

Transport and Health Resource

Delivering Healthy Local Transport Plans



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Transport and Health Resource

Delivering Healthy Local Transport Plans

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Foreword

The Transport and Health resource was jointly commissioned by the Department of Health (DH) and Department for Transport (DfT) to support the development and delivery of health conscious Local Transport Plans throughout England.

Local Transport Plans (LTPs) are required to be assessed through Strategic Environmental Assessment (SEA) (European Directive 2001/42/EC) as an integral part of developing, appraising and later, delivering LTPs. Addressing human health is a key requirement of the SEA directive, and health impacts are also covered in the statutory duty to assess for the Impact on Equality, which will need to be carried out for all LTPs.

This resource is for information and relates to existing policy. It is intended for use by Transport Planners for developing their plans, Public Health Departments that can advise on local health issues, and SEA practitioners assessing the plan and informing its preparation. It contains easily accessible evidence on the full range of the health impacts of transport modes so that the information can be incorporated into the evidence base for local transport plans and their assessment to ensure health issues are effectively covered throughout the process.

The resource:

- suggests how and when to use the four key elements of the resource (Transport and Health Screening Tool, summary of the Transport and health evidence base, suggested assessment methods and the Transport and Health Bibliography Matrix) in Chapter 1;
- shows how the different elements inform the five stages in SEA in Chapter 2;
- provides a quick reference screening tool linking health outcomes with transport mode Chapter 3;
- gives a summary of the transport and health evidence in Chapter 4 with supplementary information in Appendix A;
- suggests approaches to using SEA and health impact assessment (HIA) in Chapter 5;
- provides information on key health pathways and how they can be addressed in transport planning in Chapter 6;

- suggests key performance indicators for monitoring human health impacts in Chapter 7; and
- sets out suggested transport mitigation and community support initiatives in Chapter 8.

The benefits of more health conscious transport planning include:

- measures to improve health invariably help reduce congestion, improve air quality; increase accessibility; reduce illness related absenteeism at work; and reduce risk of injury;
- low levels of physical activity through car use in place of active travel modes contributes to the burden of chronic disease through higher levels of heart disease, stroke, cancers, diabetes and other illnesses including those resulting from obesity;
- walking and cycling are the easiest ways for most people to increase their physical activity levels. Use of public transport can also increase physical activity due to use of active travel to reach public transport interchanges;
- adults who cycle regularly have a longer life expectancy than those who don't;
- at school age active travel is one of the main contributors to achieving the Chief Medical Officer's recommendations for physical activity and maintaining a healthy weight;
- reducing motor traffic speeds in urban areas to less than 30mph directly reduces casualties and increases opportunities for active travel; and
- Infrastructure measures to benefit the active travel modes result in an average of a 13:1 Benefit to Cost Ratio⁽¹⁾.

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1. How and when to use the Transport and Health Resource

- 1.1 This resource is intended to aid in the initial development of transport plans, support and inform their assessment through the Strategic Environmental Assessment (SEA) process and help deliver Local Transport Plan (LTP) strategic objectives in line with the LTP3 Guidance. This section establishes how and when to use the resource by introducing the key content, and its interface with the SEA process.

Transport and Health Screening Tool

- 1.2 The Transport and Health Screening Tool in Section 3.1, is a matrix designed to structure and refine the detailed literature review informing the development of the transport and health evidence base. It provides a means for transport planners, their partners in other Local Authority departments and SEA practitioners to rapidly screen the key health pathways and potential health outcomes associated with specific transport modes. It can be applied to inform a number of tasks in Stage A of the SEA process, including:
- informing the screening and scoping of human health issues to be addressed within SEA;
 - as a means to navigate to areas of interest in the transport and health evidence base; and
 - as a means to inform and develop a local human health baseline section and monitoring programme.
- 1.3 The transport and health screening tool can be further applied to inform Stages D & E of the SEA process, by highlighting particularly vulnerable groups to engage with and the development of an appropriate health monitoring programme.

Transport and Health Evidence Base

- 1.4 The Transport and Health Evidence Base has been compiled from a wide range of systematic reviews on transport and health in the UK, within the specific context of the LTP3 Guidance. Given the range of health pathways associated with transport, and the requirement to focus upon health protection as well as health and wellbeing, the review was further

supplemented through a synthesis of available literature held by the Department of Health and the Department for Transport.

Chapter 2, supports stages A and B of the SEA process by providing a concise discussion as to the particular health issues and opportunities associated with transport modes and their disproportionate distribution within communities and vulnerable groups. Supplementary information is in Appendix A, and supports Stages C, D and E of the SEA process. Transport planners and partners from the health sector and SEA practitioners can apply the text to support the development of specific human health sections within SEA Environmental Reports, inform the assessment of transport options and apply it during consultation exercises to inform and address local health concerns.

Recommended Assessment Methods

Chapter 3 presents assessment methods that can be applied at the strategic level to determine the distribution, magnitude, likelihood and significance of potential health outcomes. The purpose of this section is to inform stage B of the SEA process by establishing methods that can be applied to inform the assessment of transport options, and to signpost to existing methods that are inherently designed to address human health. As demonstrated in Table 3.1, Chapter 3 provides transport planners, public health specialists and SEA practitioners with a means to more effectively draw from, and where appropriate supplement, assessment methods, offering a more consistent and cost effective approach to human health and equality impact assessment on LTPs. It is not however intended to suggest that quantitative predictions can be made of the health effects of plans.

Transport and Health Bibliography Matrix

- 1.5 The matrix lists the evidence bibliography used in this document and indicates the health impacts each one covers by the mode of transport. This is a quick method of signposting key health literature by transport mode and support stages A,B,C and D of the SEA process. and will also aid in justifying and defending strategic decision-making.

