larger. In total, approximately 1.3 million people are employed by the NHS. This places the organisation in a powerful position to set an example to the rest of the population. Active commuting cuts across many high profile important agendas.

First, the well-being and sickness record of NHS employees has been put into the spotlight with the publication of the NHS Health and Well Being Boorman review. The interim report highlighted how sickness levels in the NHS are high; staff are absent on average for some 10.7 days a year, more than the public sector as a whole (9.7 days) or the private sector (6.4 days).[32] The final report recommends all NHS Trusts develop and implement strategies for actively improving the health and well-being of their workforce, and particularly for tackling the major health and lifestyle issues that affect their staff and the wider population. The report goes onto to state that it expects various initiatives, including developing active travel strategies to encourage and incentivise staff to walk or cycle to work as part of a wider well being programme.

One of the key policy recommendations of the Marmot Review is for active travel to be improved across the social gradient; the NHS must clearly play its part in implementing such a recommendation for its own staff, patients and visitors.

Well researched guidance from the National Institute of Health and Clinical Excellence recommends such action across the population including the NHS workforce. Clinical guidance on the prevention and management of obesity emphasises as a key priority for implementation the provision of cycle parking and showers in workplaces.[33] The NHS as an employer is specifically identified and *"should set an example in developing public health policies to prevent and manage obesity …policies should encourage activity……; for example travel expenses should encourage walking and cycling to work and between work sites and that showers and secure cycle parking should be provided to encourage active travel*. Related NICE public health guidance on encouraging physical activity in the workplace[34] and physical activity and the environment[35] also emphasises the importance of encouraging employees to walk and cycle and the provision of an encouraging environment to do so for eg provision of cycling and walking infrastructure.

Secondly, the NHS has a massive carbon footprint:18 millions tonnes of CO_2 per year.[6] The NHS Sustainable Development Unit suggests that meeting the Climate Change Act targets of 26% reduction by 2020 and 80% reduction by 2050 will be a huge challenge.[6] More recently, the leaders of 18 of the world's professional medical associations have called on doctors to take a lead on reducing carbon emissions[36] and NHS organisations have been encouraged to sign up to the 10:10 campaign to cut carbon emissions by at least 10% in 2010.[37] The promotion of active commuting and reductions in car use must be part of these efforts.

Unfortunately many trusts fail to take the agenda of active commuting seriously. In order for such good practice as demonstrated by for example Addenborooke's, and Nottingham University Hospitals Trust to become mainstream within the NHS, the agenda has to be accorded a higher level of importance within Human Resources departments. For example, Equality and Diversity issues are treated very seriously within the NHS with mechanisms to ensure compliance with NHS guidance on the issue.[38]

19.2.3 Supporting more cycling

Single measures/interventions to promote active commuting are unlikely to be effective, especially in the medium to long term. One example cited in the Boorman review interim report speaks of a mental health Trust that had introduced a Cycle to Work initiative but failed to provide bicycle racks or shower/changing facilities.[29] Ideally, an ecological model should be adopted, with interventions targeting the individual supported by changes/improvements made to the physical environment and policies/strategies. As a minimum, it is recommended that NHS Trusts should offer:

- Safe and secure bicycle storage;
- Access to changing and showering facilities;
- A salary sacrifice scheme for bicycles;
- Cycle proficiency lessons and maintenance workshops in conjunction with local authorities and other providers, especially those in the third sector;
- Support for a bicycle user group (BUG);
- A stock of bicycle tools at the workplace with access limited to key members of the BUG; and
- A minimum business cycle mileage rate of 20p per mile.

Bristol Royal Infirmary improved on-site facilities, including a swipe-car entry for registered users of the new showers and lockers; paid cyclists a mileage allowance of 40p per mile for business trips; provided information on safe routes to and between their sites; and provided public cycle parking across their sites. Staff cycling rose from 2.5% in 1999 to 5.1% in 2004.[46]

The importance of a comprehensive approach to cycling to work has been recognised by Government with the cross-party launch of the "Cycle to Work Guarantee" in 2010.[39] This is a voluntary initiative challenging businesses to become cycle friendly employers by making it easy for staff to cycle to and from work. The guarantee covers the ingredients listed above, essential to achieving an increase in cycling: storage, changing, buying, repairing, and inspiring by signing up employers to signal their commitment to delivering on all five elements.

It is encouraging that many NHS trusts have signed up to the guarantee. However the measure of success will be whether such trusts do indeed deliver on their pledges and whether a modal shift to cycling is achieved. Research from NHS Spokes suggests that many trusts do not reimburse employees a reasonable mileage rate for employees using their bikes on business journeys so there is therefore great scope for improvement.

One particular problem at many hospitals is that walking and cycling access has been poor, with road layouts and access designed for cars. Not only the heavy traffic flows endanger pedestrians and cyclists but poor signage makes it difficult to navigate around the site; detours around a ring road are unhelpful and counter-productive for encouraging active travel.

19.2.4 Gender issues

The NHS workforce is predominantly female; for example, between October 2008 and December 2008, North Tees and Hartlepool NHS Foundation Trust employed 5,393 people, 82.6% of whom were female.[40] Research has shown that females are less likely to cycle, with possible explanations relating to fear of crime, appearance and a lack of confident about cycling[41]. Hence, additional interventions may be required; an example might be making hair straighteners available (free or coin operated), which are already being used to encourage girls to take part in PE lessons in Scotland[42] and have been installed at Nottingham University Hospitals NHS Trust (with encouraging initial feedback).

The low level of cycling in females have been recognised by the sustainable transport charity Sustrans who have launched a social marketing campaign with tailored information to encourage females to use bikes, the Bike Belles project.[43]

19.2.5 Visiting patients by bicycle

While writing this chapter, we have been regaled by stories of GPs around the country who commute by bicycle, and in many cases also do their home visits by bicycle. One recently won an award; an interview is available at www.care4air.org/c4a_awards_2008.html. There are also hospital consultants who visit patients by bicycle, although these are less common.

Parkside Community Trust, which used to exist in inner NW London prior to creation of Primary Care Trusts, had an excellent travel policy that included lease and pool bicycles that were used by (predominantly female) community nurses not only for commuting but also for their travel for work purposes, visiting patients at home. Where there are facilities and support, role models emerge and normative behaviour can change.

19.2.6 Promoting active travel

When marketing active travel one must be consider the distance that an individual is likely to be happy to walk or cycle to work and their role. There is no point targeting those who commute 30 miles or more to work, as the likelihood that any of these will consider switching to active modes is slim. Some research has suggested that five miles or more is too far to cycle to work in the general population,[33] although keen cyclists will often travel further. The consensus in the urban planning field is that most people will walk only about half a mile.[44] However it is still possible to encourage employees who live a fair distance to consider active travel for part of their journey. For example, they could be encouraged to cycle or walk to the train or tram station or bus stop; get off a bus stop earlier; or park further away from their workplace. Some organisations have introduced measures to encourage those who live within a short distance from work but still drive to adopt a more sustainable method of commuting, such as no parking permits for those living within two miles of work. Perhaps these are the individuals that should be targeted initially. Box 19.1 gives a case study of an NHS trust in London.

In addition to considering distance people travel, one needs to consider the job roles people are employed in. Those that genuinely need a car to conduct their job duties efficiently are unlikely to be able to switch mode of travel to work unless they are provided with pool car facilities. However, NHS community trusts in the 1990s, such as Parkside in West London, successfully provided their community nurse employees with pool or lease bikes which they used when visiting patients, even when they needed to carry some equipment with them.

Box 19.1 Case Study – Newham University Hospital NHS Trust

Well @ Work was a two year national project led by the British Heart Foundation with funding from Active England (Sport England and Big Lottery Fund's joint awards programme) and the Department of Health. The project was one of the Government's 2004 Public Health White Paper commitments and was set up in 2005 to test the effectiveness of health promoting interventions in the workplace, relating to physical activity and other lifestyle behaviours such as diet and smoking. There were nine regional projects encompassing a variety of workplaces from the public, private and voluntary and community sector.

The Newham University Hospital site was selected as the project for the London region in conjunction with St Mary's College, Twickenham, who were awarded £100,000 to run the initiative. The project ran from September 2005 through to August 2007 with the objectives of getting people to become more active and eat a healthier diet and promoting smoking cessation.

A major part of the project aimed to get more people cycling, both in terms of to and from work and also during leisure time. A baseline questionnaire was administered to staff between November 2005 and March 2006. A total of 739 questionnaires were returned, which equated to a response rate of 34%. The results showed that 4% of respondents cycled to and from work, with an average journey of between 29 and 37 minutes.

In addition, 28% of respondents indicated that they would be interested in cycling to work. The next question asked what the Trust could do to help individuals cycle to work; 46% were interested in cycle training, 59% were interested in more information on cycling routes, 81% wanted safe and secure storage at work and 51% wanted bicycle maintenance workshops. Almost two thirds (63%) said that cheaper bicycles would encourage them to cycle to work and four out of five employees (85%) wanted showers and changing facilities at work. The project team considered the results and implemented the following interventions:

- Discounted Bicycles - staff were offered a number of ways to purchase discounted bicycles, including a ride to work scheme and various discounts at local cycle shops.
- Cycle Maintenance Workshops and Training - on-site cycle maintenance workshops for staff were held at lunchtimes on the first Monday of every month. These proved highly popular, with staff liking the convenience of the workshops. Local Crime Prevention Officers also attended the workshops to postcode bicycles and provide general security advice. In addition to this, an event was held to show staff how to maintain their own bicycles.
- Cycle Lessons - the free cycle lessons available through the London Borough of Newham Council were actively promoted to staff.
- Safe Storage - a total of 30 BykeBins, 20 Sheffield stands and two locked shelters, both of which can accommodate eight bicycles, were available to staff on the site.
- Pool Bikes - a fledgling pool bike scheme was set up, with two bikes available for staff to use to travel to off-site meetings.
- Showering and Changing Facilities - staff were able to use any of the changing/showering facilities on the site.
- Bike Tools - a central store of tools were purchased, which could be used to repair bicycles that have developed problems during an individual's commute to work. This also included a number of puncture repair kits and spare inner tubes of different sizes.
- Team Pedometer Challenges - as part of the Well @ Work project, a number of team pedometer challenges were implemented to encourage individuals to increase the amount of physical activity that they do. In previous challenges implemented elsewhere, cyclists were disadvantaged as any time spent cycling could not be

counted towards their step count totals. However, the project used recently created equations to convert time spent cycling to steps, allowing cyclists to compete in the challenges fairly.

- Library Materials - the staff library in the Hospital created a Well @ Work section, which included TfL maps of the local area (free to take) and books on cycling and maintenance (free to loan).

Other information

The Trust's Bicycle User Group re-formed in January 2007 and has met every two months since. The membership of the group has representation from most areas of the organisation. A group of employees from the Trust who live in the local Borough are members of the Newham Cycling Campaign, and work with the group to organise various trips and events.

The project was evaluated in May/June 2007, and the results showed that the number of staff cycling to work had increased from 4.2% at baseline (2005) to 8.6% in 2007 ($p<0.01$). In addition, walking to work increased from 44.3% to 52.6% ($p<0.05$).

The work was recognised by the London Cycling Campaign in 2008, when the Trust won the best workplace cycling initiative award.

References

[i] Miller R, Brown W, Tudor-Locke C. But what about swimming and cycling? How to "count" non-ambulatory activity when using pedometers to assess physical activity. *Journal of Physical Activity and Health*. 2006;**3**:257-66.

19.3 Reducing car use

19.3.1 The controversy over patient and staff car parking

The financial costs to the NHS of providing car parking spaces has been addressed in section 19.2.1 above.

There has been considerable media attention devoted to the issue of car parking charges at hospitals. The media storm was stoked up by the decision in 2008 of the Welsh Assembly and then the Scottish Parliament to instruct hospital trusts to implement free car parking. Calls were subsequently made by some quarters - notably the Nursing Times and Macmillan Cancer Care - for English hospitals to follow suit. News stories accusing the NHS of "raking in millions" from car park charges and politicians offering their opinions on the matter added fuel to the fire. Evidence is now emerging of the problems that this policy has caused in Scotland and Wales, including patients being unable to park, non-patients using the car park facilities, staff being unable to park, and increased overspill parking.

Following a pledge on NHS car parking made by the then Health Secretary at the Labour Party conference , a public consultation was launched by the Department of Health in early 2010 setting out a number of options but clearly setting out the preferred option of Government to allow certain patients free car parking. The accompanying background documents revealed that such a policy would lead to an increase in numbers of patients and visitors using the car to visit hospital, estimates of increased carbon emissions, and capacity issues due to the demand generated.

The THSG is opposed to the principle of free car parking on the grounds that:

- it undermines trusts' efforts to encourage its staff and patients to be physically active;
- it increases car traffic and hence air pollution, congestion and carbon emissions;
- it will reduce access due to undermining public transport and make it more difficult for patients and staff to park;
- it is inequitable; and
- it will cost the NHS a lot of money it can ill afford.

The NHS Confederation published an excellent policy document *"Fair for All, Not Free-for-All"* in April 2009[30] and in 2010 responded on behalf of its trust membership to the DH consultation. We endorse their position. *Fair for All, Not Free-for-All* gave five principles for hospital car parking:

Have a travel plan for users of all types of transport.

Control parking fairly, with concessions for those whose health conditions or work commitments mean they have to park frequently or at anti-social hours.

Show car park and transport costs and how charges are invested.

Think about the environment and how transport can reduce the NHS's impact.

Be open and involve patients and the public.[30]

Patient and visitor car parking

Clearly the public concern around car park charges has identified a number of issues which patients have just concern about. In many cases, car park operation at many trust sites is unsophisticated and is not meeting patients' or staff expectations. Some trusts are not following good practice guidance from the Department of Health on advertising concessionary schemes or making the Health Travel Costs Scheme (which reimburses charges for those patients on low incomes and on certain benefits) easy to access. Often patients do not know how long they may be at the hospital, an appointment may overrun, and it is therefore very distressing especially if ill or ones loved ones are ill to be fined for overstaying on the car park in such circumstances.

Addenbrooke's, an exemplar of good practice as far as travel planning concerned, received particularly hostile press coverage for its parking charges, although Andrew Lansley the then Shadow Health Secretary and at the time of writing the Government's Health Secretary defended Addenbrooke's approach to car parking charge describing the hospital (which is in his own constituency) as *"behaving in a very responsible manner"*. Addenbrooke's has comprehensive travel information on its web site and a web page explaining to patients what use car parking income is put to. All hospitals should provide similar information as clearly the public do not appear to understand the necessity of charging.

The Oxford Radcliffe hospital allows all patients who attend regularly, such as dialysis patients, to park for free, as are visitors to patients in intensive care. Staff car parking permits are based on need, with a sophisticated assessment of access to public transport rather than just distance.[30] Similarly, Chelsea and Westminster Hospital waives car parking charges for cancer patients receiving regular chemotherapy treatment, parents of children being cared for in the hospital, bereaved relatives, relatives of patients being treated in intensive care, or partners of women in labour.[30]

The NHS Confederation has worked with the British Parking Association to draw up a Car Parking Charter to ensure fairness in car parking operations. We would encourage all hospital trusts to sign up to this Charter.[45]

Staff car parking

At many hospital sites, staff car parking availability is unlikely to meet demand. Many hospitals now manage demand by an application system and have criteria for car park permit allocation i.e. not all staff who wish to drive to work will be allocated a space. Unsurprisingly, in our car addicted society, when such systems are introduced passions are inflamed. It is important that staff side representatives are consulted so they are satisfied that such a system is fair.

The issue of staff charging is also potentially controversial. As discussed in section 19.2.1 above, it is necessary to charge staff at busy hospital locations. The charges levied on staff should be such that they adequately cover the costs of operation and management. Depending on location of the facility, costs will vary reflecting market demand. Often HR professionals would like to see a consistent level of charging but this is unrealistic. When it comes to car parking, a one size fits all is not appropriate. It would be unreasonable to charge the same rate at city centre sites, where there is likely to be less car parking available and better public transport options, than at a rural or semi rural site where public transport options are more limited. A balance needs to be struck: too high a charge could lead to overspill parking in surrounding streets, annoying local residents, too low and it could encourage greater car use by staff.

In addition, account needs to be taken of staff working unsocial hours when public transport options are generally not available. Charging structures need to take account of this.

The universal proposal on car parking suggested by the Department of Health in its consultation is ill advised. Trusts should have the autonomy to manage their car parks in a way that takes account of differing local circumstances.

Car parking systems generally should be such that they encourage staff to use other modes when possible. In many cases, once someone has signed up to a permit there is no financial incentive not to use the car as the space has been paid for (most commonly through monthly salary deduction) even though they may on some days be able and willing to use other modes. Smart card systems such as adopted by Pfizer at its site in Kent should be more common at NHS sites; such systems also encourage car sharing. Pfizer have saved hundreds of thousands of pounds by reducing the need to extend their car parking facilities - an important point for the NHS to note.

As more services are delivered in community settings, Primary Care Trusts will find that car parking becomes a greater issue than it has been to date. PCTs should learn from the good practice demonstrated by some acute providers and develop a comprehensive approach to car parking rather than the ad-hoc and often reactive approach adopted by many to date. One PCT leased out some of its car parking spaces and were reported in 2004 to have generated nearly £1,000 per space per year.[46] PCTs in southwest England worked together to share good practice. Teignbridge PCT extended a bus route onto the site and provided 6 pool cars; South Wiltshire PCT developed links with a local lift-share scheme and community car club; and Bristol South and West PCT provided travel information and introduced cycle training and cycle mileage allowances plus interest-free loans for public transport season tickets.[46]

19.3.2 Business Mileage Rates and Required Users Allowances

Public sector mileage rates and allowances have for many years incentivised car travel. In particular, required users allowances have incentivised more travel due to a minimum threshold which, if not reached, would result the allowance being withdrawn thus financially penalising prudent car users. Greater mileage rates are granted to drivers of large vehicles, which is hardly an encouragement for staff to choose a more fuel efficient vehicle.

In Spring 2009, NHS Employers launched a consultation on mileage allowances. The NHS Sustainable Development Unit in their response recommended a flat rate for business mileage regardless of engine size. At the time of writing NHS Employers have not put forward their final proposals however if the new rates do indeed take environmental considerations on board then such changes could have a significant effect on carbon emissions and incentivising more sustainable vehicle and travel choices.

It will be extremely disappointing if the Agenda for Change (AfC) minimum cycling mileage rate is not raised from 10p to at least 20p per mile. At present many trusts do not pay more than the Afc 10p rate[47] and each trust has to process individually an increase above that. If it were changed to 20p minimum nationally, the maximum tax free level (which is the rate paid to DH employees), it would save trusts the hassle of having to change this individually. Some Trusts have increased the cycling mileage level to higher than this. For example, NHS Trafford pays 50p a mile. However the employee is taxed on the additional 30p.

19.3.3 Greener Driving

Realistically, the private car will continue to be a major mode of choice of staff, patients and visitors to Trust sites for many years to come. It is therefore desirable to ensure that car journeys be made as efficiently as possible to assist the NHS in its aim to reduce carbon dioxide (CO_2) emissions from transport.

The Energy Saving Trusts provides a Green Fleet Review, funded by the Department for Transport, to organisations with 50 or more fleet vehicles under 3.5 tonnes. The review is carried out by experts and produces a report detailing an organisation carbon footprint as well as providing tailored recommendations to assist in reducing fleet carbon emissions and saving money. The Green Fleet Review also includes the “grey fleet” where staff are paid by the Trust to use their own vehicle for business purposes.

Smarter driving lessons are also provided by the Energy Saving Trust. These in-car lessons are part funded by the Department for Transport and can be provided to Trusts at a subsidised rate. Smarter driving lessons have been proven to teach employees practical techniques to reduce their fuel consumption in order to reduce their CO_2 emission and save money. Smarter driving lessons can also assist employees in reducing vehicle wear and tear and help them to enjoy safer and less stressful journeys.

Smarter driving tips include advice such as:

- Drive off from cold**.** Modern cars are designed to move straight away. Warming up the engine just wastes fuel - and actually causes engine wear.
- Check your revs and change up before 2,500rpm (petrol) or 2,000rpm (diesel).
- Drive Smoothly**.** Anticipate road conditions so that you drive smoothly and avoid sharp acceleration and heavy braking. This saves fuel and reduces accident rates.
- Step off the accelerator **w**hen slowing down or driving downhill, remain in gear but take your foot off the accelerator early. This reduces fuel flow to the engine to virtually zero.

Driving lessons can be booked by organisation and businesses and provide employees with a practical application of smarter driving principles. Lessons are provided by experienced driving instructors from your employment sites and take 50 minutes. The car, fuel and insurance are all provided. New for 2010, smarter driving lessons are also available for vans up to 3.5 tonnes. Smarter driving lessons could be financially beneficial for Ambulance Trusts and Trust where fleets are re-fuelled using fuel cards. In addition to assisting Trusts in reducing their carbon footprints, including staff travel to and from work, smarter driving lessons are positive for staff relations, corporate social responsibility and may assist staff in the context of rising fuel prices: based on 12,000 miles a year, it can save employees up to £250 a year (see case study in Box 19.2).

Box 19.2 Case Study: Northern Lincolnshire and Goole Hospital NHS Trust[48]

Northern Lincolnshire & Goole Hospitals NHS Trust

Making huge reductions in staff mileage reimbursement claims, thereby channeling cash into improving patient care and services, was the key reason behind Northern Lincolnshire & Goole Hospitals NHS Trust undertaking a Green Fleet Review. In relation to this, a key objective for the Trust is that it aims to cut carbon dioxide emissions by almost 20% over three years.

In line with recommendations set by the Review, the Trust implemented the following changes to help achieve overall objectives:

- Introducing shuttle buses to replace individual car use as staff move between hospital sites ; and
- Replacing existing leased and pool cars and vans with new, lower emission vehicles.

The Trust had a top-down focus on improving transport operating efficiency and reducing vehicle mileage, aiming to set the benchmark for other NHS organisations and local businesses.

Being committed to long term environmental improvement, the Trust also joined Motorvate, an Energy Saving Trust scheme which recognises and rewards organisations for achieving targeted carbon dioxide reductions from their fleet.

Transport budget focus

An analysis of the Trust's transport operations by the Directorate of Facilities Management revealed annual spending of over £1 million on all aspects of travel and transport services. Following this, Jug Johal was appointed to the newly created post of Transport Services Manager, specifically tasked with improving operating efficiencies and cutting costs.

Addressing grey fleet (staff using private cars for business purposes) was a key challenge for the Trust. More than 1,250 staff including doctors, midwives, nurses and other health workers were using their own cars to travel between three hospital sites in Goole, Grimsby and Scunthorpe as well as other areas, resulting in 1.5 million miles driven annually, costing > £750,000 in mileage claims. A target was been set to reduce that sum by £350,000 over three years.

It was decided that more fuel-efficient models should be introduced for the Trust's owned fleet (leased and owned cars and vans, and pool cars), and more employees should be encouraged into the leased car scheme.

Action plan

External help provided a snapshot of all transport usage and established a priority action plan for moving forward. 'Grey' fleet and mileage reduction were at the core of the Green Fleet Review but a package of initiatives was recommended to improve overall efficiency and environmental performance. Changes implemented to date include:

- Introducing a fleet of shuttle buses to transport staff between the three hospitals, which has been highly successful in reducing grey fleet mileage and reimbursement costs
- Installing video conferencing and actively encouraging staff to use public transport when travelling to conferences and events
- Introducing diesel pool cars and Combo diesel vans onto the owned fleet
- Purchasing a 'blue light' courtesy car, where the savings made on taxi fares exceeded the cost of the car in just a few months

- Using fuel cards to monitor budgets and miles

A best practice occupational road risk policy was also developed to spotlight driver health and safety. Driver handbooks, vehicle and driver document checks and online risk assessments have all been introduced and driver training is available for high risk drivers.

The green fleet journey continues

While the Trust has made great progress, particularly in relation to cost savings, it acknowledges there is still much to do. Determined to achieve existing carbon reduction targets, and move beyond them, Mr Johal has signed up to the Energy Saving Trust's Motorvate programme. By providing expert advice and robust monitoring of carbon reduction strategies, Motorvate ensures specific targets are met. Success is measured by a specialised accreditation process with bronze, silver and gold levels achieved as a result of the annual auditing of vehicle emissions. The Trust's journey started by establishing a baseline carbon footprint, setting reduction targets and identifying action areas but the objective is now to ensure initiatives deliver results.

Cost savings to benefit patient care

While cutting transport costs was the prime reason behind the Green Fleet Review, ultimately the main beneficiaries will be hospital patients and the environment. This approach is making major financial saving, that can be used to improve patient care. It is also anticipated that it will make all the reductions in CO_2 emissions that are expected of the Trust.

In recognition of their achievements, the Trust was named Winner in the Grey Fleet category at the 2007 Energy Saving Trust Fleet Hero Awards, in association with The Observer and Fleet News. Mr Johal was also named Fleet Manager of the Year in the sub-100 category at the 2008 Fleet News Awards .

Energy Saving Trust, 21 Dartmouth Street, London SW1H 9BP, Tel 0845 602 1425, www.est.org.uk

The Energy Saving Trust has a network of local advice centre which provide information and advice to individuals to help them to reduce their personal CO_2 emissions and fuel costs from transport. Information and advice is provided by a Department for Transport funded officer and covers smarter driving, vehicle choice and using the car less. Officers are available to support Trust in delivering these messages to staff.

19.3.4 Lease cars

Most public sector employers run lease car schemes. Eligibility varies from trust to trust but the most environmentally sensible approach would be to limit lease car provision to those staff that are genuinely essential car users. NHS Stockport has adopted this approach and has also limited staff choice to the most fuel efficient vehicles ie band A.

A number of trusts have adopted "Salary sacrifice" in relation to lease car schemes for staff (similar to the Cycle to Work Scheme). The Transport and Health Study group is opposed to the wholesale utilisation of lease car salary sacrifice schemes. In effect, such schemes provide cheaper car ownership. Some argue that it encourages staff to choose a more fuel efficient vehicle. That may be so, but it is also encouraging a sedentary mode of transport with consequential health impacts. There may be an argument for the restriction of such 'Salary sacrifice' arrangements to essential car users but it should be borne in mind that leasing a car through such a scheme is much more likely to have an impact on pension payments.

It is particularly galling that it is also possible to purchase car parking through a salary sacrifice arrangement. Needless to say, no such tax breaks are offered for train and bus ticket purchase. HMRC recently tightened up the rules which meant that tax free bus ticket purchase schemes have had to be wound up. It is clear therefore that much needs to be done so that the tax rules incentivise sustainable transport modes but not car use.

19.3.5 Public transport to health settings

Bus routes have seldom been designed to carry large numbers of people to and from healthcare facilities; even when they go nearby, they may not go into the site and may not run at hours needed by staff working shifts. As patterns of travel changes, with new residential areas and/or new destinations, bus routes need to be revised.

For example, Oxford John Radcliffe Hospitals NHS Trust, together with Oxfordshire County Council, set up and ran a bus service from a nearby park and ride car park. The service, that runs every 15 minutes, was so popular that it is now run by the council.[30]

19.3.6 Travel planning and provision of transport information

Travel plans were discussed in chapter 17, section 17.2. No matter how sophisticated car parking charging systems can be made, if they are not implemented with a comprehensive travel plan that includes incentives for other modes, any entirely justified rise in charges is likely to be viewed negatively by staff and public as being punitive. In 2001, 79% of NHS staff commuted by car or van, 12% used bus or rail, 1% walked, and 1% cycled.[8]

There are a number of examples within the NHS of excellent travel planning practice most notably Nottingham University Hospital Trust, where the travel initiatives include free Medilink - park and ride bus service (funded by car parking revenue) serving both sites (see Box 19.3), as well as large, secure cycle storage at the Queen's Medical Centre and work with Nottingham City council to ensure a range of cycle routes, some traffic-free, serving the site. In 2003, 9% of staff walked to work, 4% cycled, and 19% commuted by bus.[8]

Cambridge University Hospital NHS Trust (Addenbrooke's) set up a bus service commissioned and managed by the NHS. The trust lists all the ways that patients can access the hospital and includes information on how patients can claim discounts on parking fees. The trust has also provided improved cycle facilities and a car-share matching service for staff. Car use has fallen from 60% in 1999 to 38% in 2006, including 8% as car share. Improved bus services have doubled bus commuting by staff to 25%. A park and ride scheme aims to reduce car traffic in the vicinity of the hospital. Improved cycle facilities include 1,300 cycle parking spaces: the trust has the highest level of cycling identified in the country – 21% of people accessing the site, and 25% of staff.[30]

Newcastle University Hospital Trust provides discounted bus tickets for staff and initiatives to encourage cycling. However, such examples are the exception rather than the rule. Many travel plans are initiated in response to planning applications for hospital extensions being requiring an absolute or relative reduction in car parking spaces, either being of land use for the additional hospital facilities or as a condition of the local planning authority for permission to proceed. For example, Derriford Hospital on the outskirts of Plymouth was required by the city council to reduce demand for car parking spaces in the town and residential areas. A travel plan was developed to reduce single-occupancy car journeys by 15% over three years; ensure that patients and visitors do not spend more than 10minutes searching for a space at peak times; encourage an increase in the number of direct bus routes to the site; and reduce staff parking spaces per employee by 10% as staff numbers grow. Car parking charges were introduced as part of the plan, with free parking for night and weekend staff, disabled staff, volunteers, car sharers, and tenants of residential accommodation. The number of buses arriving at the site doubled, while the number of cars fell by 24%.[30]

Box 19.3 Case Study: Nottingham University Hospitals NHS Trust – Medilink Bus Service

Nottingham University Hospitals NHS Trust (NUH) is one of the largest acute teaching trusts in the country. It is made up of Queen's Medical Centre (QMC), Nottingham City Hospital and Ropewalk House, a facility in Nottingham City Centre where hearing services are based.

The Trust works in partnership with Nottingham City Council to provide the Medilink Bus service, a service that provides free travel for patients, staff and visitors between QMC and the City Hospital. The service was launched in September 2005, and since then, it has increased the number of passengers up to 1.2 million per year in 2010. The service is now very popular in the city and, as it is connected with the local Tram Service it also helps to facilitate travel to further areas of Nottingham City.

Different factors helped ensure the success of this service:

Location

Both campuses are located five miles apart and are near the city's Ring Road which allows a fast commute. The service route was designed to make the busses stop in strategic points for people collection, including park and ride sites.

Using pre-existing equipment

The Medilink bus service was created after the merger of QMC and the City Hospital in 2006 (when NUH was formed) to meet the travel needs between campuses and to complement the service provided by the existing fleet of buses. The logistics for the operation of the buses was already in place hence the transition to the service was smooth.

Partnership

The success of the Medilink Bus Service is a result of the strong partnership working between NUH and Nottingham City Council, which partially funds the service. The Council has supported the service by funding three brand-new buses for the launch of the service.

Different Problems, one solution

The Medilink Bus has provided a service for 1.2 million passengers during 2009/2010, a number that is constantly growing year on year. The commuting between campuses using the Medilink service saves the Trust a significant amount of money used on taxi fares. Additionally, it cuts by 50% the commuting time, making staff using it more efficient when managing their time. The service helps to cut carbon emissions. It is estimated that it saves 742 tonnes CO_2/yr.

Alberto Rodriguez Jaume, Environmental Services and Sustainable Development Manager. Nottingham University Hospitals NHS Trust

19.3.7 Car-sharing

As identified in section 19.3, driving is often the first choice for transport to and from work and may remain so for the foreseeable future. While this has some drawbacks, it is however possible to encourage more efficient use of the car by reducing the number of single occupancy vehicles through car-sharing. This can reduce carbon emissions, alleviate the pressure on parking facilities, decrease localised congestion and help to improve the health and well-being of the workforce.

Car-sharing offers a pragmatic and convenient alternative to single occupancy vehicles and can be a key component in an organisation's travel plan. By reducing the number of single occupancy cars coming on site, there is less demand for parking spaces at peak times and more spaces will be left available for patients and visitors.

While the adverse effects of motorised vehicles and a sedentary lifestyle have been explained in earlier chapters, people who car-share are likely to be more active during their commute to work than those in single occupancy cars. This is due to the fact that a convenient meeting point is likely to be a short walk away from home.

There are number of other health and social benefits to car-sharing. Driving can be stressful with 55% of employees stating that their daily commute added to the stress of their day.[49] Car-sharing at least a couple of times per week can help to reduce this. Stress can be reduced further with the social contact that sharing your commute can offer, especially by being able to discuss work with a colleague who can identify with your experiences. Car-sharing can also help alleviate social exclusion and can help people make new friends. It has also been shown that on those days when employees car-share they are more likely to leave work on time, which can help to achieve a healthy work life balance.

From a safety perspective car-sharing is also advantageous.[50] Studies have consistently shown that for drivers age 30 and older, the presence of passengers' decreases the risk of an accident. Safety can even extend as far as having someone else for company whilst broken down.

As there is a necessity to charge for parking and there are ever-increasing costs associated with car ownership and use, car-sharing offers a way of cutting costs for the individual. Car-sharing not only saves on petrol and parking but can also lessen wear-and-tear on a vehicle, reducing associated maintenance costs. Car-sharing can also be cheaper than other forms of transport.

One of the perceived barriers to car-sharing is what happens if your fellow car-sharer has some kind of emergency that would then leave you stranded at work, especially if there are other family members to be considered. A simple remedy to this is offering a 'guaranteed ride home', which ensures that everyone gets home safely. In practice, this has been used very successfully with only minimum costs to the organisation, approximately £100 per year per 1,000 employees. (S Billett, *lift*share, personal communication)

Other barriers to car-sharing can be the reluctance to give up the convenience of a personal car, and how it fits in with other commitments outside of work. However, in reality most staff could car-share at least a few days in each working week and this alone can have a significant effect on a hospital site. If a car-sharing scheme is actively marketed and there are some incentives offered such as the designated parking bays, it is possible for it to become normal behaviour.

With some car-sharing systems, it is possible to record and monitor the carbon emissions resulting from the journeys undertaken by those registered. The ability to monitor and ultimately reduce carbon means that car-sharing can become a component of NHS organisations' strategy for a carbon reduction policy (see Box 19.4).

Car-sharing has also been identified as being a viable method of transport for business travel, helping to reduce both the fiscal and environmental costs of staff driving cars for work. While existing car-sharing systems are not set up to deal specifically with business journeys, new applications are in the process of being developed. These will facilitate car-sharing as an alternative method of transport and help monitor and reduce business mile expense claims and environmental costs. For further information on car-sharing visit www.liftshare.com/nhs.

Box 19.4 Case Study: NHS Greater Glasgow & Clyde – Car-sharing

NHS Greater Glasgow and Clyde (NHS GGC) is the largest health board in the UK. With over 45,000 people employed at various healthcare and service facilities, they face transport-related challenges on a daily basis. Car-sharing is central to the reduction of single occupancy vehicles within the organisation.

Many of their acute hospital sites now operate on a managed car parking system, meaning that there is an increased requirement to provide real alternatives for staff. And having such a large and diverse workforce means that they often have staff based in rural locations, not well-served by public transport. For these people, car-sharing offers a realistic alternative to single occupancy vehicles.

Communication of the scheme has been extensive, with regular road-shows, promotional schemes, and information-based articles in staff magazines and on the intranet.

NHS GGC has also entered into a Carbon Management programme with the assistance of the Carbon Trust. Transport makes up over a quarter of all harmful emissions made by NHS GGC, and challenging yet realistic targets have been set to reduce these. Car-sharing plays a core part in this plan and has dual-priority status within both the Green Travel Plans and the Carbon Management Programme.

Winning the Health Facilities Scotland Energy and Environment Award 2008 was recognition of the success of the Travel Plans for their acute hospital sites. Dougie McIntosh, Travel Plan and Systems Manager for NHS Greater Glasgow and Clyde, said:

"I am delighted to be able to offer our staff a safe, reliable, easy-to-use system that brings benefits for the environment and the organisation, reducing single car occupancy and harmful emissions.
"The scheme has been very well received by our staff and word is now spreading that this is a realistic alternative to driving to work on your own. It provides opportunities to share your journey to and from work, between work sites and even socially - and because we have only our staff using the scheme, everyone has something to talk about!"

It is estimated that over the next 12 months that a total of 139,080 miles and 46.3 tonnes of carbon dioxide will be saved by NHS GGC car-sharers commuting to work.

19.4 Patient and visitor travel to healthcare facilities

The ease of accessing healthcare facilities depends on the location of the buildings, on the nature and severity of patients' conditions, and on their personal circumstances. Reaching an antenatal clinic at the top of a hill, accompanied by two children under 5y, will be difficult, particularly for pregnant women living two bus rides away – but it will be worse if there is no public transport serving the site.

Much of what has been written above about staff travel plans is also relevant to patients and visitors. Visitors made 70% of the 25 billion passenger-km travelled on NHS-related journeys.[8] Successful travel plans will generally improve access by public transport, as well as making walking and cycling easier and safer; car reduction will make parking easier for those patients and visitors who need to drive or be driven there.

19.4.1 Patient Transport Services and Health Travel Costs Scheme

Community Transport and Patient Transport Services

Community transport is an alternative to transport provided by the commercial and statutory sectors. It is described in more detail in chapter 20, section 20.4.

Non-emergency patient transport services (PTS) allow people to access outpatient and other services at NHS hospitals. A range of people use them, including the young and elderly, some of whom may have physical or other disabilities, and may be seriously ill or injured. Many of the users are vulnerable and depend on the free transport that they receive.

Poor access to health services because of a lack of, or infrequent, public transport, or high transport costs, is a major factor in social exclusion and rural isolation (see chapter 9). Free non-emergency PTS helps to overcome this problem. Other benefits can include increasing attendance rates at outpatients' clinics (by patients who might find it difficult to, or forget to, attend if the transport had not called at their homes). This can reduce hospital non-attendance levels and improve the effectiveness of treatments and the efficiency of resource use in the NHS. As transport may be required when patients are discharged from hospital, non-emergency PTS also helps to ensure that people leave hospital as soon as they are fit to do so, reducing bed blocking.

The basis for a link between Community Transport and Patient Transport Services can be traced back to the 2001 Audit Commission report[51] and handbook,[52] which contains detailed examples of good practice together with self-assessment checklists. It was intended to be useful both to those providing and those commissioning such services.

Although some hospital trusts provide non-emergency PTS in-house or use private sector providers, ambulance service trusts in England still provide or arrange the great majority of non-emergency patient journeys. English ambulance services:

● provide about 14 million non-emergency patient journeys a year, over 80% of all patient journeys made using ambulance services – this equates to taking on average nearly 30,000 people to and from hospital each working day; and

● spend about £150 million a year on non-emergency PTS. Expenditure on nonemergency PTS changed little, in real terms, over the 1990s as total ambulance service costs rose. Non-emergency PTS now accounts for about 20% of ambulance service expenditure compared with about 25% in the early 1990s. A (one-way) patient journey costs on average about £54.[53]

Research by organisations such as Age Concern, and the Commission's own focus groups, suggest that some non-emergency PTS remain insufficiently patient-focused and do not give enough attention to service quality. While there have been occasional criticisms of the quality of care during journeys by volunteer car services and taxi firms, most adverse comments have centred on the time taken to get to and from hospital (and the resulting length of the day at hospital), a lack of information about how long people will have to wait for transport, and on the waiting conditions at hospital. Complaints about delays and waiting are, commonly, linked to:

- block bookings for some appointments (for example, for day surgery);
- operational constraints, which mean that non-emergency PTS arrangements for a day are normally decided only on the preceding working day. This is because most day's pick-ups contain a mix of long established clinic appointments, known well in advance, and others made at short notice. This leaves insufficient time in which to notify patients of realistic pick-up times;
- consequently telling everyone to be ready by the earliest possible pick-up time (for example, telling everyone with a 10.00 appointment to be ready by 8.30, even though

only the first patient will be picked up then and the last one on a particular route may be collected an hour later). Offering the same pick-up time to everyone means that many people wrongly believe that their transport is late. Some patients become anxious believing that they will miss their appointment; and

- difficulties predicting when patients will be ready to return home. Allocating patients to vehicles in ways that use resources efficiently on return journeys may mean long delays for some as they wait for the last person who is to travel on their vehicle to be seen in clinic or to finish their treatment. Delays in treatment due to late arrival also impacts on return journey arrangements.

Within hospital trusts, non-emergency PTS is often commissioned by staff responsible for ancillary services, such as property management and laundry. This reflects the low priority and low status of the service; it is often wrongly viewed as a non-clinical service that can be 'purchased' rather than 'commissioned'.