2. The Strategic Environmental Assessment Process and Interface with the Transport and Health Resource

- 2.1 The European Directive on Strategic Environmental Assessment (SEA) creates a formal process for predicting and evaluating the environmental effects of plans or programmes⁽²⁾.
- 2.2 The former Office of the Deputy Prime Minister, now the Department for Communities and Local Government (CLG), published the *Practical Guide to the Strategic Environmental Assessment Directive 2005* which should be referred to for information on meeting the requirements of the SEA Directive: <http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea>
- 2.3 The SEA Directive requires consideration of the likely significant effects of a plan or programme on human health. Responsible Authorities may find it helpful to draw on the methods of health impact assessment (HIA) when considering how a plan or programme might affect people's health, and how positive effects could be enhanced and negative effects reduced.

Article 5 and Annex I of European Directive 2001/42/EC

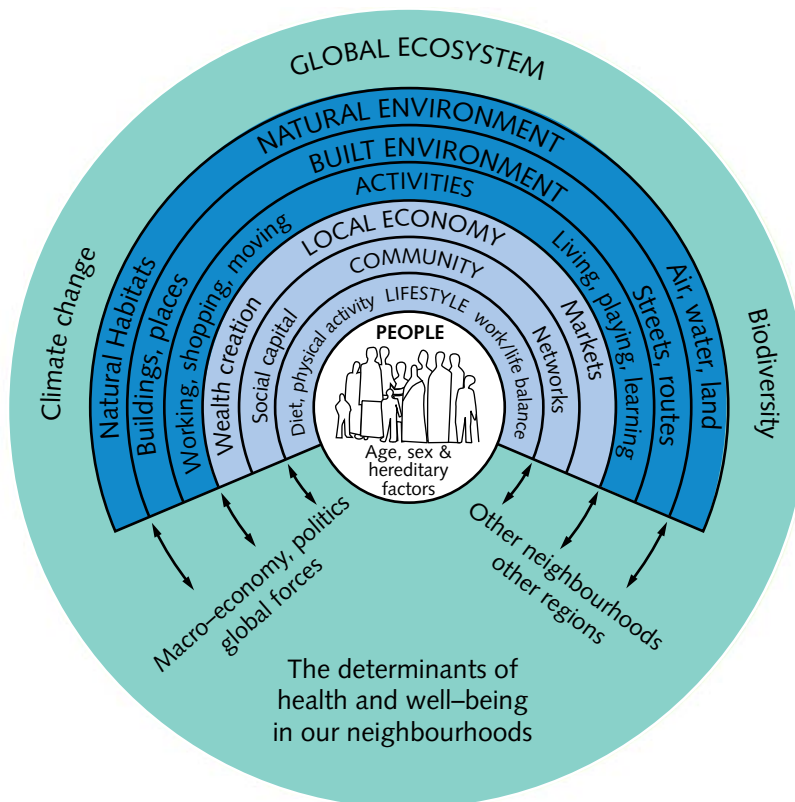
*This specifies that an Environmental Report should be written that includes an assessment of... "the likely significant effects on the environment, including on issues such as biodiversity, population, **human health**, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors."*

- 2.4 The Department of Health recommends that the definition of health used is the one used by the World Health Organization (WHO).
'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'⁽³⁾
- 2.5 This covers the full range of potential health impacts as shown in Figure 2.1. It applies to a broad environmental and socio-economic model of health that can be applied to assess how plans and programmes will influence key determinants of health and wellbeing.

- 2.6 Though consideration of health within an SEA offers the opportunity to consider issues of health and transport more formally, it is not the only mechanism for bringing about greater health gain associated with transport plans. Rather it should be viewed as one of range of tools, including HIA, that can support effective joint working across transport and health sectors on a broader and ongoing basis.
- 2.7 For further explanation of the coverage of human health in SEA refer to the Department of Health's *Draft Guidance on Health in SEA 2007*:

http://www.dh.gov.uk/en/Consultations/Closedconsultations/DH_073261

Figure 2-1 Population Health and the Environment



Source: Hugh Barton and Marcus Grant (2006), drawing on Whitehead and Dahlgren (1991) and Barton (2005). United Kingdom Public Health Association (UKPHA) Strategic Interest Group and the WHO Healthy Cities Programme.

- 2.8 Table 2.1 presents the five key stages of the SEA process, as set out in the Practical Guide, and how and when this resource can be applied to support both the LTP and SEA process.

Table 2.1: LTP, SEA Interface with the Transport and Health

LTP Process	SEA Process		Interface with Transport and Health Resource				Description
	Stages	Task	Tool and Location within Document				
			Chapter 3	Chapter 4 and Appendix A	Chapter 5	Appendix B	
			Transport and Health Screening Tool	Transport and Health Evidence Base	Recommended Assessment Methods	Transport and Health Bibliography Matrix	
Determine the scope of the LTP (strategy and Implementation Plan) clarifying goals; specifying the problems or challenges the authority wants to solve	Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope	Identifying other relevant plans, programmes and environmental protection objectives	✓	✓			By highlighting the potential health pathways and outcomes associated with specific transport modes, it is possible to aid in the identification of wider plans, programmes and environmental objectives that may further influence or compound health and inequality.
		Collect baseline information	✓	✓	✓	✓	<p>By providing a summary of the available transport and health evidence base and cataloguing the key health pathways and potential health outcomes associated with specific transport modes, it is possible to inform the development of bespoke evidence, and the development of more focused and effective health baseline consistently throughout the UK.</p> <p>Furthermore, knowing the specific data requirements for assessment methods at an early stage will:</p> <ul style="list-style-type: none"> • foster more effective engagement with representatives from health and healthcare organisations; • reduce unnecessary repetition of effort in the collection of baseline statistics (by designing the health baseline section to inform the assessment stage and be transferable to the monitoring stage); and • support the development of appropriate health indicators.

LTP Process	SEA Process		Interface with Transport and Health Resource				Description
	Stages	Task	Tool and Location within Document				
			Chapter 3	Chapter 4 and Appendix A	Chapter 5	Appendix B	
			Transport and Health Screening Tool	Transport and Health Evidence Base	Recommended Assessment Methods	Transport and Health Bibliography Matrix	
		Identify environmental problems	✓	✓		✓	<p>By highlighting the key health outcomes (both adverse and beneficial) of specific transport modes and their potential uneven distribution within communities, will aid in the identification of issues and opportunities at an early stage of bespoke LTPs.</p> <p>The identification of vulnerable community groups also provides a means to further refine consultation programmes with local communities, vulnerable groups and key health stakeholders.</p> <p>Furthermore, the identification of potential mitigation and community support initiatives will further aid in establishing the distribution, likelihood and significance of such health outcomes at an early stage</p>
		Developing SEA objectives	✓	✓	✓	✓	<p>By establishing the potential health outcomes (both adverse and beneficial) associated with specific transport modes, and the methods available to assess them, it is not only possible to inform the development of more health focused SEA objectives, but also indicate as to how the broader SEA objectives are implicitly geared to address health.</p>
		Consulting on the scope of SEA	✓	✓		✓	<p>By establishing the key health pathways associated with a specific transport mode, and how those pathways can be unevenly distributed throughout a population, provides a means to target engagement programmes more effectively.</p> <p>Furthermore, the application of the transport and health evidence base will:</p> <ul style="list-style-type: none"> • facilitate more informed discussion with local communities and key health stakeholders; • highlight how community health has been an implicit consideration from the onset of the project; and • provide a means to address community health concerns rapidly, robustly and with confidence.

LTP Process	SEA Process		Interface with Transport and Health Resource				Description
	Stages	Task	Tool and Location within Document				
			Chapter 3	Chapter 4 and Appendix A	Chapter 5	Appendix B	
			Transport and Health Screening Tool	Transport and Health Evidence Base	Recommended Assessment Methods	Transport and Health Bibliography Matrix	
<p>Generating options for the strategy and implementation plan to resolve these challenges; appraising the options and predicting their effects</p> <p>Selecting preferred options for the strategy and implementation plan and deciding priorities</p>	<p>Stage B: Developing and refining alternatives and assessing effects</p>	Testing the plan or programme objectives against the SEA objectives	✓	✓	✓	✓	<p>The evidence base and supporting tools provide a basis to integrating health and equality impact assessment into planned SEA work streams consistently throughout the UK.</p> <p>Knowledge of the potential health outcomes of a specific transport mode, and how to assess them can be applied to:</p> <ul style="list-style-type: none"> • support and iteratively assess the potential health influence of transport options; • inform and support the justification for the appraisal of multiple options; • mitigate potential risks, and support the delivery of transport objectives through community support; and • indicate how environmental monitoring and indicators are geared towards the protection of health, and rationalise the development of appropriate health specific KPI. <p>In addition, such a resource can also be applied to defining more specific and cost effective scope of work when commissioning technical assessments.</p>
		Developing strategic alternatives					
		Predicting the effects of the plan or programme, including alternatives					
		Evaluating the effects of the plan or programme, including alternatives					
		Mitigating adverse effects					
		Proposing measures to monitor the environmental effects of the plan or programme implementation					

LTP Process	SEA Process		Interface with Transport and Health Resource				Description
	Stages	Task	Tool and Location within Document				
			Chapter 3	Chapter 4 and Appendix A	Chapter 5	Appendix B	
			Transport and Health Screening Tool	Transport and Health Evidence Base	Recommended Assessment Methods	Transport and Health Bibliography Matrix	
Production of draft LTP Consultation on draft LTP Production of final LTP Adoption of LTP	Stage C: Preparing the Environmental Report	The Environmental Report is a key output of the SEA, presenting information on the effects of the 'draft plan or programme', issued for consultation	✓	✓	✓		The resource provides a founding platform for developing the health and equality aspects of the Environmental Report, its consultation and the assessment of any further revision.
		Consulting the public and Consultation Bodies on the draft plan or programme and the Environmental report				✓	
	Assessing significant changes						
		Making decisions and providing information					

LTP Process	SEA Process		Interface with Transport and Health Resource				Description
	Stages	Task	Tool and Location within Document				
			Chapter 3	Chapter 4 and Appendix A	Chapter 5	Appendix B	
			Transport and Health Screening Tool	Transport and Health Evidence Base	Recommended Assessment Methods	Transport and Health Bibliography Matrix	
Reviewing implementation of LTP	Stage E: Monitoring the significant effects of implementing the plan or programme on the environment	Developing aims and methods for monitoring	✓	✓	✓		As previously discussed, the resource provides a founding platform for developing an appropriate monitoring programme including appropriate health indicators, but also provides a basis to signposting how environmental indicators are inherently geared towards the protection of health.
		Responding to adverse effects					

Source: Table Modified from A Practical Guide to the SEA Directive (Office of the Deputy Prime Minister) and Guidance on Local Transport Plans from the Department of Transport (Annex F)