NHS Guidance requires provision of transport to and from hospital is provided free of charge when patients have a medical need, although they can be charged when the transport is provided for social reasons. Eligibility should normally be decided by individual GPs when referring a patient to the hospital, or by consultants within hospital trusts. However, many involved with non-emergency PTS in both ambulance services and on the administrative sides of hospital trusts are concerned that:

- some free transport is sometimes being provided for 'social' rather than 'medical' reasons: to people without a medical need for free transport but who have no car, are not served by public transport, or who have mobility problems that require the use of accessible transport;
- non-emergency PTS is being abused by some users, who have reasonable disposal incomes and/or their own cars, but who use the service to save on travelling costs or car parking fees at hospitals;
- those who authorise use of non-emergency PTS rarely consider the cost implications of their decisions and are unwilling to refuse patients' requests for transport; and
- in practice, most GPs delegate the decision to their receptionists, and many hospital clinicians delegate it to nurses or other staff.

Demand management for nonemergency PTS is generally undertaken but the uncertainty about eligibility means that this is approached differently across the country: people with similar conditions and circumstances are treated differently depending on where they live. In some areas, demand management is relatively informal, reminding GPs and hospital consultants with high usage of the guidance on eligibility and about the cost of non-emergency PTS. In some hospitals, individual clinics have prepared local criteria for their own use. In other cases, ambulance services and hospital trusts have consulted formally with stakeholders about how to interpret the guidance.

Despite the high unit costs of providing PTS services identified by the Audit Commission (four to five times normal community transport trip cost rates in 2001) and the call for more joint commissioning and innovative working, the intervening nine years have seen little involvement of Community Transport in Patient Transport Services. Despite this, community transport schemes have experienced increased demand for their services as PTS Qualification Criteria have been tightened by PCTs and Trusts in their efforts to reduce the level (and costs) of provision, thus "cascading" many PTS journeys on to CT services. Unfortunately, this shift in provision has not been accompanied by a movement in funding, so in many cases the community transport sector has been unable to cope with its limited resources, resulting in patients being left only with highly-expensive taxi travel as an alternative to the previously-provided free PTS services. This phenomenon has been particularly acute in the case of patients who are also wheelchair users, as conventional taxis offer no alternative to a wheelchair-accessible minibus for a user of a powered wheelchair.

The almost ‘monopolistic’ use of Ambulance Trusts for the provision of PTS contracts identified by the Audit Commission Report has continued (with one or two notable exceptions) which has in turn exacerbated the pressure on cost reduction and the resultant tightening of qualification criteria.

Offsetting this has been an acceptance of the role of the community transport sector in the context of the Healthcare Travel Costs Scheme.

19.4.2 Healthcare Travel Costs Scheme

In certain circumstances, patients and visitors can reclaim the costs of their travel to and from healthcare facilities. In April 2010, updated guidance on the Healthcare Travel Costs Scheme was published for PCT CEs, NHS Trust CEs, SHA CEs, Care Trust CEs, Foundation Trust CEs , Directors of Finance, Communications Leads.[54] This updated guidance also covered the use of this scheme for paying for community transport. It stated:

“Community transport or community car schemes provide transport for people who are unable to use, or have difficulty with access to, public transport and who are thus unable to make use of concessionary fares. Local authorities and community transport groups will be able to provide details of schemes available locally. Schemes do vary, in terms of both the population groups they serve, the area they cover and the rates that they charge. For example, some schemes set a fixed price per journey, whilst others charge a set rate per mile or rely on donations or voluntary contributions.

“Provider units should reimburse people for the use of community transport/car schemes (excluding any annual “membership” fees charged by the scheme’s operator). Patients should ensure that they obtain a receipt from the driver for each journey made using this type of scheme”.

Box 19.5 Case study. Use of Healthcare Travel Scheme (HCTS) for community transport

Barney is a retired printer living in Shropshire. He receives Pension Credit Guarantee Credit, making him eligible for help via HCTS. His arthritis is getting worse so his doctor has arranged for him to see a rheumatologist. The local bus service runs to a neighbouring town, where Barney has to change buses again to get to the hospital. His arthritis means walking is painful and he finds it hard to stand at the bus stop for the 20 minutes until the connecting bus arrives. A local charity runs a voluntary car scheme, which will take Barney directly to the hospital and back home again after his appointment. They charge 20p per mile.

In this instance, public transport is not feasible because Barney will not arrive in reasonable time, or in reasonable comfort. The journey will aggravate his arthritis and cause him considerable pain. The hospital should reimburse the cost of the voluntary car scheme. This is the best option for the patient, and it is likely to be cheaper to reimburse 20p per mile for a relatively local journey than two separate return bus fares.

There are a number of examples of the NHS working with community transport to improve access to healthcare for patients.[55] There is both a need (the high cost of PTS provision and the consequential costs of *not* providing access to health) and a willingness (on the part of the Community Transport Sector) to find innovative and effective solutions to the problem of how to provide transport to healthcare and this should not be restricted to the trips deemed by health authorities to not qualify as having a clinical need. Best Practice examples clearly demonstrate that the Community Transport sector can provide an alternative to the high-cost provision of PTS services whilst maintaining high quality service provision.

Key to increased use of community transport is *the procurement process*. Frequently, transport contracts let by public authorities are based on a prescriptive model of inputs and outputs – a certain number of vehicles delivering a certain number of journeys along a given route.[56] Although such an approach can incrementally reduce costs through competition, it does present transport commissioners with several challenges:

It is profoundly tactical: the commissioning role in public services can be visionary, helping to shape the citizen's experience of their community and their environment. Commissioners may struggle to reach for the strategic issues if their procurement model embroils them in discussions about tyre specifications.

Procurement on outputs locks out innovation: for most questions, there is more than one answer. Over-specifying contracts means there is no chance to consider bold new approaches that might dramatically cut costs, improve services, or even manage both at the same time.

It can lead to a 'race to the bottom' for service quality: the only dimension for the supply chain to compete on in an over-specified contract is price. After a point, this becomes counter-productive for service quality, as the supply chain does not invest in vehicles.

It can be expensive and time consuming to administer: once you have procured at a high level of detail, the measuring of the outputs from inputs can be an enormous tactical task.

The alternative model is to commission on outcomes, not inputs and outputs. In this scenario, the transport commissioner steps back and commands the supply chain: 'This is the outcome we are after – solve the problem!'. So "I'll have however many buses of a certain size, stopping here, here and here at these times", becomes "I have 400 patients needing to get to hospital 'y' for appointments at these times".

There are three reasons why outcome based commissioning is more likely to foster innovation:

Change is incentivised, rather than disincentivised: if you are not prescriptive about the solution, then the supply chain has the incentive to solve the problem in an entirely novel way, with the potential for order of magnitude savings.

It is purposeful:– new ideas do not flourish internally or externally when the reasons that underpin an approach are unclear or limited to simple custom and practice.

It fosters dialogue and long term partnerships, rather than command and control. This means the potential for finding further innovations together increases over time.

More often than not, PTS services are commissioned by procurement agencies within the health sector which are remote from those who will be on the 'receiving end' of the services being bought-in. The procurement agency sticks rigidly to the specification and therefore alternative (or innovative) ways of delivery are dismissed as being inappropriate. The result is that the pattern or organisation of services remains static and incapable of responding to changing consumer demand.

There therefore needs to be a fresh approach to the commissioning of transport to health which concentrates on outcomes and allows innovation. Such an approach can potentially have the dual benefits of reducing costs of delivery whilst improving the quality (and even the scale) of the transport service. An example of this would be a PTS system which operates like a community transport Dial-a-Ride service, providing transport to health throughout the day rather than (as is the case with many PTS services) delivering all patients to the hospital at the same time in the morning and then expecting them to wait until their appointment time arrives, with the same process in reverse when the patients need to be taken home. Such a service could cater for a range of passengers, including visitors, and thereby be both more convenient for the end user and cheaper to operate as it benefits from the fares income from other users.

Community transport is well placed to provide such innovative ideas and has the experience to deliver on the scale required. The biggest hurdle is simply starting the dialogue.

19.4.3 Benefits of providing accessible transport to health facilities

The benefits of providing accessible transport in order to allow people to access health facilities have long been recognised. The Joseph Rowntree Trust report[57] identified that there were a range of services or activities where accessible public transport could be expected to realise cross-sector benefits. These included:

- Chiropody,
- General Practitioners,
- Domiciliary Care,
- Patient Transport Services,
- Preventative Healthcare.

The Report contained a range of potential national annual benefits based on Low, Medium and High forecasts valued at £256m, £582m, and £1,161m respectively. These figures can be doubled to express them in 2010 prices.

More recently, in 2004, a Report commissioned by the Countryside Agency[58] identified considerable secondary evidence, and some primary evidence, of 'transport to health-care' schemes achieving *direct* savings in health sector budgets or time inputs, or contributing to NHS targets in the following areas:

- **Freeing up beds:** Use of community transport schemes can form part of a hospital's discharge strategy. A case study of the Cornwall TAP scheme by NERA/MVA for the Department for Transport estimated the financial cost of bed blocking at £300-400 per day, for surgical and medical beds respectively.

- **Reducing 'Did Not Attends':** DNA rates for hospital appointments are typically 5-15%, and the cost to the NHS of a missed appointment has been estimated at between £65 to £100). Sources differ widely (10% to 69%) on the proportion of DNAs attributable, directly or indirectly, to transport problems. For the Norfolk and Norwich University Hospital Trust, a total of 30,331 appointments were missed in the year 2003/04. If even 10% of missed appointments were transport-related, this would represent 3,033 missed appointments, at an estimated cost of between £197,000 and £303,300 per year. However, some trusts are adopting a strategy of routine overbooking. This reduces the immediate cost of DNAs but does not deal with the health consequences of missed appointments, either for the patient or the health service.

Reducing costs through early treatment: Diabetes is cited as an example of a serious medical condition for which late detection or poor management can result in severe complications, including blindness and limb amputation. Around 5% of total NHS resources and up to 10% of hospital inpatient resources are used for the care of people with diabetes. The presence of diabetic complications increases NHS costs more than fivefold and increases by five the chance of a person needing a hospital admission. One in 20 people with diabetes incurs social services costs and, for these people, the average annual costs were £2,450 (1999 prices). The presence of complications also increases social services care costs fourfold. The same principles apply to other medical conditions, such as cancer.

Contribution to NHS targets: Transport initiatives can contribute towards achievement of targets for waiting lists, access to a GP, health inequalities, patient choice and patient & public involvement.

Additionally, Stakeholders consulted during the study felt that health-outcome-related benefits from transport initiatives were perhaps more important than direct benefits, although they are more difficult to measure. These *indirect* benefits included:

- **Improved health outcomes from earlier detection and treatment:** As noted above, both physical and cultural barriers can hamper access to health-care in rural areas. There is evidence in academic literature that people living remote from cancer centres tend to be diagnosed later (and with more advanced cancers) than those living close to such centres. Their prognosis may consequently be worse. Other studies show that people with coronary heart disease or asthma symptoms are less likely to visit a GP to report symptoms if access to a GP is difficult. In Newark and Sherwood and Denton, easier transport encouraged elderly and isolated people to seek medical advice from their GP – or attend preventative health-care sessions - when they might otherwise not have done so.

- **Reduced health inequalities:** Research by the University of East London Transport Studies Unit reported that those at risk from social exclusion were most disadvantaged in accessing health-care.[59] Nearly all of the case studies reviewed in the study are targeted primarily at people who are socially or economically disadvantaged, including elderly people, those with care responsibilities, those with mobility difficulties, people on low incomes and those without access to a car. These schemes are therefore well placed to help reduce health inequalities.

- **Mental health benefits of reduced isolation:** There is strong anecdotal evidence from health practitioners and transport providers of the mental health benefits of 'getting out', particularly for elderly and infirm people and others at risk of isolation. A number of broad-based transport schemes play an important role in providing social contact for their users. There are even reports of people using the bus simply for social contact, or changing their shopping habits to increase the chance of meeting people. Several health-specific transport schemes were also reported to provide important social and mental health benefits to users, both through the development of a relationship with a regular driver and through access to support groups and other activities that reduce isolation.

- **Reduction in stress associated with difficult journeys:** Travel to health facilities, and particularly to hospital, can involve a great deal of stress for vulnerable patients. Travelling by shared ambulance or ambulance car can involve long, exhausting journeys, and can exacerbate certain medical conditions because of the ride quality. Many voluntary car schemes are particularly effective at providing shorter journeys and one-to-one support to vulnerable patients, as the driver will usually accompany the patient into the hospital and wait to pick them up after their appointment. Hospital bus services can also play a major role in alleviating stress, obviating the need for long, inconvenient journeys by public transport or expensive taxi trips. Some users are car drivers who have difficulty finding a parking space at the hospital, especially one close enough for a comfortable walk, and prefer to travel by bus.

- **Benefits of hospital visiting:** Transport for hospital visiting can pose a serious problem for patients and their families, particularly in the evenings and at weekends. Anecdotal evidence suggests that visiting has a significant impact on the mental wellbeing of the carer as well as the recovery of the patient. There has been little research into the effects of visiting on long-term health outcomes, but there is some evidence that hospital visits can have short term beneficial effects on certain medical symptoms. The case studies emphasise that transport for hospital visiting is a priority issue in some areas, particularly rural areas where patients are often referred to hospitals outside the district. Several of the case study schemes provide transport for visitors, enabling more frequent visits and saving expensive taxi fares.

Enabling people to live independently at home for longer: The Audit Commission found that 55% of local authority expenditure on services for the elderly was spent on residential care, although this represents only 2% of the total number of people of retirement age. Cranfield University and MVA estimated that deferring or preventing a transfer to residential care saves local authorities £5,000 per year per person. There is anecdotal evidence from users of Project Switch that the project helps them to maintain their independence, by providing access to a range of local facilities including health services, social care and – where appropriate - shopping.

Although these studies demonstrated the theoretical financial and social benefits which improved transport to health could provide, they did not offer practical solutions as to how they could be achieved. As a result, despite the potential benefits having been identified some 20 years ago, steps towards achieving the cross-sector benefits of improved Transport to Health have been few.

However, recent innovations in the provision of transport services to health facilities have the potential to release this potential. A number of them are identified in a report published in 2010.[60] This project was part of a wider programme that examined the ways in which public sector organisations plan, process and operate passenger transport services in such a way as to be efficient and promote accessibility and social inclusion. It extended beyond the role of local authorities and included NHS agencies in the procurement and operation of non-emergency patient transport. Initially, through the NPTMG, a number of primary care, acute and ambulance trusts were engaged and representatives of these joined with local authority transport professionals to form a working party led by the North West Regional Centre of Excellence (NWCE) transport programme director. This group examined the opportunities for partnership and integration in the provision of patient, client, education and general passenger transport.

During the course of this work it was recognised that many health service locations have been planned - in terms of both location and site design - with little regard to the ease, or even the possibility, of access by patients without access to a car. Additionally, an absence of integration between trusts and local transport authorities in most areas has resulted in:

A) Additional unnecessary costs due to:

- duplication of resources;
- inefficiencies in procurement and planning; and
- many patients using higher specification/more expensive transport than they need.

B) A poor service to the public with little planning to optimise access for those who have difficulty travelling to their health care.

It identified that the Third Sector (primarily Community or Voluntary Transport) can play a significant role in local authority and health sector transport provision and recognised that it often provides a safety net for people who would otherwise have no means of access to a health appointment. It concluded that a small level of support for core costs can result in a substantial return in relation to provision of transport for individual needs across a wide area.

Whilst it recognised that smaller community transport organisations, providing valuable local services, might not want to expand into partnership in integration projects, it stated that there is considerable potential for growth of the third sector role in partners and can deliver wide-ranging User benefits such as by:

- Maintaining and assist client independence by greater range and provision of transport options
- Improving accessibility and social inclusion.
- Providing a single point of access for information and booking.

- Providing a seamless client booking process for transport provision.
- Supplying quality vehicles for transporting users, with the opportunity for standardisation (eg accessible taxis, low floor minibuses).
- Ensuring the use of trained professional staff.
- Enabling transport availability and quality improvement to reduce accident rates.
- Improving public access to information on all transport options to their care.

Additional Environmental benefits identified included:

- Reduction in emissions through improved utilisation of transport resources for completing journeys i.e. higher vehicle occupancies reducing "dead" mileage.
- Reduction in private car trips and hence congestion where group transport is available.

The Report made the following Strategic recommendations:

1) Local Authorities and NHS Agencies

Should recognise the benefits, especially in terms of financial savings, of an integrated approach to passenger transport planning procurement and provision, and should establish partnerships to facilitate this approach.

2) Government Departments

Should recognise that this is a cross-sector issue to be addressed at a local level, but which requires a joint view at government level. The respective government departments should actively encourage and support local authority/NHS agency partnerships, with pump-priming funding where necessary.

3) Commercial and Third Sector

Providers should recognise the need for brokerage schemes. In particular, suppliers of the essential IT software should ensure that their products can interface with partnership arrangements and with other, relevant, public authority support systems.

It summarised the current situation as follows:

"The nature of demand for transport to meet health, education and social care requirements is changing. On the one hand, hospital based health facilities are becoming concentrated in larger units, while supportive facilities for health and social care are becoming more dispersed into smaller, community-based units. Also greater opportunity for choice is available in care and education provision.

This has fundamental implications for patient, client and student access, especially as front-line delivery of education/child services, adult care services and health services are, increasingly, working towards closer integration. In this context, the integration of transport services providing access to these front-line services is becoming more essential. In addition, government policies on social inclusion and accessibility require extensions of the general public transport network.

Patients without car access are as important as those with them but, unless this is recognised and addressed, poor access to health services by organised passenger transport will continue to result in a two-tier health system. While health trusts, understandably, wish to concentrate their efforts and funding into advancements in clinical care, poor access means that while those patients who have access can enjoy improving clinical care, others without access frequently may not enjoy even basic levels of health care, let alone any advancements. This can only be addressed by placing a high priority on improving transport, to improve efficiency and to ensure access for all through an integrated approach."

In support of those conclusions, the Report provided examples of successful Joint Working and Integration at a range of locations.

19.4.4 Active travel

For some patients and more visitors, active travel will be a feasible method to access healthcare, subject to certain circumstances. Apart from distance and location, the availability of bike parking facilities is key to encouraging cycling, while the presence of pavements, with wide, smooth surfaces free of clutter; adequate signposts; and suitable, direct routes are crucial for encouraging walking to and from the site.

19.5 The role of the NHS as a local strategic partner advocating for the creation of active travel-friendly environments

Public health includes communicable disease control and other health protection activities, screening and other preventive health services, needs-based evidence-based advice on the pattern of provision of appropriate healthcare services, informing the public about how to improve their health, and carrying out appropriate marketing of healthy lifestyles. However, the key task for public health is influencing other sectors to enable and support them to address the wider determinants of health. The last of these tasks is extremely important and is a major element of public health practice. This understanding has taken decades to truly develop within health policy, from the time of the Declaration of Alma-Ata International Conference on Primary Health Care in 1978[61] and the subsequent Ottawa Charter in 1985.[62] The Declaration of Alma-Ata stated that:

> *'The Conference strongly reaffirms that health, which is a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector.'*[61]

In England, the role of public health departments has been enhanced in recent years through the joint appointment of directors of public health between local authorities and the local NHS.[63] This itself has provided the foundations upon which stronger intersectoral collaboration across a range of public policy areas can be developed and expanded. Although important, this is insufficient; to be effective it will require, among other elements, an expert team 'behind' the Director and a recognition of the legitimacy of public health involvement in areas that have not traditionally been seen as "health". It is also important that directors of public health are seen as having an independent professional duty to the health of the people and are not merely corporate representatives of local authorities and the NHS.

The NHS has an advocacy role to play, especially through public health. The NHS can provide robust evidence of effectiveness and impacts on health, which tends to be missing from the carbon- and congestion-focused assessments usually found in transport planning. Additionally, the NHS can press and support local highway authorities to develop health-promoting transport policies and practice. Local Strategic Partnerships or similar also provide a starting point for collaboration but again are in themselves insufficient.