3. Transport and Health Screening Tool

- 3.1 The transport and health screening tool provides, transport planners, health professionals and SEA practitioners with a rapid means of identifying potential health pathways associated with transport modes, informing both the initial stages of the LTP process and stages A and B of the SEA process as set out in Figure 2.1.
- 3.2 To use it, select the appropriate transport mode column and scroll down to establish the key health opportunities and issues associated with that transport mode. This information can be applied as a primary means to establish potential human health issues or a gap analysis to ensure human health has been sufficiently addressed. It can also be applied to navigate to key information within the summary of the transport and health evidence base in Chapter 4, or the more detailed evidence base within Appendix A. The screening tool helps develop an evidence base tailored to the development of LTPs.
- 3.3 By indicating the potential health outcomes associated with transport modes (both adverse and beneficial), the screening tool also provides, transport planners, health professionals and SEA practitioners with the means to inform the development of appropriate human health strategic objectives, appraisal criteria and select appropriate assessment methods from Chapter 5 (Recommended Assessment Methods).

Figure 3.1: Transport and Health Screening Tool

Determinant of Health	Health Pathway	Potential Health Outcome	Transport Mode										
			Active Transport		Private Transport		Public Transport						
			Walk	Cycle	Car	Motorbike	Taxi	Bus/Coach	Rail	Tram/Light Rail/Underground	Ferry Boat	Air	Freight (Road, Rail and Canal)
HEALTH OPPORTUNITIES													
Lifestyle	Increase in physical activity	Cardiovascular benefits (prevention and recovery)	✓	✓				✓	✓	✓	✓		
		Respiratory benefits	✓	✓				✓	✓	✓			
		Obesity management	✓	✓				✓	✓	✓			
		Diabetes (type 2) minimisation & management	✓	✓				✓	✓	✓			
		Improvement in life expectancy	✓	✓				✓	✓	✓			
		Reduced stress levels (mental health)	✓	✓									
		Improved emotional wellbeing	✓	✓								✓	
		Strengthen bones/muscles/joints	✓	✓				✓	✓	✓			
		Reduced cancer prevalence (some types)	✓	✓				✓	✓	✓			
		Reduced cost to health care and society	✓	✓									
Economic Health	Reduced transport costs and increased disposable income	Relatively improved socio-economic health and coping skills	✓	✓					✓	✓	✓		
		Improved pedestrianisation of streets and increased patronage/viability of community resources, amenities and facilities leading to healthy and more vibrant communities	✓	✓				✓	✓	✓	✓		
	Supporting a sustainable and vibrant economy	Delivering both goods and customers to services, amenities and resources critical to maintaining and promoting a healthy vibrant population											✓
Increased access to social networks and destinations	Improved social cohesion and interaction	Generally improved social, mental and physical health	✓	✓				✓	✓	✓	✓		
	Crime prevention	Design out crime and the perception of crime through improved and more frequent use of surrounding areas/ community facilities	✓	✓				✓	✓	✓	✓		

Determinant of Health	Health Pathway	Potential Health Outcome	Transport Mode										
			Active Transport		Private Transport		Public Transport						
			Walk	Cycle	Car	Motorbike	Taxi	Bus/Coach	Rail	Tram/Light Rail/Underground	Ferry Boat	Air	Freight (Road, Rail and Canal)
Environmental Benefits	Improved urban environment	Generally improved social, mental and physical health	✓	✓					✓	✓	✓		
	Improved air quality	Improved cardiovascular and respiratory health	✓	✓					✓	✓	✓		
		Reduction in cardiovascular and respiratory hospital admissions	✓	✓					✓	✓	✓		
		Reduction in all cause mortality rate and improved life expectancy	✓	✓					✓	✓	✓		
	Road safety	Improved road safety and reduction in the number of killed and seriously injured	✓	✓					✓	✓	✓		
	Contribute to reducing the UK greenhouse gas emissions	Potential health benefit at the local, national and global level	✓	✓					✓	✓	✓		
	Improved noise environment	Reduction in annoyance and associated stress and anxiety	✓	✓									
		Reduction in sleep disturbance	✓	✓									
		Improved mental health and cognitive function	✓	✓									
	Reduced congestion	Improved urban environment with implications for improved access and accessibility, reduced community severance, reduced noise and air pollution exposure with physical, mental and social health benefits	✓	✓						✓	✓		✓

Determinant of Health	Health Pathway	Potential Health Outcome	Transport Mode										
			Active Transport		Private Transport		Public Transport						
			Walk	Cycle	Car	Motorbike	Taxi	Bus/Coach	Rail	Tram/Light Rail/Underground	Ferry Boat	Air	Freight (Road, Rail and Canal)
HEALTH ISSUES													
Lifestyle	Reduced opportunity for physical activity	Increased cardiovascular disease risk and prevalence			✓	✓	✓	✓	✓	✓	✓	✓	
		Increased risk of overweight and obesity prevalence			✓	✓	✓						
		Increased risk of Diabetes (type 2) prevalence			✓	✓	✓						
		General reduction in stress management and coping skills											
		Increased risk of osteoporosis prevalence and increased risk and severity from slips, trips and falls within the older population			✓	✓	✓						
		Increased risk of cancer prevalence (some types)			✓	✓	✓						
		Increase in all cause mortality and reduction in life expectancy			✓	✓	✓						
		Increased cost to health care and society			✓	✓	✓						
	Physical strain	Risk of injury from increased levels of physical activity	✓	✓									
	Community severance	Reduced access and accessibility to social networks, amenities and facilities with a subsequent impact upon general social, mental and physical health			✓	✓	✓	✓					
Economic Health	Cost of transport to the individual	Relative reduction in socio-economic health and coping skills			✓	✓	✓	✓	✓	✓	✓	✓	
	Local economy and viable local amenities, facilities and social areas	Less active modes of transport reduce the level of footfall within communities and can adversely reduce the level of local spending that in turn reduces the viability of local level services and amenities, with social, mental and physical health impacts. This has a tendency to impact upon specific community groups in particular (older people, the infirm and socio-economically disadvantaged) with fewer alternatives			✓	✓	✓	✓					

Determinant of Health	Health Pathway	Potential Health Outcome	Transport Mode										
			Active Transport		Private Transport		Public Transport						
			Walk	Cycle	Car	Motorbike	Taxi	Bus/Coach	Rail	Tram/Light Rail/Underground	Ferry Boat	Air	Freight (Road, Rail and Canal)
Environmental Issues	Risk of collision	Risk of serious and fatal injuries			✓	✓	✓	✓	✓				
	Increased generation to vehicle emissions	Increased risk and prevalence of cardiovascular and respiratory disease			✓	✓	✓	✓	✓	✓	✓		✓
		Increase in cardiovascular and respiratory hospital admissions			✓	✓	✓	✓	✓	✓	✓		✓
		Increase in all cause mortality rate and reduced life expectancy			✓	✓	✓	✓	✓	✓	✓		✓
	Noise & Vibration	Increase in annoyance and associated stress and anxiety			✓	✓	✓	✓	✓	✓	✓	✓	✓
		Sleep disturbance			✓	✓	✓	✓	✓	✓	✓	✓	✓
		Reduced mental health cognitive function			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Increased Congestion	Increased commuter stress and anxiety			✓								
	Community Severance	Reduced access to social networks, amenities and facilities with subsequent impacts to social, mental and physical health											
	Personal crime & security (and perception)	Reduced opportunity to increase community patronage of streets and prevent opportunistic crime/improve perceptions of crime influencing social behaviour, community use and ultimately physical, mental asocial health. Of particular concern to older people and the infirm with fewer alternatives			✓	✓	✓						
Poor perceptions of safety at modal interchanges limiting transport options and influencing social, mental and physical health						✓		✓		✓			

4. Transport and Health Evidence Base

- 4.1 The transport and health evidence base has been compiled following a systematic review of the health effects from key transport modes, supplemented through a synthesis of available literature held by the Department of Health, the Department for Transport (DfT) and Voluntary Sector Organisations (e.g. Sustrans). This is a summary of the available evidence base, and is supported by a more in-depth discussion within Appendix A.
- 4.2 No single mode of transport is solely good or solely bad for health, and local strategies have to provide a balance to cater to community, retail and development needs in order to facilitate healthy, vibrant, sustainable and cohesive communities. For this reason, this chapter has been structured to provide a brief discussion of the potential health issues and opportunities associated with the individual transport modes (and their potential disproportionate influence upon vulnerable community groups), followed by a final discussion as to the potential health pathways and outcomes.

Transport Modes

Walking

- 4.3 Evidence suggests that increasing levels of walking as a key mode of local transport not only promotes good health and wellbeing, but also aids in significantly reducing the prevalence and treatment costs for a wide range of key physical health issues in the UK. Including levels of obesity, type 2 diabetes, cardiovascular disease, cancer, osteoporosis and will ultimately aid in reducing all cause mortality. In addition, walking also promotes social inclusion, can reduce crime and perceptions of crime (more people walking and watching over neighbourhoods can discourage opportunistic crime and anti-social behaviour), has no direct environmental impact and is typically open to all age and socio-economic groups⁽⁴⁾⁽⁵⁾.
- 4.4 Potential health risks are largely associated with the potential risk of collision with road vehicles. Despite a decline in child mortality from road traffic collisions, evidence suggests that children in general and children from some minority ethnic backgrounds and in disadvantaged areas in particular, are more at risk from road traffic collisions.

- 4.5 Barriers to improving levels of walking within a population are largely environmental and behavioural. Environmental barriers may include physical barriers reducing access and accessibility, the quality of the urban environment influencing the need or desire to walk over alternative options, and pedestrian safety. The location and design of common destinations – eg employment and education sites, retail parks or leisure centres can make people favour the car.
- 4.6 Behavioural barriers are more complex, varying between the commuter type (i.e. office run, school run etc), age groups and relative socio-economic status, and may include:
- general sedentary behaviour and poor knowledge as to the convenience, economic and social, mental and physical health benefits of walking;
 - a lack of, or perceived lack of supporting infrastructure (e.g. public toilets, rest stops, shelters etc);
 - crime and perceptions of crime; and
 - safety and poor perceptions of safety (both from road vehicle collisions and the quality of the urban environment).

Community engagement is therefore important to gaining an appreciation of local community circumstance, and identifying and addressing barriers to walking and associated health benefit uptake during the development and assessment of bespoke transport plans.

Cycling

- 4.7 Similar to walking, evidence suggests that encouraging a modal shift towards cycling not only offsets the health risks from other transport modes, but again promotes good health and wellbeing, and aids in significantly reducing the prevalence and treatment costs for a wide range of key UK health issues. Economic modelling commissioned by Cycling England has calculated the economic value of cycling. This estimated that a 20% increase in cycling by 2015 would result in decreased mortality valued at £107million. Potential savings to the NHS are estimated at £52 million due to reduced illness, with a further £87 million saved by employers through reducing absences from work⁽⁶⁾. Following the initial cost, cycling presents a relatively cheap, healthy transport mode with no direct environmental impact and is typically open to a range of commuter types (office workers, school run etc) and age and socio-economic groups.