With regards to collaboration on transport and health, effective collaboration is still far from the norm despite good intentions. In England, a few primary care trusts (PCTs) have established strong links with their co-terminous local authorities to the extent that PCTs have funded posts for public health specialists to be located within the transport planning or planning departments (eg Bristol, Stockport and Coventry) but these are exceptions. In Scotland, a number of health boards have jointly commissioned work with local authorities to assess progress to promote active travel. Examples of PCTs engaging with local authorities regarding the policies in their Local Transport Plan however are rare.

It is essential that public health professionals engage with local authorities particularly during the development of local transport plan and local development frameworks to ensure that relevant NICE public health guidance is incorporated into such plans. A checklist has been developed by NICE and the Centre for Public Scrutiny with respect to NICE Guidance on Physical Activity and the Environment.[64] Professionals, elected members and the public can use this to assess how plans and policies conform to such guidance.

Core roles for public health departments with regards to transport planning are therefore likely to need to be:

- Establishing mutual trust at all levels and prioritizing support within transport planning at Officer Tiers 1 - 3I in terms of decision making and legitimacy – and aiming for placement of public health staff within transport planning.

Articulating and explaining the multiplicity of health impacts beyond the acute and the urgency to address the disease burden from transport including weight gain and how these are co-benefits[65] to many transport goals, including sustainability and reducing carbon emissions.

Advocating the need to increase walking and cycling levels across the social gradient in order to reduce the disease burden and help tackle health inequalities and providing specific evidence of effectiveness of interventions (eg NICE Guidance 8[35] and 17[66] to promote physical activity and NICE Clinical Guideline 43 on the Prevention and Management of Obesity[33]).

Providing evidence-based guidance on a regular basis (eg Bristol City Council[67]).

- Ensuring that public health specialists are able to contribute to and comment on proposed major transport policy and practice interventions.
- Act as a 'Critical friend' - challenging ways of working in a constructive dialogue of support.
- Seek to establish jointly funded projects – potentially with a local university as a third party (eg Knowledge Transfer Partnerships).
- Overall, helping to facilitate changes in transport planning priorities to implement active travel interventions as the major programmes in developing supportive environments based on a low carbon economy.

It is however worth noting that unless the NHS itself practices what its public health advocates preach, eg being an exemplar employer regarding travel, adherence to relevant NICE Guidance, working in partnership to improve sustainable transport access to its sites, and taking into account fully the transport implications of future service configurations, many local authorities may not take what such advocates say very seriously and therefore influence on local transport policy will be limited.

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20 Other strategies for a healthy transport system

Original chapter by Julian Hanna, Steve Morton & Stephen Watkins; updated and expanded by Stephen Watkins, Jennifer Mindell & Barry Connor

20.1 Planning and development control

20.1.1 Spatial planning

As was stated in chapter 2, section 2.2.1, mean population weight is 6lb lower in areas with good pedestrian permeability.[1] A 6lb difference in mean population weight is important – equivalent to a death rate of one per 1,000 per annum. Pedestrian permeability should not, therefore, be lightly sacrificed. For example, some police architectural liaison officers argue against pedestrian links for crime prevention reasons. These arguments can seem compelling if the health implications seem minor or theoretical, but are obviously less important than the health issue when the health impact is large. For example, Home Office guidance on Alleygating commends as an example of good practice a local authority which had closed a pedestrian passage that was being used for young people to gather and engage in minor antisocial behaviour. This closure affected walking routes to local shops but the Home Office commented that the diversion was "only" 450metres.[2] For many people, the distance they are willing to walk is about 1km (less for many elderly or disabled people) so a diversion of about half that length will seriously reduce walking. Some local authorities have therefore not proceeded with gating alleys because of concerns about reducing walking,[3] although this effect of alley gating is not mentioned in Home Office advice to the public.[4] A walkability index has been developed in the USA.[5]

Chapter 5, section 5.3 described the evidence for the effect of traffic volume and speed on community severance and the use of streets for social and communal purposes. Traffic is also a major deterrent to cycling and to walking, particularly regarding crossing roads. No new developments should be allowed to create the situation of a steady flow of traffic in a residential street. There should be limits to the number of houses that can be accessed via any residential road. Industrial developments or other developments generating high traffic flows should have their own access roads and not be accessed through residential neighbourhoods. If this necessitates placing car parking some distance from the development then so be it – this will also promote walking.

Spatial planners should ensure that residential streets do not become thoroughfares carrying long distance traffic, as is currently often the case in rural areas. Where this has occurred it should, if possible, be reversed by closing the street to through traffic but in some situations where it has already happened, the situation may be irreversible. For example, many cities have houses lining the main roads into and out of the city, as do most villages. If the road is wide enough to segregate part of it as an access road it might be possible to separate this from the main road by a hedge or even a glass barrier similar to those used alongside a motorway that runs through a residential area in Dordrecht, creating effectively a lightly trafficked street alongside the main road. It is plausible that social interaction similar to that achieved in quiet streets can be created by use of communal gardens. Sometimes pedestrian access to the houses can be relocated to the back. In irreversibly heavily-trafficked streets close to town centres. it may be that houses as they become empty should be turned into shops, offices or housing for temporary use such as holiday lets.

Spatial planners should ensure that there is a high frequency public transport network and that development is designed to make use of it. Development should also be designed with cycle and walking access strongly encouraged. Spatial planning can make the largest contribution to the distances travelled to access goods and services. Residential areas located at a distance from commercial districts, entertainment areas, shopping precincts, all separate from each other, are not conducive to walking and may not be feasible for cycling. Keeping distances short has sound economic and environmental reasons but also promotes social inclusion. This requires both mixed developments and increased density.[6]

Parks and greenspace are important contributors to walking and so is the retention of city farms or country parks within the city. Living walls (walls with plants climbing up them), green roofs, green security (thorny hedges rather than metal fences), gardens and street trees should all be encouraged by spatial planners for a number of reasons. They contribute to overcoming the urban heat island effect, there is increasing scientific evidence that they improve health directly by promoting tranquillity, but they also make pedestrian routes more attractive and therefore more likely to be used.

20.1.2 Local Transport Planning

The promotion of walking and cycling (active travel) is an essential part of the strategy to address obesity, mental health, and osteoporosis (see chapter 2). The contribution it can make is substantial and it should be seen as lifesaving and a core public health goal. As an indication of its significance, lack of pedestrian-permeability raises death rates by one per 1,000 per annum (equivalent to one extra death every 10 years in a population of 100, which could be as few as 25 to 30 houses).

Key policy measures to promote active travel include infrastructure and the physical environment; information, education and marketing ('smarter choices'); partnerships; commitment to and resources for the plan; and evaluation and monitoring. Promoting cycle-friendly streets and road design using the 'hierarchy of provision', combined with measures to reduce the speed and volume of motor traffic, are necessary to increase the attractiveness of cycling as a travel mode and divert drivers out of their cars.

Reducing the use of the private car contributes to addressing climate change.

The Downs-Thompson Corollary of Pigou's Theorem shows that once the road system is saturated road congestion will be influenced most by the availability of alternatives to the car as this provides an additional alternative to using a car or not travelling and therefore raises the equilibrium speed at which congestion leads people to make a decision not to travel. Hence expenditure on roads is wasteful and useless. Downs and Thompson specifically advocated investment in public transport but for reasons described above this is a limited perspective and to address congestion local transport planning needs to focus on the development of walking, cycling and public transport and do that in parallel with the spatial planning measures listed in section 12.11. A typical road lane can carry seven times as many bicycles as cars.

The promotion of walking requires attention to pedestrian needs in relation to road crossings, junctions and the like. People will walk further if routes are attractive so the development of an aesthetically attractive network is important.

20.1.3 Development Control

Development control needs to be deployed to address the above objectives. There is no point having a local transport plan emphasising walking, cycling and public transport if developers are routinely asked to pay for road improvements and are rarely asked to contribute to developing walking and cycling networks. There is no point having a spatial plan which emphasises local facilities if centralised facilities are allowed to expand and develop without taking steps to establish local outposts. There is no point having a walking strategy which calls for the creation of walking networks if planning applications are approved which close pedestrian routes without adequate replacements or which build loop and lollipop cul de sac designs without pedestrian interconnections to make the area pedestrian-permeable.

The replication by Hart of the earlier study by Appleyard & Lintell now makes it clear that that traffic in residential streets diminishes social support networks amongst residents and also leads to a lack of sense of possession over large areas of the street. The implications of this are very serious – social support is a major factor reducing mortality while areas of street over which residents do not feel possession will increase crime, disorder and vandalism. It should now be regarded as unacceptable for a residential street to have a steady flow of traffic and development control must prevent any further such situations on new developments. They should limit the number of houses that can be accessed by a residential road either by preventing houses being built on the access road or by requiring large developments to be broken up into residential cells with multiple accesses and no through vehicular routes (although there should be through cycle and pedestrian routes). They should prevent existing residential streets being used as access routes to developments likely to generate substantial traffic, even if this means that parking for the development must be some distance away. This principle should be seen as a high priority and not lightly sacrificed to conflicting considerations – the time may well come when we will see houses built on heavily trafficked roads as unfit for human habitation.

Development control officers have to weigh conflicting considerations and it is important that the development framework emphasises the priority to be attached to the above strategies. Often development control officers are blamed for failing to enforce the above strategies when, in reality, they have not been provided with the clear policy frameworks that would justify them so acting. In order for development control officers to act as enforcers of local transport plans, spatial plans, and traffic-free residential streets, the plans need to be clear and unequivocally incorporated into the policy framework applicable to the development control process.

The power of development control was undermined both by the Thatcher Government and the Blair Government. The former imposed a presumption in favour of development which diminished the power of development control to pursue desirable and preferred development instead of simply judging what was laid before them. The latter established a strong drive to make decisions to fixed timescales so that many planning departments shifted their role effectively to making defensible decisions within those time limits rather than taking the time to get decisions right. At the same time an increasing tendency to award costs at planning enquiries made it difficult for planners to listen to communities – indeed it was even sometimes suggested that commitment to the views of a local community was an improper bias.

The present Government is committed to giving more power to local communities and this might empower Development Control officers to support local communities in shaping patterns of human settlement, regaining in the process much of their lost vision and purpose.

20.1.4 Less Road Building

The belief that road building relieves congestion and stimulates economic regeneration is not supported by the evidence[7] [8] [9] (see chapter 10). In fact road building generates traffic,[10] increasing road use by as much as 8-10% per year[11] until congestion, possibly on other parts of the road network, is undiminished. Then there may be demands for yet more road building. This is self-defeating and damaging to the public health.

Decisions regarding investment in public transport and new roads should use comparable criteria. These should monetarise all social and environmental costs and benefits, including effects on pedestrians and local employment. As discussed in section 20.7, such comprehensive cost benefit analysis would result in more investment in public transport and less in road building.

The decisions should also be made together. Often they are made separately so that roads are built because rail planners are not engaged. The idea of a rolling motorway through the Woodhead tunnel instead of the damaging road improvements planned[12] [13] is a classic example of an idea which was difficult to advance in a system where rail and road planning are completely separate.

Indeed, looking to the future, it is questionable whether road building ever makes sense now that it is vital to start to reduce the role of the private car and lorry. It is like investing in an ostler's business in the 1830s: it may have seemed sensible, it may even have met short term economic tests, and no doubt many people did it. But actually it was taking passage on a sinking ship.

20.2 Traffic Education

Traffic education is broader than conventional road safety education. Traditionally road safety education has consisted of teaching children to avoid road safety risks. Traffic education is a broader concept that aims to promote safe and healthy traffic behaviour. It covers the promotion of walking and cycling as well as the avoidance of traffic risk and it aims to ensure that coming generations will be more responsible as road users (and even use them to educate their parents).

20.2.1 Traffic Education in Schools

Schools have a number of roles in traffic education. They should set a good example by having a School Travel Plan. Safe Routes to Schools should form part of this.

Schools should:

- incorporate teaching about the causes of congestion into physics and geography courses and teaching about the health benefits of physical activity into biology courses;
- teach about climate change;
- offer cycle proficiency training; and
- teach children about avoiding traffic dangers and in this teaching they should include detecting the presence of traffic, visual timing judgments, coordinating information from different directions and coordinating perception and action. Latvia combines teaching of safe stopping distances and practical teaching of visual timing judgments with scientific teaching about the forces involved in road crashes.

Based on previous research Thomson, Tolmie, Foot & Maclaren advocate that pedestrian training should cover safe place finding, roadside search strategies, visual timing and gap selection and perception of other road user's intentions.[14] Zeedyk, Wallace & Spry say that motivating children to observe, investigate and learn can also contribute to pedestrian training.[15]

Innovative teaching methods can be used. For example, the DfT's experimental Neighbourhood Road Safety Initiative tried out a number of pilot ideas including the use of art and theatre in education and produced some educational material.[16] Simulation has been shown to be effective.[17] [18] [19] [20]

The involvement of parents is also useful, as children copy their parent's behaviour. It is important to persuade parents that bringing their child to school in a car risks childhood obesity and also hinders their acquisition of traffic skills, thus endangering their safety. Walking buses (groups of children walking to school with guides or stewards – perhaps provided by the school or perhaps by a rota of parents) can involve parents.

20.2.2 Training Teachers in Traffic Education

No country in the EU trains teachers in traffic education. Even in road safety education alone, only Denmark has an effective system. Denmark requires one designated teacher in each school to attend a three day course and these teachers form a network of contacts.

Austria and Spain commit about 20 to 30 hours of training in road safety education in the training of nursery teachers and Bavaria gives road safety education training to all teachers in vocational schools. Otherwise throughout the EU, training in road safety education is offered voluntarily only to those with a special interest and only once. It is not surprising that schools do not play their full part in road safety education given this lack of professional emphasis.

The Danish approach is commendable so far as it goes and we believe it should be followed in the UK but expanded to cover traffic education rather than just road safety education.

20.3 Maintaining Public Transport Safety

We discussed the causes of transport-related injuries in chapter 4. Sustained pressure from regulatory authorities has steadily made public transport safe. The work of the Railways Inspectorate represents over a century of progressively analysing rail safety and introducing fail safe systems which understand both human frailty and technical limitations. This good crash record of public transport must not be compromised by financial pressures to cut costs. Indeed our fundamental argument in the preceding sections is that similar measures should be applied to roads.

However, at the little used margins of the system, there is a danger in rigidly applying strict safety standards designed for the heavily used core system. The effect of doing so would be to lead to many services being withdrawn or alternatively to pre-empt resources which could be used on expansion of the system. Overall transport safety would therefore be diminished by shifting to less safe modes of transport. At the time of the first edition of *Health on the Move*, the THSG was concerned that some community minibus services were threatened by EU regulations on public service vehicle licences; some little used railway stations might have been closed because of the cost of meeting the Railway Inspectorate's new requirements on platform height; and development of light rail systems was being held back because collision-impact requirements prevented light rail and heavy rail trains using the same track. Where the consequence of such safety requirements is that people shift to the road because the service cannot be provided, then overall safety is diminished.

The THSG commented that only an unimaginative bureaucrat would find it impossible to relate safety standards to usage in such a way that they become progressively stricter in the core of the system, while common sense relaxations take place at the margins. The use of inflexible, legal rules, rather than of risk management principles, will produce a system in which safety in the heavily used core of the network will be under enforced, but at the margins of the network, safety regulations will be excessive and counterproductive.

Happily, common sense has prevailed in many of these areas. The threats of closures due to platform height requirements and of withdrawal of minibuses did not materialise. The community railway concept has relaxed rail safety standards at the margins of the system as the THSG advocated. It is now possible to mix light rail and heavy rail on the same track although there is so far only one example in the UK – between Heworth and Sunderland.[21] [22] At least in part this is because attention has focussed instead on the tram/train, an alternative way of mingling the two systems by developing a vehicle capable of operating on both. Although it has been widely used in Europe, particularly in Kahlsrühe,[23] the Sheffield to Meadowhall line is the first example of this in the UK[24]; there are plans to extend it to Rotherham as a trial of mixed light rail/heavy rail.[25] There are also plans to test tram-trains on the Penistone Line between Sheffield and Huddersfield via Barnsley; an initial plan to mix light and heavy rail was abandoned due to the cost of running diesel light rail but the electric tram-trains are considered to be a more affordable option.[26]

There are however still examples of rigid regulatory requirements preventing the growth of the safest transport system with consequent overall loss of safety. Inflexible rules still often prevail over sensible risk management.

In chapter 18 (section 18.8) we mentioned risk averse systems. It is important to draw a distinction between risk averse and safe systems. Risk averse systems are not safe systems because:

- safety regulations become too ubiquitous to be universally regarded;
- health and safety becomes discredited as a concept;
- people lose the capacity to manage risk sensibly;

- the combination of the above factors creates a situation in which excessive attention to relatively minor risks runs hand in hand with neglect of more serious ones; and
- important benefits (including health benefits) are lost by safety constraints or by the opportunity costs of safety-based expenditure.

Between the first and second editions of this publication there was the major rail crash at Paddington with multiple fatalities caused in a head on collision between a local commuter train and a high speed Inter City train after a signal was passed at danger. The signal had been passed at danger several times before and investigations subsequently showed that it was confusingly positioned and could be obscured.[27 28]

The widespread public view was that this crash resulted from neglect of safety.[29] At the time THSG put forward an alternative view[30]: we felt that the view generally held was not compatible with the fact that at the time there was an intense drive to achieve zero deaths on the railway. Indeed the problem of passengers falling off the edge of station platforms was being seriously considered. We pointed out that it is characteristic of systems which have tipped over from being safe into being risk averse that excessive attention to minor risks coexists with neglect of serious ones. We suggested that it might be in such a risk-averse setting that a sense of perspective was lost and that nobody did anything about a signal repeatedly passed at danger. Perhaps even the description of the action that should have been taken under the procedures (‘convene a Signal Sighting Committee’) indicates the bureaucracy that had replaced putting the basics of safety at the core of management. Our view was not widely accepted. The THSG believes, however, that it remains a warning of the dangers of allowing attention to safety to tip over into risk-averse behaviour.

20.4 Community transport

20.4.1 What is community transport?

Community transport schemes enable people without use of a car, (often because of low income), to travel when conventional public transport services either do not exist or are inaccessible or inappropriate. They attempt to serve identified needs among members of society who are frequently disadvantaged, such as women, people with restricted mobility, people in rural areas, and community groups.

They should, therefore, be supported by, for example:

- adopting local and national community transport policies;
- extending of concessionary fares schemes to include community transport; and/or
- encouraging vehicle sharing schemes (passenger and vehicle brokerage).

The links between Community Transport Sector and Health are well established and growing in importance for social, financial and political reasons.

20.4.2 Community Transport across the UK

Community Transport (CT) is a wide and diverse sector which has been operating and developing over many years and has a strong tradition of supporting local communities in both rural and urban areas. Virtually unique to the UK, it offers a very real alternative to transport provided by the commercial and statutory sectors and is characterised by its innovation and social responsibility. Community transport is a term covering a wide range of transport solutions usually developed to cover a specifically identified transport need, typically run by the voluntary sector for the local community on a ‘not for profit’ basis.

These community transport operators contribute to a fairer economy and society; they can create opportunities and training for those who are marginalised. This is an important contribution to a changing economic landscape, particularly in tough economic times. In the context of an economic downturn, the role and ability of community transport operators to cushion its impact on the local economy is more important than ever.

The Department for Transport's strategy *Delivering a Sustainable Transport System (DaSTS)*[31] has '*equality of opportunity'* as one of five overarching goals and this commitment is reflected in their guidance for the next generation of local transport plans which all local authorities have to produce. Through the planning process and the advent of the Local Transport Act, the Department for Transport is keen to develop the role of community transport. The financial constraints imposed by the economic situation also mean that authorities are seeking more competition and better value for money.

Community Transport has a role to play in tackling a range of issues, such as connectivity, equality, the economy, the environment, insufficient public transport services. The scope of what community transport can do is not just about picking up what mainstream public transport leave behind – it has a more personalised service that meets the needs of those who are isolated.

Community transport fits well with government's personalisation agenda for older people and serves an ageing population. However, there is a need to break down perceptions that community transport is just for those with disabilities. For example,. it can provide access to jobs for those who are isolated or work unsociable hours. Community transport operators want to be able to deliver more regular, wider spread services but need support and backing to do so. New ways of thinking about moving people around are needed to create a more holistic transport system. For example, health services run their own transport services (see chapter 19) but this could be done externally and tied in with other services and needs to be more efficient.

Community transport could lead the way in innovation in transport e.g. piloting things like electric vehicles. It has a community enterprise role: more people need to be encouraged to deliver it. The Local Transport Act 2008 introduced a new framework for transport authorities to form quality partnerships with operators. It also included a number of measures designed to enable community transport to contribute a more significant role on the overall pattern of transport coverage.

20.4.3 Personalisation

Following the Department for Health's *Putting People First* report[32] the firm trend is now towards personalisation. This means a shift from funding such services as day care as 'block contracts' to allocating a 'personal budget' to the service user for them to spend as they feel appropriate (subject to a care plan being agreed). A key part of this agenda is the provision of transport. In the past, specialist transport services have often been organized on a group basis with the individual being required to fit in with schedules and other priorities. Now the emphasis has shifted to the needs of the individual as the central focus, maximizing consumer choice. This means that local authority transport planners and providers, those responsible for care services and community transport operators all need to re-think and re-organise the way in which transport is commissioned and provided to meet this new policy.

The 'localism' agenda also fits with the development of community transport. The Cabinet Office publication *Working together: public services on your side*[33] refers to community transport expanding its services and promoting the role of social enterprise as a business model to achieve social change. In its publication *Developing the local government services market,*[34] the Department for Communities and Local Government highlighted the need to

> *"stimulate the latent potential of the social enterprise sector to deliver a bigger share of community transport services."*

The Commission for Rural Communities has long held a policy interest in public and community transport (which dates back to the significant funding interventions by the Countryside Agency). They now recognise the importance of developing enterprise in rural community transport and have committed time and money resources to a number of development programmes.

20.4.4 Addressing disadvantage

Community transport organisations already contribute to providing better public services and targeting social disadvantage. The community transport sector delivers public services at the same high standards as other providers and adds value to address inequality of opportunity and to assist in the regeneration and strengthening of their local community. Contracting with the community transport sector enables purchasers to meet more than one objective through purchasing decisions. It might be possible, for example, to combine the contract to provide work opportunities for long-term unemployed people with that for access to day-care. By working cross-departmentally there is scope to make savings and purchase social and or environmental benefit.

20.4.5 Added Value in service provision

The specific value which a community transport operator can add to a particular procurement will be apparent after an analysis of the tenders received. A community transport will only be awarded a contract where they can offer the best value for money solution in meeting the specific requirements. Community transport operators (particularly small organisations) offer valuable benefits in the following areas:

- Local community transport operators are deeply involved/embedded within their local community and skilfully utilize their community as a resource for the organisation (e.g. volunteers working for the community transport from admin to board level).
- Specialist knowledge and experience of community transport to recruit more extensively from those with direct experience of CT.
- Community transport is part of the third sector, which enjoys less restrictive structures and rules than the private or public sector. Community transport is more driven by altruistic aims than the search for improved profit margins (more social, less economic); it must have an innovative and flexible approach to achieve sustainability in a changing era from grants to tenders for contracts.
- It is well placed to offer innovative solutions through their charitable aims and objectives (operating an out of hours bus service to take hospital patients home), to identify and improve access to services in their segment of the market.
- Community transport is a small but expanding sector in the UK, operating within a niche market, which private bus companies find unattractive or outside their competence, as it is unprofitable.

A mapping exercise carried out in 2008 by Greater Manchester Centre for Voluntary Organisations' (GMCVO's) Health Partnership project had the unexpected outcome of exposing the significance that transport has on the work of third sector health providers and some of the obstacles that providers face in trying to fund transport.

The Transport Resource Unit undertook a small-scale qualitative research study, which found that community transport offers other benefits than simply transporting people from door to door. The 'added value' comprises many different facets, from the accessibility and responsiveness of the service to its potential to enable greater independence and social interaction for the service users, many of whom would rarely leave their house without this provision. The role of drivers is key to this 'added value' and their relationship with passengers is of mutual benefit.

It found that transport and health are inextricably linked; that poor quality of, or access to, transport can damage a person's health, while good transport can serve as a vital stepping-stone in the recovery process. When delivery agencies plan services without taking into account transport needs, these issues are brought to the fore.

The study also found that community transport operators and third sector providers alike often struggle to demonstrate the 'added value' of transport and its impact on their service users' lives and, therefore, funding for such provision was rarely successfully obtained from health sources. Despite this, both types of organisations could clearly articulate the impact through anecdotes about service users.[35]

20.5 Community participation in transport planning

The people who gain least and suffer most from transport policy tend to be the least articulate in society. Considerable efforts need to be made to include the views of such people in all aspects of transport planning in order to counterbalance the powerful influence of the 'road lobby'. At national level this should be the responsibility of the Department for Transport and may require a specific division. In the longer term it should be made possible, for communities which desire it, to live in a car-free zone, whether this be a neighbourhood area or town.

There should be an open and informed debate on transport issues. To encourage this, information on the relative costs and benefits of transport options needs to be widely available in an accessible and understandable form.

20.6 Reduction of emissions from transport

The health and climate consequences of emissions were discussed in chapter 3. Many of the other strategies would reduce pollution through, for example, their influence on journey length and choice of mode of travel. However, there should also be specific measures to reduce pollution from motorised vehicles. Examples include:

- quieter vehicles
- noise reduction devices
- electric vehicles
- dual fuel vehicles
- mechanisms for recovering energy from braking.

Biofuels have been widely promoted but there are doubts about their economic impact in a time of growing world hunger,[36] although this may change in the future if the development of biofuels from algae becomes feasible on a large scale.[37] Doubts have also been expressed about the sustainability of biofuels.[38] However, there is government commitment to increasing biofuels to fulfil both UK and EU requirements, with this a major factor in the government's strategy for reducing CO_2 emissions from transport .[39]

The *Climate Change Act 2008* created a legal requirement for a minimum 34% reduction in UK greenhouse gas emissions by 2020, and at least an 80% reduction by 2050, from a 1990 baseline.[40] In 2009, the government published a *Transport carbon reduction delivery plan* for 2010-2012.[39] This focuses on encouraging stricter EU regulations for reducing CO_2 emissions in new cars and vans through better technology. Other contributory approaches include promoting 'greener behaviour' and 'greener vehicles' (particularly electric vehicles – although that electricity needs to be generated and most of the UK's electricity is from non-renewable sources and results in CO_2 emissions). In March 2010, the government published a *Climate change transport adaptation plan* to predict how transport might be affected by climate change and how adverse impacts could be avoided.[41] Extending Sustrans' TravelSmart programme to the entire UK could sve 0.9million tonnes of carbon, the equivalent of taking 300,000 cars off the road.[42]

20.6.1 Environmentally friendly freight

Lorries are particularly intrusive, stressful, polluting and damaging to the environment, hence the need to reduce the need for freight transport (see section 17.3.1). There is scope to diminish the amount of freight movement with greater use of local products. The failure to account for social costs of freight transport is a hidden subsidy which distorts the market and removes market pressures for local production.

Where freight still needs to be moved, long distance freight should be conveyed by rail, sea, or waterway wherever practical. For local distribution of freight, the development of a city-friendly (small, quiet, slower less polluting) lorry should be encouraged.

Examples of measures to achieve this include:

- road pricing to charge vehicles appropriately for their contribution to road damage, congestion and environment damage
- fiscal measures to stimulate changes in operating patterns and vehicle design
- improved technology for transferring freight between modes, including conveying lorries on trains.
- expansion of rail freight networks
- expansion of waterway freight transport

20.7 Paying for Transport Infrastructure

20.7.1 Why the THSG's proposals are not unrealistic

In the introduction (chapter 1), we pointed out that the recommendations for substantial infrastructure investment that we have made in this document would seem to be unrealistic to many transport professionals brought up in an era of constrained capital spending and asset-squeezing. This may seem especially the case now that public finances are tightening and transport may well face cuts rather than growth, and despite the fact that congestion on our roads is estimated to cost the UK economy at least £11billion[43] and perhaps more than £20billion annually.[44] In chapter one, we gave three general responses to that criticism.

The first was that it is the place of public health to outline what is needed to improve health and that the significance of health as a social value is such that much that was seen as impossible when advocated came to pass relatively quickly. Past generations of public health professionals were derided for the major cost of their proposals for sewers in the 19th century or for clean air in the mid 20th century but these came about, despite the cost, within a quarter of a century. Our generation was derided when we first suggested smoke free public places but we have seen them come to pass.

The second was that transport investment has been seen as an essential prerequisite of social and economic success for most of the last three centuries. The last three decades have been an unusual period in which a country which built the turnpikes then the canals then the railways then the tramways then the trunk roads then the airports then the motorways suddenly abandoned this process and started worrying about how it would pay for a high speed rail line.

The third comment was that in a time when carbon reduction is essential for the survival of our species, it is vital that our broken financial system is compelled to find a way to fund the essential infrastructure.

These general statements are fundamentally important. It is essential that everyone understands the potentially disastrous unrealism of pessimistic approaches to problems which must be solved. A 'can do' mentality is necessary. It is tempting to confine ourselves to advocating such a mentality since we are not financiers or economists and it is their job not ours to solve the problem which we pose. Nonetheless, we wish to make a few preliminary comments on how the problem may be solved.

20.7.2 Four steps to investment

There are four stages to paying for something. The first is cost-benefit – whether the proposal will produce enough benefits to be worth the cost of doing it. The second is funding – whether the benefits can be turned into ongoing flows of funds sufficient to pay the interest on the money borrowed, to provide for maintenance and renewal and to meet running costs. The third is finance – who will supply or lend the money to build the infrastructure and purchase the equipment. The fourth, linked to the finance, is risk-apportionment – who bears the risk if the project fails. These are distinct exercises: when you buy a house, the mortgage finances it; the part of your salary which pays the mortgage and the running costs funds it; your love of the house you are buying or its location provides the cost/benefit; and in the UK, you bear the risk of the project failing (although in the USA, where it is often possible simply to hand back the keys, more of the risk is borne by the lender). It is unfortunate that current systems of public finance often conflate these four separate issues.

20.7.3 Cost Benefit

The costs of congestion - or rather, the costs saved by reducing congestion – are described in more detail in chapter 10. These, together with the health and environmental benefits of a different transport system, provide the benefits which must be weighed in the balance against the costs. Congestion, obesity, poor mental well being, and carbon change are each huge problems. There are certainly the benefits to satisfy cost-benefit analysis. However this may not seem to be the case if whole-system effects are neglected and undervalued as they are in many current cost/benefit models in use in transport and if health and environmental benefits are not properly incorporated.

Reducing noise, improving air quality, reducing greenhouse gas emissions, and improving physical fitness are currently assessed within the Environment objective of English Transport Analysis Guidance (WebTAG). The Safety objective covers 'accidents' and personal security.

Best practice as expressed in WebTAG is to monetarise the health benefits referred to above. For example, for the physical fitness sub-objective, as set out in WebTAG unit 3.3.12[45], the method is to calculate the change in all-cause mortality rates, translate that into lives saved or lost as a result of the scheme, and monetarise the cost/benefit using the standard economic value of a life[46].

The accuracy of these estimations relies on the availability of information. Whereas improvements in physical fitness are relatively well documented and can be monetarised relatively easily, it is more difficult to estimate issues like reduction/increase in injuries as a result of a new walking/cycling facility: this relies on an estimate of the change in demand for walking or cycling and an estimate of the combined effect the new facility and the change in demand will have on injury rates, in order to calculate the value of injuries caused/prevented.

A major update to WebTAG currently in draft will place more emphasis on health benefits, establishing a new safety, security & health sub-objective, which will encompass sub-objectives assessing the extent to which a scheme will reduce the risk of death or injury, improve health through physical activity, and reduce air quality health costs. However, the guidance is subject to overall government direction and is therefore under review following the formation of a new government.

The WHO Health Economic Appraisal Tool for cycling (HEAT) indicates that, for example, the total health benefit to cyclists who used the National Cycle Network in 2008 was worth £270million, with an estimated saving to the NHS from cycling on the current Network over the next 10 years of £3.4billion.[Error! Bookmark not defined.] Sustrans have reported the benefit:cost ratio of three of their projects as 18:1, 22:1, and 38:1, using the Department for Transport's guidance on evaluating transport – guidance that considers a ratio above 4:1 as demonstrating very high value for money.[Error! Bookmark not defined.] A 2009 Cabinet Office report endorsed the high benefit: cost ratio of cycling interventions.**Error! Bookmark not defined.**

Health Impact Assessment is a mandatory requirement included within the Welsh Transport Planning and Appraisal Guidance[47] (WelTAG). However there is no set methodology, nor is there guidance on monetarising impacts. The Scottish Transport Assessment Guidance (STAG) does not cover health benefits of physical fitness. Although they could be included as part of 'wider economic benefits', this would rely on an individual planner's technical knowledge in the area or willingness to refer to the English guidance. This is a key issue in appraisal because standard appraisal software such as COBA and TUBA do not monetarise health benefits and so correct appraisal of health benefits/costs is overly reliant on the knowledge of the individual or organisation undertaking the study.

20.7.4 Funding

Only those benefits which can be turned into a funding stream will help fund the project. In the 18th and 19th century, other benefits may have motivated the promoters of schemes but did not impact on the return to investors. Investors often ended up providing these benefits to society at large, either intentionally when rich business people helped improve transport to their own community knowing that they and others would benefit, or unintentionally as in the mid 19th century when the bulk of the British railway system was built in a five year period financed by a speculative bubble and funded by the ruin of its investors. A similar situation in the United States led to the saying *"Nobody ever made a fortune by running a railroad but lots of people made fortunes buying and selling them".*

By the 20th century, it had become usual for the state to make up some of the funding. This was either by contributing to funding, through paying a subsidy for social benefit, or by reducing the need for funding by paying some of the building costs to reduce the amount of finance that needed to be supported by funding. This was justified in terms of allocative efficiency and the purchase of social benefit. In the 21st century it remains to be seen whether Governments will have the deep pockets necessary to fund non-user benefits. If they do not then they will need an alternative approach in the form of benefit-capture. This is simply a system whereby non-user-benefits are turned into a funding flow through some kind of charge or tax. Simultaneously, social benefits are turned into a funding flow by taxing their opposite with a green tax, thus creating an economic incentive to avoid the tax.

Drivers in the UK currently claim they have the 'right' to drive and to park on roads *"because they pay road tax".* In fact, road tax was reduced in 1926 and was abolished in 1937, since when roads have been paid for out of general taxation, so everyone who pays income tax or VAT pays 'road tax'. Drivers pay vehicle excise duty (VED), for which the accurate vernacular is 'car tax' not 'road tax'.[48]

For example if we are right in chapter 10 in arguing that working at home (including a need for high speed broadband, neighbourhood work facilities, home offices etc), active travel, and comprehensive public transport networks together comprise the solution to the problem of congestion, their costs should not be borne only by those who use them. They should be borne also by those who benefit from the reduced congestion – ie by road users. Road charges are the obvious mechanism and this fits with our analysis that these are necessary anyway for the solution to work.

Other forms of non-user benefit include impact of transport on the value of land and on the promotion of economic activity. These are both benefits which it ought to be possible to devise a system of capturing.

There is wide support for creating a carbon market where those who produce greenhouse gases would have to pay for the privilege, and this would allow the carbon benefits of schemes to be captured as a funding element.

20.7.5 Finance

The improvement of the highway system in the 18th century was financed by Turnpike Trusts, who were granted the right to levy a simple form of road charge - a toll - in return for improving the road. A similar model could be used today, provided that it was the completion of a comprehensive network of alternatives to the road which was constructed and non-user benefits, including road charges, formed part of the funding stream.

In the 19th century, the railways were financed commercially by investors who expected a satisfactory return from user-benefits alone and often did not obtain them. They may well have fared better if ways had been found of tapping non-user benefits.

An interesting example of this was the Metropolitan Railway, which grew in parallel with the London suburbs which it made possible.

In the 20th century, it was more normal for Government to provide finance. There is nothing wrong with Government debt provided the public finances are not generating deficits which make it unsustainable. If the necessary funding flows are in place, there is no reason for Government not to finance these investments.

Any of these methods is feasible, provided the funding flows are right. In principle it should be possible to finance anything which can be funded. If the supporting funding flows can be identified but the finance cannot, this may imply that the funding flows have been calculated on too low an interest rate; it may imply that there are capacity problems in some important resource; or it may imply that there is too little money in the financial system. Money is a means of exchange and has no other existence. If the financial economy does not match the real economy, it is the financial economy which must be changed not the real economy. If there is insufficient money to support viable transactions to bring actual unused resources into productive use, then there is a shortage of money and it should be printed (a process also called "quantitative easing").[49] This is the fundamental message of Keynesianism.[50] [51] [52] [53]

There is a fundamental question of how the infrastructure necessary for a low carbon economy will be financed; transport is part of this problem. One possible solution is an international agreement to create money specifically for this purpose by an international process of quantitative easing. An alternative possibility is that China, now a major engineering power, might assist by mobilising for this purpose the resources represented by the difference between the notional and actual value of its undervalued currency the remninbi.

20.7.6 Risk?

Who runs the risk if the project doesn't work? Suppose that we are wrong in our prediction that congestion will be reduced by a combination of comprehensive public transport, local cycle and walking networks, road charges, and better homeworking opportunities. Suppose also that the financial proposal has built in funding flows from capturing the benefits of reduced congestion. Do the investors suffer the failure of their investment, does the community make good the funding deficiency, or do those who would have benefited from the reduced congestion pay for it anyway even though they have not received it? One possibility may be to have a risk share for some early pilot projects, thus establishing the basis for straightforward commercial investment thereafter.

Who runs the risk if Government changes its mind over benefit-capture? Suppose for example that the comprehensive public transport system, active travel network and homeworking facilities are established but Government then loses the political will to impose road charges? There is only one answer to this question: Government must commit to benefit-capture or to the provision of replacement funding. The Turnpike Trusts would never have worked if the right to charge tolls had been at the annual discretion of Parliamentary expenditure estimates.

Who runs the risk if only part of the proposal is implemented? Suppose for example that the comprehensive public transport system is completed but there is a failure to complete the high speed broadband network or neighbourhood work stations necessary to facilitate homeworking? Either a single financial entity must be responsible for the entire scheme or Government (national or local) must take on the role of coordinating the various elements and accepting responsibility for the impact that failure of any one element has on the funding flows for the others.

20.7.7 Conclusions

When considering the costs of our proposals, the current costs or UK transport should be borne in mind. Some costs, such as building transport infrastructure and running fuel-intensive vehicles, are obvious. For example, in October 2005, the Highways Agency estimated the cost of motorway construction as £28million per mile.[54] There are many other costs to society that are less well recognised, in addition to the £11bn[43] -£20bn[44] pa that congestion costs the economy. Table 20-1 lists some of these other ‘hidden’ costs.

Table 20-1. The wider costs pa of transport in English urban areas

Problem	Costs (billions)	Year in which measured or forecast
Excess delays	£10.9	2009
Collisions	£8.7	2008
Poor air quality	£4.5 – 10.6	2005
Physical inactivity	£9.8	1998
Noise - amenity	£3.0 – 5.0	2008
Greenhouse gas emissions	£1.2 – 3.7	2003
Total	*c. £38 - 48*	

Source: PMSU Urban Transport Study 2009 [55]

For the cost of building one mile of motorway, one could provide cycle training for over a million schoolchildren.

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21 Recommendations

This chapter gives the Transport and Health Study Group's detailed recommendations for healthy and sustainable transport policy. It includes recommendations for local policies but also specific recommendations aimed at national government, at the health professions, and at the transport and engineering professions. Examples of good practice are given in boxes through out the chapter.

010. We recommend that local transport planning continues to be seen as important and as relevant to health, and that those involved in local transport planning (such as the LTP3 process in England) take full account of the above strategies, build health impact assessment into their planning process and pursue the following priority actions.

011. All local transport plans should include an assessment of the carbon footprint of the local transport system and an estimate of the extent to which the plan will reduce it.

012. All local transport plans should include firm plans, committed resources and a target date for completing a cycle network usable by new cyclists as well as established cyclists and for providing cycle parking.

013. All local transport plans should include a timetable (with firm plans and committed resources) for closing rat runs so as to reduce the number of households experiencing heavy street traffic and so as to contribute to recommendation 012.

014 In developing their cycle network, all local transport plans should use the revised hierarchy of provision recommended in chapter 14 which gives high priority to linking quiet streets to create a comprehensive quiet cycle network.

015 All local transport plans should include firm plans, committed resources and a target date for improving pedestrian routes by removing engineering obstacles to pedestrians, providing safe crossing points over busy roads, and enhancing pedestrian signage.