- 4.8 The key health risks are again largely associated with a risk of collision with other road users. The total number of pedal cyclists killed or seriously injured has risen year on year since 2004, however, the rate of fatal and serious casualties per mile travelled has not changed significantly, suggesting much of this increase is the result of increased numbers of cyclists. There is some evidence that increasing the numbers of cyclists decreases the risk of casualties, known as the 'safety in numbers' hypothesis. However this effect is unlikely to be 100%, so any increase in numbers in cyclists may still be associated with an increased number of cycling casualties, though the proportion of cyclists affected would decrease. One study has suggested that as cycling doubles, the risk of accident per kilometre travelled by cyclists decreases by 34%⁽⁷⁾. The precise mechanisms associated with the safety in numbers effect is unclear, however the following possibilities have been proposed:
- Greater expectation of other road users that they may encounter a cyclist and hence having visual search strategies to actively look for them;
 - Increased tendency for car drivers to have experience as cyclists such that there is more awareness of possible cyclist vulnerability; and
 - Better planning of highway and safety infrastructure to provide for increased levels of cycling⁽⁷⁾.
- 4.9 Key barriers to cycling are associated with the perception of danger, concerns about fitness, unrealistic assumptions about relative speed of car versus cycle journeys, initial cost, convenience, the secure storage of bicycles (both at home and destinations) and the opportunity for modal interchange with other forms of transport and perceptions about safety. Critical mass, where cycling becomes normalised may be a major factor in overcoming many of these barriers.
- 4.10 Unlike walking, cycling incurs additional costs to the individual for the bicycle, safety and security equipment (helmet, high visibility equipment and locks) and clothing. Such costs are relative to the individual, and primarily affects those on lower incomes. However, cycle ownership generally is much higher than cycle use, so affordability is not the only barrier to participation.
- 4.11 Cycling requires the ability to store bicycles safely at homes and at the desired destination. Unfortunately, not all homes are able or in the case of rented accommodation in particular, allowed to store bicycles indoors

(fire safety), and as with destinations, may further lack appropriate storage facilities outside. Poor storage can result in theft, vandalism or premature deterioration of bicycles, limiting the level and viability of cycling as a mode of daily transport. For many cyclists, the lack of secure storage facilities at destinations, is a key barrier limiting the choice of cycling over other transport modes.

- 4.12 Cycling also lends itself well to improved public transport modal interchange, providing a means to offset road vehicle trips to train and bus stations. In circumstances where bicycles can also be transported, cycling can provide additional interchange, thereby further promoting a modal shift to cycling and incurring additional health benefits. However, barriers limiting such additional modal interchange include:
- a lack of storage facilities on public transport thereby removing any opportunity for further modal interchange;
 - additional carriage costs; and
 - a ban on bicycle carriage during peak transport hours.
- 4.13 Such barriers coupled with a lack of secure storage can significantly reduce the convenience, cost effectiveness and viability of cycling as a transport mode. Addressing such barriers will support the uptake of cycling as a key mode of transport and for recreational purposes.

Public Transport

- 4.14 The various public transport modes in the UK provide a crucial, safe and overlapping transport network within both urban and rural areas, catering to a wide range of commuter, age and socio-economic group needs. Public transport typically encourages environmental and health conscious transport behaviour, by reducing overall vehicle movements and associated health risks. Furthermore, there is typically a higher level of transfer between public transport and more active forms of transport, where on average, walking to and from public transport can contribute towards 66% of the recommended daily level of moderate physical activity necessary to promote good health⁽⁸⁾⁽⁹⁾⁽¹⁰⁾.
- 4.15 The key health issues associated with public transport are similar to that of private vehicle use and can include the generation of local level emissions to air, noise, risk of community severance and risk of accident and injury.

- 4.16 The choice of public transport is relative to the individual and varies according to general availability, the commuter need, the distance to be travelled, speed and to some extent the overall convenience and quality of the trip (i.e. proximity to home and destination)⁽¹¹⁾. Public transport may not always prove a viable, cost effective, or convenient option, particularly in rural areas or for particular commuter requirements (carriage of belongings or goods, linking multiple journey requirements etc).
- 4.17 Key barriers to the uptake of public transport and associated health benefits can vary within specific age and socio-economic groups, and can include actual and perceived concerns of comfort, speed, reliability, convenience and to some extent cost. Although some forms of public transport may be less accessible to socio-economically disadvantaged groups (particularly during peak times), the overlapping nature of public transport typically provides alternatives, yet may prove less convenient.
- 4.18 Evidence further suggests that addressing barriers to modal interchange between active and public transport modes is critical, where both men and women from a wide range of age groups indicate concerns of security and safety when waiting at train and bus stations.
- 4.19 Improvements to the quality and safety of intermodal areas (bus and train stations), information systems (real time display boards) and addressing common poor perceptions of public transport are therefore key when planning and supporting the delivery of effective transport systems.

Private Transport

- 4.20 The ownership and use of private vehicles has brought enormous freedom and convenience to a wide range of socio-economic groups and commuter types. Such convenience has enabled us take more control over our lives, providing greater access to amenities, facilities, housing, education, employment, recreation and social networks when we want them.
- 4.21 However, such convenience has not been without costs. The proliferation of private vehicle ownership, and their use over distances that could be typically taken via more active forms of transport has contributed towards a more sedentary lifestyle in the UK, which evidence suggests is linked to increasing levels of obesity, type 2 diabetes, cardiovascular disease and cancer. Given the increasing ageing population in the UK, such issues are likely to continue to grow, with significant impacts on the quality of life and the cost of treatment to the NHS and society.

- 4.22 Private vehicle trips are also a major source of noise and air pollution in urban areas (and disadvantaged communities in particular), creating a range of environmental barriers leading to community severance and are a key contributor to the UK's total green house gas emissions. The rate of fatal and serious road traffic collisions from private vehicles continues to decline. However casualty rates are not evenly distributed, with those aged between 16 and 29 years of age having the highest rates of death or serious injury⁽¹²⁾
- 4.23 Such convenience has further influenced spatial planning, where ownership and use of private vehicles has increased the distances we are prepared to travel for every day tasks (i.e. out of town shopping, employment, schools etc). Such planning has positively reinforced the requirement for private vehicle ownership, with long-term implications to the health and wellbeing of communities throughout the UK.
- 4.24 However, that is not to say private vehicle ownership does not have a place in an effective and sustainable LTPs, but that the issues must be managed to prevent risk and the widening of inequality within communities. Such management requires a more joined up approach to spatial planning, transport and health.

Freight Transport

- 4.25 Freight provides a crucial component in the construction and delivery of sustainable and vibrant communities, but, is typically poorly perceived by the general public and associated with risk of road traffic accidents, emissions, congestion and community severance. Although measures have been taken at the Government level to reduce the number of environmental risks and improve efficiency, reliability and cost of freight transport. Further consideration of freight in local transport planning can be applied to reduce cumulative impacts with other commuter types (i.e. to avoid employment and the school run) and vulnerable modes of transport (i.e. cyclists and pedestrians). Such consideration will aid in delivering more environmental and health conscious transport behaviour.

Civil Aviation

- 4.26 Civil Aviation has been included within the evidence base review as it has a number of factors which can influence resident communities and adjoining modes transport. However, the strategic framework for the development of airport capacity in the United Kingdom over the next 30 years has been set out by the Aviation White Paper⁽¹³⁾, taking a strategic view of where

airport development may be needed, balancing the benefits of new airports against the impacts they can have. As such, Local transport authorities are not required to develop or perform SEA on civil aviation projects.

Transport opportunities that influence health

- 4.27 The key and repeating message from the available evidence base is that transport has the opportunity to significantly influence the health and wellbeing of communities by:
- improving access and accessibility to income, employment, housing, education, services, amenities, facilities and social networks crucial to maintaining a healthy vibrant and cohesive community;
 - influencing the quality of the urban environment (air quality, noise, severance and risk of collision) with social, mental and physical health outcomes; and
 - influencing lifestyle and behaviour with opportunities to either prevent or compound many of the UKs key economic, social, mental and physical health issues (and associated health care costs).
- 4.28 The development of more health conscious LTPs is therefore not only critical to facilitating daily tasks and driving sustainable employment, retail and manufacturing sectors but overlaps with the delivery of Local Development Framework (LDF) objectives, strategic health care planning and community support initiatives.
- 4.29 Research indicates that the key health pathways associated with the various transport modes are overlapping, vary between the commuter type and resident community groups and the distribution, magnitude, likelihood and significance of potential health outcomes are further influenced by relative socio-economic status and age structure. Such complex interactions cannot be addressed through a generic evidence base, however an appreciation of the following key health pathways, and their interaction with specific community groups will aid in the development and delivery of bespoke, health conscious LTPs.

4.30 As discussed below, the key health pathways associated with transport include:

- lifestyle;
- access, accessibility and community severance;
- economic health;
- safety (risk of trips, strain and collision);
- crime;
- congestion and stress;
- air quality;
- noise.

Health Inequalities & Transport

- 4.31 Fair Society, Healthy Lives, The Marmot Review⁽¹⁴⁾ of health inequalities identified a series of recommendations to tackle the health inequalities that persist within England. The Review found that there remains a social gradient in health – the lower a person’s social position, the worse his or her health.
- 4.32 The Review aimed to identify the ‘causes of the causes’ of these inequalities and concluded that health inequalities result from social inequalities. As a result, action on health inequalities requires action across all the social determinants of health and transport will have a role to play.
- 4.33 Transport enables access to work, education, social networks and services that can improve people’s opportunities. However, the relationship between transport and health are multiple, complex and socio-economically patterned, for example there is a clear social gradient in access to work and services, with greater freedom to travel, linked to increased car ownership, as income increases.
- 4.34 The impact of transport on health inequalities is most significant when looking at deaths from road injuries. Children in the 10% most deprived wards in England are four times more likely to be hit by a car than children in the 10% least deprived wards.
- 4.35 The review recommends that to reduce the steepness of the social gradient in health, actions to tackle social inequalities must be universal, but with a

scale and intensity that is proportionate to the level of disadvantage. A concept the review terms 'proportionate universalism'. Therefore the Review recommends that policies seeking to increase active travel should consider their impact on health inequalities, and work to target communities progressively across the social gradient.

- 4.36 The report supports a move towards an increase in active travel and public transport use, both as a way of directly increasing levels of physical activity and in turn improving health, but also because of its role in developing more sustainable communities.
- 4.37 In recognition of transport's role in improving access, and its role as a key factor in making communities more sustainable transport planners and SEA practitioners may want to engage planning, housing, environmental and health systems in the LTP and SEA process in order to address the social determinants of health effectively.
- 4.38 The review concluded that improving active travel across the social gradient requires incentives to increase levels of active travel as well as initiatives to improve safety and encourage active travel. Interventions need to both improve road safety and improve parental and peer support⁽¹⁵⁾.
- 4.39 There is also evidence that there are potential health benefits and health inequality benefits from enabling increased use for public transport.
- 4.40 The Review also found evidence that where 20 mph zones have been introduced injuries have decreased by 40% with cyclist injuries falling by 17% and pedestrian injuries by a third. The review concludes that if appropriately targeted such zones could help achieve a relative reduction in inequalities in road injuries and deaths⁽¹⁶⁾.