016. All local transport plans should include firm plans, committed resources and a target date for aesthetic enhancement of pedestrian routes.

017 All local transport plans should develop plans for bus priority measures which will ensure that the bus network operates freely. Transport planners should have the confidence to transfer road space for this purpose, recognising that the significance of the Downs-Thomson Corollary of Pigou's Theorem is that a free-flowing bus network will ease congestion but additional road space will not.

018. All local transport plans should focus any efforts directed at congestion upon improved public transport rather than new roads. Where bypasses are built to divert traffic, the bypass should be of no greater capacity and no faster than the road it replaces (to avoid traffic generation) and the old road should be closed to through traffic and traffic calmed. Under no circumstances should money be wasted on enhancing the capacity of the road system. Capacity issues should be addressed by public transport or rail alternatives.

019. All local transport plans should address road safety by area-wide 20mph speed limits in residential areas and at accident black spots on main roads.

Greenways for the Olympics and London (GOAL)

GOAL is Sustrans' contribution to the Olympic legacy, but with wider impact. It is the strategic masterplan, combining all of Sustrans' practical collaboration with London authorities to develop a London-wide network of greenways and traffic-calmed streets, passing to and through the capital's green spaces and facilitating large numbers of daily active travel trips.

An intensive monitoring programme is designed into the GOAL implementation work; automatic cycle and pedestrian counters will be supported by face to face user surveys, currently at 13 sites.

www.sustrans.org.uk/sustrans-near-you/london will present implementation and usage information.

020 We recommend that those engaged in spatial planning recognise the significance of the Appleyard / Lintell / Hart findings and proceed on the basis that it is entirely plausible that within the near future it may come to be considered that heavy traffic in a road renders houses bordering that road unfit for long term human habitation.

021. There should be a strict prohibition on new development of any kind being accessed via a residential road (other than a major road with residential development along it) if this would increase the flow of traffic along the road to a steady flow. If it is necessary, in order to avoid this, for the main car parks of a new development to be some distance away with the final access being on foot, then so be it.

022 There should be a strict prohibition on residential properties being built with their principal pedestrian access being from a main road, with exceptions for owner-occupied plots purchased before the policy was adopted, holiday homes, or properties to be used as temporary lodgings.

023 In new residential developments there should be a strict limit on the number of properties that might be accessed by a residential road. Developments larger than this should either have multiple access points or a non-residential access road.

024 Where residential properties have already been built on a main road, spatial planners should facilitate measures to address this, including reorientation of the properties' relationships to the road, shared gardens or conversion to holiday homes, temporary lodgings, or business premises.

025. The Home Zone should be adopted as the norm for all new residential streets.

026 All future large residential developments should be divided into residential cells, so as to prevent the creation of new rat runs. There should, however, be pedestrian and cycle links between the cells, with only motor vehicles being prevented from passing through.

027. Residential developments should have a pedestrian-permeable street design, with good cycle routes and aesthetically attractive pedestrian routes through them.

030.We also recommend that Government recognises the importance of spatial planning to health and other social values, that the NICE work programme on spatial planning cancelled by Ministers in December 2010 be reinstated and that those engaged in spatial planning adopt a policy that the health of the people shall be a material consideration to any development proposal, build health impact assessment into their procedures, and pursue the following actions.

031. Spatial planning should aim to ensure that the whole population can access the sources of a healthy lifestyle – recreational exercise opportunities, affordable healthy food shopping, parks and countryside, work, education, places of social interaction, health facilities.

032. Spatial planning should aim to ensure that people are provided with opportunities to build exercise into their daily lives more easily than to avoid it.

033 Spatial planning should have a goal that people spend as much as possible of their day in surroundings that are green and aesthetically attractive and should to that end make as much use as possible of street trees, grass, open space, green roofs and living walls, .

034 Spatial planners should aim to make it easy for people to obtain facilities as close as possible to where they live and work. Much of the movement that we call 'increased mobility' is a human benefit but much of it is not – much of it is the hardship of having to travel a long way to find something that once was local.

035. In making provision for transport infrastructure spatial planners should move away from thinking 'car' and towards a future that is 'train, bus, cycle and foot'.

036. Insofar as spatial planning must be intimately linked to economic development, it must recognise good environments as an economic driver since the knowledge-based industries of the future, much freer in the choice of where to site themselves, will want to place themselves where it is pleasant to live.

037. Two of the aims of town planning should be firstly, to minimised journey lengths, by resisting the trend to fewer and larger facilities, and secondly, to ensure that all facilities are easily accessible by foot, bicycle and public transport. This is particularly important for shops, schools, health services, local authority services, recreational facilities and places of employment.

038. Planning should ensure that residential developments can be serviced by public transport. Particular care needs to be taken with areas of low residential density since these tend to be difficult to serve by public transport.

040. We recommend that those involved in financing, designing and providing public transport systems cooperate together to provide a National Integrated Transport Web (perhaps with a brand name like Transweb).

041 There should be a Transweb station within 1km of each settlement in rural areas and each place of residence, business, work or public recourse (such as parks or beauty spots) in urban areas; within 5km of almost all places of residence, business, work or public recourse outside settlements (with exceptions being predominantly for places intended to be accessed only on foot or situated a long way from a public highway); and within 15km of any point on the public road network.

042. Transweb stations should have a service in each direction at least every 20 minutes in urban areas, at least every 30 minutes for mainland rural settlements, at least every hour for

other places of residence and (when open) of work or business, and at least every three hours in almost all cases. Where services of this frequency cannot be justified on a scheduled basis they should be provided on a demand-responsive basis.

043. Local services should be reintroduced on almost all railways in the national rail network with the reopening, at least as a tram stop, of almost all stations that have been closed if the line on which they were situated remains and with the opening of new stations or tram stops where communities, workplaces, business developments or places of significant public recourse adjoin the track. These stations should normally be served by a new tram/train stopping service, although in some cases there may be other solutions (examples are given in the text of chapter 15).

044 Highways authorities should have the power to establish a street tramway on any road on which public vehicular rights exist. This will not only facilitate the expansion of light rail systems but the construction of such tramways for the use of tram/trains will help address issues of rail capacity at junctions and other bottlenecks.

045 In view of its successful adoption in Europe, the British perception of the tram/train as an untried technology requiring extensive evaluation and careful consideration should be abandoned.

046. High frequency mid-distance bus services stopping typically about once every 8km and high frequency long-distance coach services stopping typically about once every 20km should operate on almost all motorways and should serve on a rotational basis local Transweb stations situated typically every half a mile or so along the motorway.

047. There should be serious consideration given to reopening a reserved track public transport service along the corridor of each railway that has been closed This will not always be justified and may sometimes be achieved by a bus, coach or tram service along a parallel road (if appropriate bus/tram priority can be achieved). However, reopening of the railway will be appropriate in many cases. To that end there should be a statutory power for public transport authorities to authorise the construction of heavy rail or light rail infrastructure or busways along any disused railway formation. Provided certain conditions can be met, Transport & Works Act procedures and planning permission should not be needed. These conditions should be that it does not interfere with the use of the formation for walking and cycling, preserves any highway rights or private rights of access that have used the formation, makes compensation for any displaced commercial or agricultural use, makes a wayleave payment to the owner of the land on a fixed scale, does not affect any established residential use of the land (or alternatively makes arrangements acceptable to both the owner and the occupier), meets proper noise standards for residential properties bordering the track and arranges protection for wildlife, tree cover and habitat. (In making this recommendation we have no wish to add our voice to any general pressures for relaxation of planning controls nor to oppose the empowerment of local communities in development control but we believe that the special circumstances of a type of development essential to climate change and public health, requiring linear developments passing through several communities and capable of being obstructed at any one point, are exceptional and that the conditions we propose are rigorous and protective of legitimate concerns).

048. The Transweb system should link to cycling through cycle hire, cycle carriage and cycle storage, although not all Transweb stations and services need have cycle facilities if a station with cycle services is within a reasonable cycling distance over good quality cycle routes.

049. The Transweb system should also include high frequency or limited stop bus services with bus priority, links to stations (such as travelators, gondelbahns and people movers and demand responsive services) and, where necessary, ferries.

04X. The Transweb system should operate as an interconnected system with through ticketing.

04XI. The contribution of the Transweb system to reducing congestion should be identified and a commensurate funding stream established, based on road charges.

Integrated national timetable in Switzerland

A wide range of public transport operators in Switzerland, including the national railways, private railways, cantons, the Postbus operators and bus companies cooperate in the production of an integrated national timetable, which produces a wholly integrated transport system reaching to every part of the country, notwithstanding the problems created by rural areas intersected by mountains and lakes.

Public health proposals for Greater Manchester LTP2

The Directors of Public Health of Greater Manchester recommended a proposal similar to the Transweb scheme in their Advice to LTP2. They developed proposals for orbital rail services (using disused rail formation and underused orbital rail lines with street tramways to by pass areas of rail capacity restriction) and orbital bus services (many of them using the orbital M60) to augment the predominantly radial nature of transport in the conurbation. They included proposals for motorway bus stops. They identified areas of the county more than three miles from a railway station and suggested ways to link them to the train/cycle network. They proposed cycle vans on trains. They proposed demand-responsive services for rural and overnight services. They proposed the inclusion of the proposals in the suggested Greater Manchester TIF bid (congestion charge scheme funding public transport development) by expanding the funding in the scheme with road charges. They were unable to persuade Greater Manchester transport leaders to adopt the proposals but they were able to secure the incorporation of evaluation of some elements of their proposals into the Greater Manchester TIF bid.

Unfortunately the proposals, like the entire Greater Manchester TIF package, failed due to lack of political will and defeat at a referendum. Tragically one of the arguments successfully deployed against the Greater Manchester package in the referendum was that its benefits were not universal and its costs fell unfairly – arguments which could not have been used if the public health proposals had been adopted.

050 We recommend that public transport operators commit to the goals and strategies in recommendations 001 and 002 and in particular commit to growing public transport usage in place of the car instead of merely finding the cheapest way to convey their captive customers

051. Public transport operators should commit to the Transweb concept. They should work together to design the Transweb network and should campaign for it to be established.

052. Bus operators should be aware of the fact that bus usage is higher in cities with rail-based public transport systems and they should view the rail system not as a competitor but rather as the part of the public transport system at the cutting edge of competition with the car that will benefit the entire system.

053. Train operators (and other public transport operators when they operate in areas that are not rail-served) should view the train/cycle combination as a major potential source of business and revenue and should aim to promote it and make high quality provision for it.

054 Bus, taxi and community transport operators should work together to design an effective demand-responsive transport system.

055 Public transport operators and the ambulance service should work together to create a universal public transport system for those whose use of mainstream public transport is affected by impairments. Various levels of provision should exist for different levels of impairment. The system should also be available to those affected by temporary difficulties.

056 Public transport operators should make better provision for shopping and for luggage, recognising that they are in competition with the car boot.

057.Public transport operators should consider the complex journeys made by those with childcare needs and should develop effective solutions, perhaps including the provision of childcare at public transport interchanges, the adjustment of connections at bus stops close to childcare establishments, or demand responsive feeder services.

Examples of Demand Responsive Transport (DRT)

Suffolk Links is a DRT service which provides connections to bus and train links in rural areas. It collects people who are not able to access a bus directly, by picking them up from a convenient point. Where appropriate, Suffolk Links connects with other bus services for onward travel to further destinations. Where this is not possible, end to end journeys are possible, although only within each service area.

The service can be booked by telephoning Suffolk Links up to a week before travel. Bookings are made on a first come, first served basis. Booking times and hours of operation vary between each Suffolk Links service. Each vehicle is fully accessible with low steps, hand rails and a lift for wheelchair access. Potential users are asked to let the operator know at the time of booking if assistance is required.

Journeys are charged like a bus fare. Passengers are informed of the fare when booking a journey; tickets are issued when boarding. Concessionary passes and Explore cards are valid on all journeys. It ispossible to buy through fares for many journeys, to avoid paying twice. (www.suffolkonboard.com/suffolk_links_demand_responsive_transport)

Other examples include *traintaxi*, which provides information for business travellers of the availability of taxis to travel the final few miles between rail stations and the eventual destination (www.nbtn.org.uk/news/story/215) and the Wiltshire Wigglybus (www.drtbus.co.uk/) .

060 We recommend the active marketing of cycling.

061. All authorities and agencies should project positive images of cycling as a safe and healthy option for local travel.

062 Steps should be taken to ensure that the media are enabled and assisted to present cycling issues accurately, especially with respect to the low risk of injury and the high risk from sedentary living, and that factual inaccuracies in unhelpful coverage be pointed out.

063 The NHS should promote the importance of cycling in improving health and longevity, and should include it in health trainer schemes, exercise referral schemes, cardiac rehabilitation programmes, weight management programmes, obesity treatment and the like.

064 Cycling is also an important weight management intervention for those with healthy body weight, not only those who already have problems, and should be promoted as such.

065 There should be promotion of cycle training.

066 Care should be taken that any helmet promotion does not undermine the image of cycling as safe, or overstate the message. Risk assessment shows it is no more rational to wear a helmet for cycling than it is when walking, driving or playing football or rugby. See Section 7.4 for more details on cycle helmet evidence.

067 Train operators should regard the train/cycle combination as a potential major source of traffic and revenue and should actively promote it as a mode of transport of comparable flexibility to the private car.

Bikeability

Bikeability is 'cycling proficiency' for the 21st century, designed to give the next generation the skills and confidence to ride their bikes on today's roads. There are three levels. Level 1starts when children can already ride a bike; it teaches control of the bicycle in a traffic-free environment, such as a school playground. Level 2 introduces children aged 10-11y to cycling safely on roads, while level 3 (for secondary school children, aged 11-18y) covers a wider variety of road conditions and more challenging traffic situations (see www.dft.gov.uk/bikeability/)

Bike It

Bike It is a Sustrans programme which works intensively with schools to increase levels of cycling to school and establish a pro-cycling culture. A typical work programme includes school assemblies and classroom work; assistance with school travel plans, cycle storage, and cycle training; after school cycle skills sessions; and family-friendly school travel events and rides.

In 2008, *Bike It* worked with 89,000 children in over 400 schools; the proportion of children cycling every day doubled from 4% to 8%; those cycling at least once a week rose from 14% to 26%, and those never cycling to school fell from 75% to 55%.

More information at www.sustrans.org.uk/what-we-do/bike-it

070 There should be a marketing initiative to promote the concept of healthy transport.

071. In addition to the active promotion of cycling referred to in recommendation 060, there should be similar promotion of walking.

072. The impossibility of addressing congestion in a universally car-based system should be actively pointed out, to encourage people to accept that only responsible limited use of cars is compatible with their benefits being enjoyed at all. The low average speed of traffic in cities should be emphasised.

073. The benefits of the lifestyles involved in our proposed healthy transport system should be holistically promoted to show that a healthy transport system is empowering rather than constricting.

074 The role of congestion as a Tragedy of the Commons should be explained to demonstrate the flaw in a libertarian approach and point out that only collective choices will empower us to achieve what we all want.

075. Physical activity should have a much higher profile in publicity about obesity; moderate activity built into everyday life should have a much higher profile in publicity about physical activity; and transport should be prominent in such publicity (alongside the use of stairs and children's independent play).

076 The present dislike of health and safety restrictions should be built on and turned to positive purpose by emphasising the need for proportionate risk judgments and the danger of risk averse approaches.

077 There should be an attempt to promote a clear vision of how the healthy transport system fits together.

078. Analogies like the replacement of the horse by the railway, the construction of the sewers, and the cleaning of the air should be used to counter the argument that these proposals are unrealistic.

080 We recommend that employers take steps to promote active travel, low emissions and safe driving.

081. All places of work and business should have safe and secure bicycle storage and all places of work should offer access to changing and showering facilities.

082. All employers should operate policies such as compressed hours and homeworking which allow their employees to come to work on no more than four days a week (with a medium term objective of introducing three day weekends with most workers also working at least one day a week at home, reducing work attendance to three days).

083. All employers who offer subsidised parking, company cars or lease cars should offer subsidies to cycle purchase and public transport use to at least the same extent. All employers should offer a salary sacrifice scheme for bicycles and for public transport season tickets.

084. All employers should offer cycle proficiency lessons and maintenance workshops in conjunction with Local Authorities and other providers, especially those in the third sector.

085. All employers should support a bicycle user group (BUG) and provide a stock of bicycle tools at the workplace for members of the BUG.

086. All employers should pay a minimum business cycle mileage rate of 20p per mile and should restrict the mileage rate for car usage to marginal cost only at a fixed level irrespective of engine size and set at a level appropriate for small cars.

087. All employers should limit the provision of company cars or lease cars to electric vehicles or vehicles meeting class A emissions standards and should consider the use of electric pool cars and a bicycle pool.

088. All employers should consider journeys frequently made by their employees which are best made by public transport and should ban mileage claims for such journeys, except in certain circumstances (eg employee with a disability rendering them unable to access current public transport). They should consider a contract with the public transport operator to cover all journeys made by their staff on these routes.

089. All employers should have safe driving guidelines. These should prohibit the use of mobile phones whilst a vehicle is moving, warn against driving whilst tired, and emphasise the need to comply with speed limits and not exceed 20mph in residential streets. Lorry drivers should be repeatedly warned of the dangers of trapping cyclists when turning left. “How well am I driving?” numbers should be the norm on all commercial vehicles.

Travel Actively

The *Travel Active* consortium (see chapter 14, Box 14.1) is delivering 50 projects to increase everyday walking and cycling, supported by the National Heart Forum and National Obesity Forum. The total programme costs over £30 million, with £20 million coming from the Big Lottery Fund. Target groups are those who are most at need of increasing their physical activity levels. These include young people, older people, women, people from black and minority ethnic groups, people with physical health issues, and people with mental health issues.

Between 2008 and 2012, the project partners aim to enable two million people to become more physically active. There is a robust monitoring programme, to identify the outcomes, which will be disseminated widely.

More information at www.travelactively.org.uk

090. We recommend that highways authorities

(a) devote at least 10% of their resources to walking and cycling;

(b) distinguish clearly between residential streets and other roads and recognise that the prime purpose of the former is community interaction, its role as a highway being secondary;

(c) recognise the importance of lower speed limits.

091. We recommend that the National Cycle Network and the Long Distance Footpath Network be 'trunked', thereby putting the core of the national cycle and walking networks on the same footing as the core of the vehicular road network. The Highways Agency should invest 10% of its resources in the improvement and development of these two networks, the provision of safe crossings over Highways Agency roads which sever walking and cycling routes, and the provision of cycling facilities on or parallel to all trunk roads on which it is unsafe to cycle and for which there is no parallel National Cycle Network route.

092. Local highways authorities should have clear plans for the development of walking and cycling networks. These should comply with recommendations 012 to 016 above directed to local transport planners; highways engineers should strenuously object to any failure of a local transport plan to address these recommendations.

093. Local highways authorities should require the Home Zone to be the normal layout of all new residential streets and should support conversion of existing streets where possible.

094. Local highways authorities should be receptive to proposals for the closure of rat runs.

095. For cycle provision all highways authorities should adopt the revised hierarchy of provision recommended in chapter 14, which gives high priority to linking quiet streets to create a comprehensive quiet cycle network but also takes steps to support cyclists using main roads.

096. All highways authorities should ensure that the bus network operates freely and should have the confidence to transfer road space for this purpose, recognising that the significance of the Downs-Thomson Corollary of Pigou's Theorem is that a free flowing bus network will ease congestion but additional road space will not.

097. Highways authorities should not promote new roads as a response to congestion. Where bypasses are built to divert traffic, the bypass should be of no greater capacity and no faster than the road it replaces (to avoid traffic generation) and the old road should be closed to through traffic and traffic-calmed. Under no circumstances should money be wasted on enhancing the capacity of the road system. Capacity issues should be addressed by public transport or rail alternatives.

098. Highways authorities faced with congestion which might in the past have been addressed by new road building should consider solutions based on public transport alternatives. The Highways Agency should enter into discussions with Network Rail about rail alternatives to new roads, including rolling motorways and other car-carrying and lorry-carrying services.

099. Legislation should be introduced distinguishing the legal position of roads, streets and quiet lanes. Only on roads (class I,II and III roads and other roads designated by the highways authority) should there be an unrestricted right of through motorised vehicular passage. In streets, the right of motorised vehicular passage should be limited to access and to other uses explicitly and exceptionally permitted by the highways authority except that slow moving personalised vehicles like invalid carriages, mobility scooters, motorised wheelchairs, lawn mowers and vehicles controlled by pedestrians should still be allowed through use to take short

cuts. “Access” should include use by buses serving bus stops in the street. In quiet lanes the same restrictions should apply but agricultural vehicles should still have a right of through passage and highways authorities should consider finding ways to permit limited use to preserve the opportunity for country drives.

09X. Highways authorities should introduce town-wide 20 mph speed limits in urban areas and should reduce speed limits on many rural roads.

DIY Streets

DIY Streets is Sustrans’ innovative approach to making streets safer and more attractive, using Home zone principles at lower cost, by supporting residents in re-designing their own streets. The approach is initially being piloted in 11 communities, moving to a national scale in the near future.

Project evaluation has concentrated on the process and on learning from it. As impacts on behaviour become clear these will be reported by Sustrans.

See www.sustrans.org.uk/what-we-do/liveable-neighbourhoods/diy-streets

The National Cycle Network

The National Cycle Network has been developed since 1995 by local authorities, major landowners, national and local voluntary groups, business, and others, coordinated by Sustrans. It passes within a mile of 55% of the UK population and is continually being extended and improved. One-third of the Network is traffic-free, the remainder on quiet or traffic-calmed streets.

In 2008 the Network carried 386 million trips, roughly 50:50 walking and cycling, for all purposes. 71% of users surveyed claim that the Network helps them increase their physical activity levels, while 134 million trips could have been made by car.

See www.sustrans.org.uk/resources/research-and-monitoring, including annual usage reports with demographic, trip purpose, carbon, physical activity and economic analysis

Connect2

Connect2 is a Sustrans programme to develop 79 local walking and cycling networks, mainly in urban areas, around the UK, partly funded by £50 million from the Big Lottery Fund, allocated on the basis of a national public vote. When complete, Connect2 will invest over £150 million and transform travel options in many of the project locations.

Connect2 is currently in development. When complete, the 79 projects will offer improved walking and/or cycling options to approximately six million people – 10% of the UK population. Connect2 is being studied by a cross-disciplinary research team, called i-Connect, with leading physical activity, climate and transport specialists.

More information at www.sustrans.org.uk/what-we-do/connect2

ACTION BY GOVERNMENT

100. We recommend that the Dept for Transport and its counterparts in the devolved administrations should fully recognise the vision of a healthy transport system, recognise its importance as a measure that will save tens of thousands of lives and contribute to addressing climate change, and regard its implementation as a major objective. It should involve its public health adviser in decisions at the highest level, should use health impact assessment routinely and should ensure that public health issues are fully understood by all its policymaking staff.

101. Government should consider incorporating the DfT into a new department with responsibilities for transport, physical activity and food and a remit of addressing obesity. Such a department, perhaps called the Dept of Walking, Cycling, Transport and Sport should have a high standing in the pecking order of Government departments.

102.DfT should endorse the goals and strategies set out in recommendations 001 and 002.

103. DfT should issue guidance in relation to LTP3 in line with our recommendations 010 to 019.

104. Local authority and other transport planners should read, and follow the guidance in, the DfT publications *cycle Friendly Infrastructure* and *Cycling by Design*. However this should be revised to take account of the situations described in section 14.6.1 where dedicated infrastructure should, exceptionally, have a high priority.

105. DfT should modify highways guidance to emphasise the need for a cycle network and a walking network, and to emphasise the need for aesthetic enhancement of the walking network.

106. DfT should give clear guidance to highways authorities and planning authorities that the prime role of residential streets is community interaction and that their role as a highway is secondary to this; DfT should revise design guidance accordingly. It should implement the legislative change proposed in recommendation 099.

107. Aviation policy should be changed to favour high speed rail and recognise the need to make progress towards a limited role of aviation only for flights across major bodies of water or polar ice cap, flights to islands, and local journeys in trackless wilderness. The first step should be the replacement of domestic flights within the mainland of Great Britain by high speed rail and collaborative discussions with other countries to eliminate short haul mainland flights in Europe and replace them with high speed rail.

108. DfT should abandon the concept of focussing public transport on the most popular journeys and replace it with a recognition of the need for a comprehensive network. It should:

(a) take steps to draw together the partnership necessary to create Transweb (recommendations 040 to 04XI);

(b) expand the role of the tram/train without awaiting the outcome of the present very limited experiments. The experimentation has already been done in Europe.

(c) put in place a programme of rail reopening;

(d) put in place motorway bus and coach services;

(e) be willing to abandon bus deregulation as a failed experiment if it stands in the way of the collaborative development of Transweb.

110. Government should find Parliamentary time for a Transport and Health Act.

(A link to a draft Bill will be added to electronic versions of this document when we have completed this work. If you have a print version of the book or you have downloaded an e book before this link was added or your e-book reader cannot handle this link please check the THSG website)

111. Statutory effect should be given to the policy of developing Transweb and to the consequent rail reopenings, motorway bus and coach systems and coordinated system development.

112. Statutory duties should be laid on NHS bodies, public transport authorities, Transweb, highways authorities and spatial planning bodies in relation to the promotion of walking and cycling, enforced by a new Walking & Cycling Authority which should be an NHS body (with performance management functions), part of the Public Health Service, an inspectorate and a highways authority with default powers.

113. Statutory effect should be given to the role of residential streets in community interaction. This should include the legislation suggested in recommendation 099.

114. The drink driving limit should be reduced to 50mg/100 ml with new lesser offences at 35mg/100ml (fixed penalty notice and 3 penalty points) and 20mg/100ml (fixed penalty notice without penalty points)

115. (a) The normal speed limit in urban residential areas should be 20mph.

(b) A speed limit of 10mph should normally apply in Home Zones, car parks and other settings where pedestrians mix with manoeuvring vehicles, drives and other in-site roads where all forms of traffic are mixed; pedestrianised areas at times when the restriction is suspended; and on byways open to all traffic.

(c) A speed limit of 5mph should normally apply when exercising private or other exceptional motor vehicle rights on bridleways, footpaths, pedestrian zones or restricted byways.

(d) The normal speed limit on all-purpose rural roads should be reduced to 40mph.

(e) This should be reduced to 30mph on any road where pedestrians use the same roadspace as motor vehicles, and 20 mph on any such road which is single track or on any quiet lane.

(f) There should be provision to increase the 40mph rural limit to 50mph (or the 20mph urban limit to 30mph) on A or B roads but only if there is separate roadspace provided for pedestrians and cyclists (either on or parallel to the road), there is adequate provision of safe crossing points, and the road is neither residential nor used for shopping (unless the access to shops or houses is separated from the through carriageway into a distinct enclosed street-like access area). A further increase from 50mph to 60 mph or from 30mph to 40mph should be possible on an A road if the provision for pedestrians and cyclists and any access area for houses or shops is separated from the carriageway by a fence, railing, hedge or crash barrier. A further increase from 60mph to 70mph should be possible on a dual carriageway and a similar increase from 40mph to 50mph should be possible on non-residential non-shopping dual carriageways in urban areas, provided adequate noise abatement is also implemented.

116. Only in cases of deliberate self harm or malicious behaviour should it be possible for a driver to plead contributory negligence by a pedestrian or cyclist in a residential street or in a side street which forms part of a cycle network. Indeed in such settings liability for a collision between a motor vehicle and a pedestrian or cyclist should be presumed to lie with the motor

driver and the presumption should be rebuttable only by evidence of self harm, malicious behaviour or extreme unpredictable stupid behaviour going well beyond normal carelessness and well beyond the unpredictability of behaviour a driver should expect of pedestrians in a relaxed hazard free home setting. In other settings contributory negligence should not be ruled out but should not be used as a covert restriction on road usage. The failure to wear a cycle helmet is not contributory negligence.

117. Spatial planners should have greater powers to pursue the provision of local facilities, including powers to establish local multi-user outposts (such as neighbourhood work stations or local shops that also serve as ordering points for goods from large supermarkets) and finance them by a levy on the operators of the central facilities.

120. We recommend

(a) that fiscal measures be taken to ensure that the cost of motor vehicle use is fully felt at the time of use. If there is no appetite for increased motoring taxation this should be offset by reducing other costs of motoring.

(b) that fiscal measures be taken to ensure that the cost of traffic generation is felt by organisations with poor corporate travel planning;

(c) that fiscal measures be taken to encourage car clubs.

121. There should be no exemption of either road transport or aviation from carbon emissions trading schemes.

122. Universal road charging should be introduced. As well as charges by the mile there should be charges per journey (to increase the price per mile of short journeys which could have been walked or cycled), mileage based congestion charges for use of roads at times of heavy congestion, supplementary charges for journeys ending in the centres of towns and cities well served by radial public transport, and charges for travel above the speed limit where this has, for some reason, not led to prosecution or fixed penalty.

123 There should, however, be provision (possibly, for administrative reasons, limited to regular journeys) to claim rebates for journeys for which adequate public transport is not available and there should be provision for public transport authorities to enter into gain-sharing agreements with the road charging agency where better public transport diminishes those rebates.

124. As well as road charging, there should continue to be emissions-oriented taxes such as fuel duty.

125 We see no reason to hold back from increased taxation of motoring, given the economic climate, the gap in the public finances, the need to invest in new transport infrastructure, and the relative decline in the cost of motoring. Certainly there should be a year on year increase in the cost of motoring by more than the cost of public transport. However, if there is no appetite to increase motoring taxation, the above charges should still be implemented even if it is thought they have to be offset by reductions in those motoring costs not based on mileage or emissions. If this situation applies the following might be a suitable order of priority for such measures:

> First, the elimination of all taxes and public charges on motoring which are not mileage, fuel or emissions related, such as vehicle excise duty, driving test fees, fees for driving licenses, VAT on cars and car accessories, car club membership etc.

Secondly, subsidies to the administrative costs of car clubs.

Thirdly, the replacement of other compulsory charges by public subsidies. This could apply to things like basic insurance (charged at a high rate, with low risk drivers obtaining rebates or extra cover by opting out of the Treasury scheme and taking out a policy with an insurance company) and MOT fees and should extend to car clubs.

Fourthly, if necessary to achieve the desired level of offset, the partial state reimbursement, up to a fixed limit, of charges for essential safety-related car maintenance (including allowances for work done by the owner personally subject to certification that the work was necessary and was done satisfactorily) and a proportion of breakdown service membership. It should also cover all maintenance and breakdown provision by car clubs, thus treating these clubs preferentially.

126. Developers should be required to pay for the public transport, walking and cycling infrastructure necessary to serve their development and to compensate for the motor vehicle traffic likely to be generated.

127. A proportion of employers' national insurance contributions should be replaced by a new tax for each employee-day on which an employee drives to work.

128 There should be a tax on all free or low cost private non-residential car parking provision (including estimates of the use made by customers of free on street parking).

129 There should be provision for public transport authorities to enter into gain-sharing agreements with developers, businesses and employers where new services facilitate travel planning which reduces the burden of the above taxes.

130.The Government should have a coordinated approach to addressing climate change in which the contribution of each sector is clearly recognised, quantified and enforced. ***(Transport, energy, waste and the purchase of low carbon products each have their place in this strategy; our recommendations are limited to those relating to transport).***

131. The contribution of modal shift to this strategy should be clearly recognised, with objectives for reducing motor vehicle emissions by promoting active transport, for a shift to electric traction, for the use of lower-emission vehicles and for a shift from aviation to high-speed rail.

132. There should be an element of the strategy directed to substantially reducing the carbon emissions produced in the manufacture of electricity, so that the shift to electric traction can be effective in its climate change objectives.

133. The contribution of commuting to this strategy should be clearly recognised by goals for employers aimed at moving towards a normal week consisting of three days of working at the place of work, one day of working at home and three days not working. This should be largely achieved by increased productivity and by changes in working methods but may also entail the lengthening of the (fewer) working days.

134. The contribution to the strategy to be made by spatial planning should be clearly recognised as involving the reversal of the trend towards centralised facilities and the provision of more facilities locally, thus reducing the need to travel. Spatial planners will need more powers to this end (see recommendation 117).

135. The Department of Health should ensure that the NHS Operating Framework requires that the NHS reverses so far as feasible its current trend to centralisation of provision, recognising that there are diseconomies of scale as well as economies, promotes active transport, uses travel planning to reduce car use by its staff when coming to work and by its patients when attending appointments and uses local procurement when feasible. These transport goals should sit alongside energy use in healthcare buildings and the carbon contributions of NHS procurement and waste disposal as the NHS contribution to the strategy.

140. The Government should pursue a programme aimed at achieving a more rational approach to risk. This is much broader than transport but the following recommendations are transport related.

141. We have already made recommendations relating to a more rational approach to the risk of cycling (see 061, 062, 066, 076, 116)

142. The Department of Justice and the Law Commission should ensure appropriate legal changes and appropriate training of the judiciary and legal profession to ensure that the law reflects a rational approach to risk in areas such as judicial review, personal injury litigation, etc.

143. Those concerned with rail safety should recognise that the overall safety of the transport system is undermined if the development of the railway system is obstructed by unnecessary restrictions and bureaucracy supposedly related to safety but in fact of little value. The traditional approach of the Railways Inspectorate had much to commend it and it is unfortunate that it has been undermined by newer organisations which sometimes appear to lack common sense.

144. All transport safety organisations should recognise that if safety regulations come to be perceived as a bureaucratic burden, that attitude will affect the important regulations as well as the unimportant ones and overall safety will be reduced. It should be widely recognised that one of the characteristics of a risk-averse system is the existence of unnecessary attention to minor risks alongside blatant disregard of serious ones.

145. The cost and timescale of railway construction work has risen considerably more than construction work in general. There should be a review of how far that is due to unnecessary safety bureaucracy.

150. Effective systems of interdepartmental coordination of policy should be put in place to prevent Government departments undermining core areas of strategy. Climate change reduction, risk and obesity strategies should be protected by this system.

151. The Home Office should revise its alleygating guidance to emphasise the importance of maintaining pedestrian permeability and to remove the present suggestion that a diversion of 450 metres on a significant pedestrian route is insignificant.

152. The police and others responsible for the enforcement of traffic regulation should be more positive about enforcing traffic laws that relate to safety (including those relating to pavement parking and speeding). Breaking of traffic laws should have the same status as any other criminal activity that puts members of the general public at risk.

153. All Government departments should review their attitude to centralisation and localisation of facilities and pursue a localisation agenda.

154. Post Offices have considerable potential for the provision of local financial facilities and local shopping facilities (including acting as ordering points for goods from more distant facilities). Royal Mail should engage with this potential and the Post Office closure programme should be reversed.

155. There should be a programme for the development of a broadband network of sufficient speed to sustain the use of virtual reality for meetings and conferences.

156. Telemedicine, tele-education, tele-advice and other similar processes should be considered as ways to help maintain small local facilities in all fields of Government and the public services.

157. The Office for Fair Trading should discontinue the practice of regarding cooperation between public transport operators as anticompetitive. This attitude hinders public transport's effective competition with the car.

160. The European Union should recognise that because of climate change and safety ,rail should be promoted as an alternative to the car, lorry and plane as much as possible. The European Union should develop an international high speed rail network as an alternative to much current aviation and should also develop a Europe wide train/cycle network.

161. The European Union should enter into discussions with the United States, Russia, China, India, the African Union, Arab countries, ASEAN and the OAS with a view to establishing an international and intercontinental network of very high speed trains (at least 600kph – perhaps maglev). The development of this network should include the construction of the Bering Straits Railway, of a tunnel under the Straits of Gibraltar, and of a railway from Russia to Japan via sea tunnels and Sakhalin Island.

162. Whilst this international and intercontinental network would probably, in Europe, mainly serve capital cities and financial centres, it should be supported by a European high speed network (at least 300kph, probably conventional trains) linking the cities and regions of Europe to each other and to the international and intercontinental network. The EU should pursue the creation of such a network.

163. When these networks are fully in place, it should be possible to reduce the volume of aviation considerably and EU policy should aim at managing such a decline. The immediate aim should be the rail replacement of most short haul European internal air services. There is however likely to be a continuing need for aviation for

- business journeys over 2,500km;
- leisure journeys over 4,000 km;
- relief for rail services from Northern Europe to the Mediterranean on summer weekends and from all parts of the Europe to winter sports destinations on winter weekends;
- flights on routes which are substantially shortened by crossing large expanses of water or polar ice cap;

- flights from the mainland to islands which are too far from shore to rely on ferries or tunnels;
- local journeys in very remote areas such as the Arctic.

164. The EU should examine whether the construction of high speed railways could be speeded up by the conversion of motorways either as a deliberate substitution, or by the vehicular usage remaining in the form of vehicle-carrying trains or by the roadspace needed being diminished by the use of automated highways, with the consequent freeing of space for conversion to a railway.

165. The train/cycle combination should be promoted as a distinct transport mode, with a European network ensuring that the whole of Europe is:

- within reasonable cycling distance (perhaps 5km in urban areas, 10km in rural areas and 15km in remote areas);
- over a safe cycle route from a cycle-Metro station with cycle hire, cycle parking and cycle storage deposit schemes (cycles which are being left for more than two days being moved to a central storage point until the date they are needed again);,
- each such station being served by a cycle-carrying public transport system (typically a train but in rural areas it could be a cycle-carrying bus and on islands it could be a ferry);
- operating frequently (typically with a scheduled service every 15 minutes in urban areas, every 30 minutes in rural areas or every hour in remote areas, but where this is not economically viable demand responsive services could be provided);
- these local services feeding into the European network of interurban, interregional, intercity and international trains, all of which should have a cycle van attached for the conveyance of bicycles;
- with proper provisions for cyclists to change trains at major interchanges in significant numbers without obstructing classic passengers.

166. The trains which provide this network would in most cases also function as part of the classic network and would also serve stations which are designed to be accessed on foot over shorter distances. However, for the cycle/train mode to be promoted as a viable alternative to the car, the additional provision needed will be more than just a small modification of the rail network. It will need additional rail vehicles, additional facilities at stations, additional stations, and additional cycle links to stations. It will be in every sense a new network for a new mode.

167. The rail developments necessary for a European high speed rail network and for a cycle/train network would contribute significantly to developing rail to compete more effectively with the car. Urban areas (and rural areas where possible) should also have Metro services within walking distance. This may not be a Europe-wide issue but the EU should be prepared to deploy funding in appropriate circumstances.

168. The EU should ensure that it is fully understood that cities with rail-based public transport systems are more effective at modal shift from the car, to the point that they actually have more bus usage than cities with bus-based systems. In bus-based systems, public transport seems to be a residual mode for those without cars and the buses actually compete with walking and cycling rather than with the car.

170. The European Union should generally commit to the goals and strategies set out in recommendations 001 and 002.

171 Safety requirements and emission requirements on vehicles are important. The development of vehicle design measures to protect pedestrians and cyclists from collisions is a priority.

172. Road pricing is needed to reduce road traffic and ensure that the externalities of emissions and congestion are taken into account in the market.

173. The EU should consider the strategic aspects of transport for people with impairments or encumbrances.

174. EU regional policies should recognise the contribution of transport to health inequalities both by limiting access to health-promoting lifestyles and by differential application of the negative features of transport and should recognise lack of transport as an obstacle to work creation in poorer areas.

175. The EU should establish a European Transport & Health Observatory.

176. There should be European funding of transport behaviour change programmes.

177. There should be European funding of walking and cycling transport schemes.

178. The EU should require formal Health Impact Assessment in Strategic Environmental Assessments.

179. To account for commuting, the EU should change the weekly limit on hours under the Working Time Directive by

(a) adding 10 hours

(b) providing for 2 hours to be deducted for every day on which the worker is required to start and finish work other than at home.

180 Government and the European Union should commit to the principle that freight should be moved off the roads onto rail or water as a contribution to climate change and safety.

190 Government, the European Union and international economic organisations should find ways to finance the developments that are necessary to implement this strategy.

Finance and economics lies beyond the scope of this publication. However it is essential that humanity does not allow resources that could be mobilised in solving its climate change, obesity and transport problems to lie idle for lack of a means of exchange. Consideration could be given to international quantitative easing focussed on climate change, to Keynesian methods of public sector accounting which take account of funds created by employment or economic growth, to ways of capturing changes in land value or economic opportunity resulting from transport changes, to bonds on which repayment was tied to economic development or particular funding streams, or to arrangements in which the right to levy road charges was offered to consortia who put in place a walking, cycling and Transweb network, subject to their attaining specified performance standards.

HEALTH PROFESSIONS

200. We recommend that the public health system should actively promote the goals and strategies referred to in recommendations 001 and 002.

201**.** All Directors of Public Health should designate a consultant or senior manager to pursue the above goals and strategies.

202 Directors of Public Health should make full use of health impact assessment and the right of independent advocacy to create pressures for a healthy transport policy benefiting their population**.**

203. Public health professional organisations and campaigns should ensure there is effective national advocacy for a healthy transport system.

204. Transport should have a prominent place in the obesity strategies of local authorities, Primary Care Trusts, and their successor public health organisations.

210. Clinicians should be aware of aspects of transport and health relevant to their practice

211. Chapter 11 of this publication should be used as a basis for clinical awareness of transport and health.

212. The transport implications of disability should be understood by all those dealing with rehabilitation and with disability.

213. Each clinician should be aware of transport-related contributions to the aetiology of conditions which they treat.

214. All GPs, surgeons and physicians need to understand the relationship between health and driving.

215. All clinicians who advise exercise should be sufficiently well informed about walking and cycling to include it in their advice.

220. Transport and health should have appropriate exposure in medical education.

221. Recommendations 210 to 215 should be reflected in appropriate educational material.

222. Transport should figure prominently in public health training in relation to obesity, climate change, risk and the place of health in public policy.

230 Medical organisations should support the goals and strategies in recommendations 001 and 002.

240. Medical organisations that wish to be active in the promotion of cycle helmets should adopt a similar attitude to the wearing of helmets by pedestrians, drivers, footballers and rugby players, so that the risk is not exaggerated.

250. The biomedical and epidemiological aspects of the research agenda set out in chapter 22 should be funded and pursued.

TRANSPORT AND ENGINEERING PROFESSIONS

300. The goals and strategies in recommendations 001 and 002 should be built into the curriculum of all transport professional training and in the training of engineers whose work extends to transport or spatial planning.

310. The professional Institutes should take steps to promote a wider understanding of these goals and strategies and collaborate with public health organisations in pursuing them.

320. The technological developments in the research agenda set out in chapter 22 should be funded and pursued.

22 CONCLUSIONS

Stephen Watkins, Jennifer Mindell, Judith Cohen

22.1 Development of the Body of Knowledge since the first edition

Since the 1st edition of *Health on the Move*, the scientific body of knowledge has moved forward considerably.

22.1.1 Active travel

This edition places much more emphasis on active travel. This was certainly advocated strongly in the first edition but in this edition we have devoted three chapters to it. At the time of the first edition it was clear that active travel was healthy. It was not as clear then as it is now how much the obesity epidemic would unfold or how significant transport trends would be in its creation. It is now clear that the epidemic is larger than we had envisaged a decade ago and more far ranging in its effects. Although the rate of increase in obesity appears to be slowing down in adults and obesity prevalence is falling in children,[1] prevalence remains far too high and a range of serious health problems will increase in the population unless obesity falls substantially. It is also widely accepted that it is predominantly an epidemic of diminished physical activity rather than food-driven. It is true that obesity arises from imbalance between physical activity and food intake and that the imbalance can be tackled on either side of the balance. However, key amongst the causes of reduced physical activity are the reductions in walking and cycling and the reductions in children's independent play. Indeed some claim that the epidemic is statistically explicable by these factors alone. Of course even if diminished physical activity has created the imbalance it can still be tackled by reduced food intake. There is however some evidence emerging of the effect of reduced basal metabolic rate in undermining weight loss due to dieting and conversely the effect of increased basal metabolic rate in enhancing weight loss due to physical activity. Physical activity can mean many things and even if an imbalance has arisen from a shift in transport modes it could be responded to by expansion of sport or of fitness programmes. It has recently been suggested that vigorous physical activity leads to compensatory food intake as a reward and that it is regular moderate exercise that is most effective. However, we have not been able to find any evidence to support this. If evidence firms up that regular moderate exercise is the most effective weight-loss strategy the case for a transport-based solution will become overwhelming. More importantly, it can be far easier to incorporate activity into daily lifestyle than to 'do sports or exercise' Indeed, in his last annual report,[2] the former Chief Medical Officer, Sir Liam Donaldson, said:

> *"The benefits of regular physical activity to health, longevity, well being and protection from serious illness have long been established. They easily surpass the effectiveness of any drugs or other treatment. The challenge for everyone, young and old alike, is to build these benefits into their daily lives.*
>
> *"The potential benefits of physical activity to health are huge. If a medication existed which had a similar effect, it would be regarded as a 'wonder drug' or 'miracle cure'."*

22.1.2 Streets and community severance

We have been much clearer in this edition in advocating changes in streetscape and in the nature of streets. While we referred to Appleyard & Lintell in the first edition it remained a single study and there were questions about its generalisability beyond the circumstances of San Francisco. Its replication by Joshua Hart in Bristol has shifted the balance of scientific evidence to one in which the burden now lies on those who query the hypothesis to prove their case and the best available interpretation of the evidence is that traffic in residential streets diminishes social support with inevitable health implications. At the same time Hart's findings that it also reduces the extent to which the street is perceived as personal space has obvious implications for crime and disorder. We are now therefore much more confident in advocating reductions in traffic in streets. More evidence has also emerged about the importance of aesthetic surroundings for health which also has implications for streetscape. Again, we are in line with others in our proposals. Policy Objective E of the Marmot Review in 2010[3] was to:

> *'Create and develop healthy and sustainable places and communities'*

Priority objectives were to develop common policies to reduce the scale and impact of climate change and health inequalities; and to improve community capital and reduce social isolation across the social gradient. The policy recommendations included improving active travel across the social gradient; improving the availability of good quality open and green spaces; fully integrate the planning, transport, housing, environmental and health systems to address the social determinants of health; and to support locally developed and evidence-based community regeneration programmes that remove barriers to community participation and action and reduce social isolation.

22.1.3 Climate change

At the time of the first edition there was still some scope for scientific doubt about climate change, the full extent of the problem was not yet understood and political acceptance was restricted. Climate change is now the greatest threat to public health and to the world's economies. It is universally recognised as such by the world's Governments. We are therefore much more confident in this edition in advocating steps to address modal shift. Hence our proposals for an international high speed rail system, a national integrated transport web and the restriction of aviation to flights across water and polar ice caps and local journeys in trackless wilderness. A decade ago we might have felt that it pushed beyond the limits of the evidence to propose these as public health measures. Now we feel justified in doing so. Nor are we out of step in doing so. In 2008, the Sustainable Development Commission published a document on the role and responsibilities of the NHS in addressing climate change.[4]

22.1.4 Congestion

At the time of the first edition Mogridge had already published his work providing empirical evidence in support of the predictions of the Downs-Thompson Corollary of Pigou's Theorem. Despite this strong theoretical base and empirical evidence the idea that new roads generated congestion, rather than accommodating it, was still a fringe idea at the time of the first edition. For our part we were actually unaware of Mogridge's work at that time and we were not alone in that – it had been largely ignored. This was wrong. Mogridge made a bold statement for his work:

"We now know how to organise congestion-free transport in cities".

There was a considerable degree of justification for that statement if the empirical evidence he provided legitimated the theoretical predictions of Downs and Thompson. Pigou's Theorem predicts limits on the effectiveness of markets when there is a downwardly sloping cost curve. It is widely neglected because it is politically inconvenient to those who seek market solutions. As well as its implications for transport, it also has implications for energy and for hospitals. Indeed the tariff system used in the NHS internal market neglects Pigou's Theorem. Upon this neglected theoretical basis Downs and Thompson produced their politically unpopular and to some extent counter-intuitive projection that the only way to reduce congestion was to invest in public transport rather than roads. Mogridge then took the predictions of this theoretical model and provided the empirical evidence to support it. It is perhaps unsurprising that his work was not greeted with the acclaim that it deserved. It is however unfortunate that we have now had a further decade of development of a spatial pattern that disseminates land use and makes it more difficult to identify public transport corridors. This has led to the problem that we discussed in chapter 10 that public transport networks rather than individual public transport services must be taken into account when applying Downs & Thompson's ideas. Rail capacity is another issue which now needs to be drawn into the equation and which did not seem so problematical at the time that Mogridge published his work.

22.2 Areas for Further Research

Physiologically there is need for more understanding of the metabolic factors which underpin the choice of dieting, vigorous physical activity, and moderate physical activity as weight-loss mechanisms. It has become clear that there is more to this than just balance and intriguing suggestions of the role of basal metabolic rate, fat mobilising substance, and certain neurotransmitters and hormones. A full understanding of this picture would be valuable. There is need to confirm physiologically the presumptive hypothesis that inappropriate persistence of the stress reaction is the cause of links between mental well-being and health. We need more understanding of how social support and aesthetics interact with stress so as to confirm the presumptive hypothesis that the health consequences of social support and of aesthetic surroundings are mediated through the stress reaction either directly or indirectly.

The finding suggestive of a link between rheumatoid arthritis and traffic is fascinating. We have not felt able to make much of it in this edition as it is only a single study and the causal link is unclear. It needs to be further investigated to see if it is real. If the association is confirmed, the biological mechanism needs to be identified to increase our understanding of yet another health consequence of the automobile.

There needs to be more epidemiological evaluation of links between health and exposure to traffic. It would be valuable to know if the Appleyard / Lintell / Hart impact on social networks can be shown as an association with identifiable ill health.

There is considerable need for behavioural research into the factors that influence transport behaviour so that appropriate policies can be adopted and appropriate social marketing prepared. In particular, obstacles to cycling and the use of public transport need to be identified.

If we are right to argue in chapter 7 that misperception of cycling risk is an important factor in restricting cycling, then the obesity epidemic, driven by declining walking and cycling and independent children's play, can be portrayed as an epidemic produced by risk-misperception. We have mentioned the distinction between safety and risk-averseness in our discussion of public transport safety in chapters 18 and 20. Risk-misperception has also hindered the development of technological constraints on drivers, since manufacturers fear litigation if they fail. It is perceived that society might accept that 12 people a day die on the roads due to human error and human recklessness but that if that figure were reduced by over 90% and the one remaining death was due to software failure there would be a public outcry and a manslaughter prosecution. The greatest risk-misperception is the reluctance to put in place controls that will avoid mass loss of life and reduction in living conditions by climate change. There is a need to expand our understanding of human risk behaviour.

In terms of technology it would be a convenient start to the process of building international high speed rail links if motorway corridors could be handed over to provide the trackbed formation for the new railways. This may be possible if the function of the motorway could either be replaced by a rolling motorway or compressed into part of the current road by the use of automated highways. This is an area which would warrant technological investigation. So, at lower speeds, would signalling systems that allowed automated highways and railways to share formation. Virtual reality settings for meetings and conferences are important to reduce business travel. Multistorey urban farms could help provide food more locally. Other areas for technical advance include pedestrian safe vehicles, better electric cars, systems for recovering braking energy for reuse, and hybrid bicycles which store energy in ordinary use to provide assistance up hills.

22.3 A Vision for Healthy Transport

Our vision for a healthy transport system is one in which short journeys are made on foot or by cycle, in which:

- streets become not just passages for access but also sources of community activity and social interaction;
- there is a comprehensive network of public transport for longer journeys;
- the cycle/train combination becomes a major flexible transport mode;
- high speed rail replaces aviation for journeys across land masses;
- aviation is used only for flights over sea and local journeys in trackless wilderness;
- business travel is reduced by the use of virtual reality video- or tele-conferencing;
- multistorey urban farms make it possible to produce more food locally;
- local shops experience a renaissance by serving also as order points for delivery systems thus expanding the range of goods they can offer;
- it becomes abnormal to attend work on five days a week. A combination of compressed hours, homeworking and greater productivity makes the usual pattern to spend three days a week at work, one day a week working at home and three days a week free of work; and
- there are neighbourhood work stations where people from a range of different employments can share a communal provision of work equipment close to their home.

In chapter 1 we outlined the impact of this on the lives of two individuals. We commented:

> *"The lifestyle described in the cameo is not an isolated travel-free lifestyle nor an unpleasant restricted one. It is a technologically feasible lifestyle. It is healthy. It protects our environment. It actually offers chances to improve our lives – the extra space in the house because the garage is no longer needed, the extra garden taken*

from the street, the extra personal time due to shorter journeys and less travel time. Why should it not come about?"

Why indeed? Is it that people are locked into the past? Is it that those who bought a car to drive it on an open road across a Scottish moor irrationally refuse to accept that it is destined to spend most of its time in a traffic jam? Is it that people never end a day of driving in urban traffic by looking at the average speed figure on their trip computer and observing that a horse would be faster? Or is it that as a society we have lost the vision to reach out for a different future?

We have called for the creation of new networks – new cycle and walking networks, new streetscapes with reconstruction of most streets, the new integrated transport web, the new cycle/train network, the new international high speed rail network, the network of neighbourhood work stations, and the high speed broadband connections necessary for interactive virtual reality. There are those who will say that this is unrealistic. Why? "Sweating the assets" and a process of make do and mend is what most UK transport professionals have accepted as common sense for the last three decades and they will challenge the realism of our vision. But we ask why such engineering lies beyond the capacity of a nation which first built the turnpikes, and then almost immediately supplemented them with the canals, and then replaced both with the railway (building 20,000 miles of railway in five years) and then laid the urban tramways and then built the motor roads and then replaced them with the motorways and did all of this because it believed a trading nation needed a transport infrastructure. What is right – the "common sense" of the last three decades or the wisdom and vision of the last three centuries? The Bering Straits Railway is seen as an impossible dream. Why? Russia, Canada and the USA have each built more than one transcontinental railway with pick and shovel and gelignite. Why, with all the technological advances of the 20th century, do they now find it impossible to do it again?

We have commented already that in 1825 it would have seemed more sensible to invest in an ostler's business than in a railway just as today it may seem more sensible to build an airport than an intercontinental high-speed railway. The reality is that the railway did replace the horse and so the transport system that we advocate will replace our current system. The railway did not replace the horse smoothly and no more will the present shift be smooth. The early adopters gained great benefit – small villages that embraced the railway grew into large cities and powerful towns that rejected the railway shrank into rural backwaters. So the cities and nations which are first to embrace the new transport system will be the economic powerhouses of the knowledge-based economy.

We will be told that it is unrealistic in these harsh financial times. Macroeconomics lies beyond the scope of this book, but money is a means of exchange and financial systems are intended to allow human beings to combine together to realise their potential, not to constrain them. Resources should not lie unused and human beings stand idle while human need is unmet.

22.4 Transport in Public Health Practice

The NHS has an important role in sustainability.[4] Five per cent of road traffic is generated by the NHS. The NHS is the country's largest employer. It is important therefore that the NHS acts as an exemplar of good practice. Public health should clearly articulate this need in NHS managerial and professional discussions, although in the new system this may need to pursued through the Health and Well Being Boards or .through relationships between the Public Health Service and the NHS Commissioning Board. In the financial climate that will apply in the next few years, it is important to articulate the direct financial benefits that can be drawn from sustainability (reduced spending on energy, parking, and car mileage), the reduced future costs as carbon pricing takes effect, and the impact of reductions in obesity on health care costs.

Public health will play an increasingly important role in local authorities once the health improvement function has been transferred to local authorities as part of the current NHS reorganisation. NICE recommendations on physical activity should be drawn clearly to local authority attention. Directors of Public Health must emphasise the importance of completing and promoting walking and cycling networks. Following the reference of spatial planning to NICE, public health must ensure that it is well-positioned to influence spatial planners over land distribution, walking and cycling and the reduction of traffic in streets. Directors of Public Health should be advocates for Living Streets.

Health Impact Assessment is an important mechanism for ensuring that health is taken into account in transport schemes. Often HIA is grafted onto an environmental impact assessment and carried out by people with little understanding of health and especially of its social and behavioural determinants. Sometimes it is carried out by people skilled in HIA but unfamiliar with transport. Public health professionals should ensure that Transport HIAs meet the standards we described in chapter 12. It is important that Directors of Public Health establish that, as the local authority's public health adviser, the authority should require that they are satisfied with the methodology of any HIA.

The medical profession enjoys one of the highest level of public trust of any occupational group. Public health is a medical specialty and, although there is non-medical access to the specialty, public health specialists should still shelter under the profession's umbrella. Public health is therefore well placed to be an effective advocate for new ideas, provided that it acts with the integrity, openness and scientific rigour which the public expects of medical specialists. This ought to be used to promote visions like Living Streets and the importance of walking and cycling.

Public health specialists have professional skills as change agents and a professional body of knowledge which embraces an understanding of behaviour change. Travel planning as a behaviour change exercise has much in common with the other kinds of behaviour change that we have experience of promoting through social marketing and so we have much to contribute to the discussion of how people can be persuaded to change their behaviour. In particular there is much relevance to the principle that most of the time most people on most issues do what they think is normal and so behaviour change requires action to change communal norms, or misperceptions of those norms (one of the reasons for removing tobacco advertising, for example).

If a drug were invented tomorrow which treated or prevented obesity, depression, diabetes, osteoporosis and heart disease, the pharmaceutical company would think five Christmases had been rolled into one. It is strange therefore that so little use is made of the therapeutic benefit of physical activity.[2] It is also strange that when attention does turn to physical activity, it so often focuses on expensive facilities like gyms or swimming pools and on making time for sport or physical recreation. Walking and cycling for transport should form part of exercise referral schemes and of brief interventions about physical activity. Health trainers have a role in supporting this behaviour change. So do community organisers and there is no doubt that the Big Society has its implications for health.

22.5 Health as an Issue for Transport Professionals

Transport has not been at the centre of decisions about the future of human civilisation at any time in the lifetime of existing transport professionals. It has, however, played much more significant roles in the past. In the 18th and early 19th century, transport was at the centre of scientific and engineering advances. In the middle of the 19th century, the railways shaped a new civilisation, linking humanity as it had never been linked before and breaking down the distances that had confined people to their own villages. In the late 19th and early 20th century, transport shaped empires and determined the outcome of wars – it is interesting to consider the role of railways in the unification of Canada, India, the United States and

Russia, or the significance of logistics in constraining diplomacy in the immediate prelude to the First World War.

In this book we place transport at the centre of the solution to the greatest current epidemic of the developed world and at the same time as a key player in the most crucial challenge facing our species, that of climate change. We argue that transport is now at a crossroads similar to that of the 1830s and 1840s, where the past was dead but the future not yet born (except in tantalising glimpses), and transport was about to change dramatically, changing the world as it did so.

For transport planners, the prescriptions of this book will be nothing new. They already seek to create a system with less use of the car and more use of public transport, walking and cycling. This book will provide them with additional arguments, the prospect of additional allies, and perhaps more confidence and better tools for demanding resources.

For highways engineers, this book poses the challenge of major change. We ask them to learn the distinction between saturated and unsaturated road systems, to understand that their current model of congestion is valid only in one of those situations, and that wholly new approaches are needed in the other. We ask them to distinguish between streets, lanes and roads and treat them differently. We ask them to see each of these three types of highway as more than just a route for traffic. We ask them to see streets as primarily areas for community interaction and the design challenge as being to ensure that the passage of traffic can be accommodated without disrupting that prime purpose. We ask them to see roads as multimodal corridors, to pay more regard to walking, cycling, bus priority and tramways and to reach out for the potential of automation. We ask them to see lanes as primarily routes for cycling and walking and the design challenge as being to allow them to continue to play their role for end access and local links without motor traffic taking them over. To call upon a profession to change its traditional way of thinking so substantially is to invite inevitable resistance. Those who resist will be the major drag upon the future of transport and will waste much money on useless projects. Those who adopt our ideas will shape the future of their discipline and they have challenging and exciting careers ahead of them.

For the rights of way officers and walking officers who manage our path network, this book calls on them to assert their discipline as centre stage, not the backwater it has so often been. For railways, we ask them to believe again in their core role but in doing so to understand that they must re-evaluate the low priority they ascribe to stopping trains and cycles. For spatial planners. we ask them to believe again in their power to make a difference and to help local communities shape the pattern of human settlement, and ultimately they will prevail over those who prefer the comfort of a pointless bureaucratic fiefdom driven mainly by the twin drivers of not being late and not being overturned on appeal. There will be those, in each of these groups, who are so scared of the future that they will seek to ensure that the past prevails. They will fail. The future will come.

22.6 References

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