Lifestyle

- 4.41 Transport choice and behaviour can significantly influence levels of physical activity or inactivity, with subsequent long-term consequences for physical, mental and social health and wellbeing throughout the UK. LTPs geared towards increasing the appeal and use of active and public modes of transport will contribute in increasing levels of physical activity with subsequent reductions in the prevalence of obesity, type 2 diabetes, coronary heart disease/stroke and some types of cancer. Evidence further suggests that increased 'walkability' within a built environment can

improve perceptions of risk and personal safety, further encouraging walking and social networks within particularly vulnerable groups, including older people and the infirm⁽¹⁷⁾.

- 4.42 Considering the increasing ageing population in the UK, the promotion of active transport will further aid in reducing the prevalence and managing the symptoms of osteoporosis, lower rates of all-cause mortality and aid in facilitating improvements in health and wellbeing for all age and socio-economic groups. More health conscious transport planning can therefore have a profound influence upon lifestyle, the quality of life and reduce health care costs and the cost to society.
- 4.43 Strategies intended to improve physical activity however, should not adversely impact upon strategies geared towards improving access and accessibility or risk widening pockets of socio-economic and health inequality. To clarify, some commuter types and community group needs cannot always be accommodated through active and public transport. LTPs should therefore seek to encourage a modal shift away from private vehicle use that would be better served through active and public transport modes (i.e. the school run, employment etc).

Access, Accessibility and Community Severance

- 4.44 Improved access and accessibility is the principle aim of transport planning, providing and improving access to a wide range of activities and amenities critical to maintaining good social, economic, mental and physical health, and improve the level of control over and quality of life. The overlapping nature of active, public and private transport modes provides a means to cater to all commuter types and needs. However, with the increase in modal choice towards private vehicle use, the very process intended to improve access and accessibility is invariably impinging on access and accessibility, with a disproportionate impact upon communities subject to relative disadvantage.
- 4.45 To clarify, the increased modal preference for private vehicles significantly contributes towards current capacity and congestion issues, can create environmental and perceived barriers, resulting in community severance, and has influenced the nature of spatial planning which increases the distances the majority of the population are prepared to travel on a daily basis (i.e. schools, employment out of town shopping centres etc). This can not only reduce levels of access and accessibility to those with limited access to motorised modes of transportation, but the increased modal

preference for private vehicles can further compound such impacts by reducing patronage, viability and frequency of public transport modes in suburb areas, and reduces the viability of small, local level retail facilities and amenities.

- 4.46 In contrast, evidence suggests that well planned urban areas that promote high quality transport networks, and prioritise active and public transport modes facilitate improvements in lifestyle, increase physical activity, reduce crime and perceptions of crime, improve social networks and offset the risks associated with private vehicle use⁽¹¹⁾⁽¹⁷⁾⁽¹⁸⁾⁽¹⁹⁾⁽²⁰⁾. Increased footfall within communities also presents an opportunity to increase induced spending, with subsequent opportunities to support local regeneration and the development and viability of local community facilities and amenities.
- 4.47 The development of LTPs cannot therefore work in isolation, and must be designed to complement and support the delivery of LDF objectives and address pockets of socio-economic and health inequality.

Economic Health

- 4.48 Income and employment are key determinants of health influencing a wider range of health determinants, including access and accessibility to facilities, amenities and social networks, the location and quality of housing, levels of education and relative coping skills and can further influence lifestyle and risk taking behaviour. The association is statistically significant where pockets of socio-economic deprivation correlate with higher burdens of poor health, lower levels of life expectancy and higher treatment costs.
- 4.49 Although economic health is largely addressed at the strategic level through spatial planning in LDFs, LTPs play a critical roll in the delivery of LDF objectives and can further address local circumstance and sensitivity, and support the removal of barriers to income and employment, contributing towards the reduction of socio-economic and health inequality.
- 4.50 Vulnerable community groups include those experiencing relative disadvantage. It is important to note however, that although such communities experience both impacts and benefits from improved transport access to income and employment. Wider initiatives are required to improve the relative skills base to fully uptake such opportunities and prevent the widening of local inequality.

Safety

Risk of Collision

- 4.51 The most obvious and immediate health risk from transport is the risk of fatal and serious injuries from collision with vehicles. The rate of serious and fatal collisions have continued to decrease in the UK . Such improvements in road safety, and the relative differences between the specific transport modes are thought to be largely due to improved vehicle safety features, improved road infrastructure (e.g. junction improvements, more and better pedestrian crossings) and improvements in road user behaviour (including reduced drinking and driving and improved speed limit compliance). Despite overall improvements in road safety the relative magnitude and likelihood of risk varies between the various transport modes with motor cyclists, pedestrians and bicyclists having KSI rates orders of magnitude higher than those of car and public transport modes⁽²¹⁾.
- 4.52 Evidence further suggests that there is a disproportionate risk of KSI injuries to children and children from socio-economic deprived and minority ethnic communities in particular. Such risk is thought to be due to a combination of factors including, a higher likelihood of such communities residing in proximity to main and busy roads, lower quality urban areas without open and green space for recreation, and a lower appreciation as to the relative risks.

Trips and Slips

- 4.53 The quality of the urban environment (including the provision of safe pavements and cycle paths) can significantly influence transport behaviour and levels of physical activity, where evidence suggests that older people and the infirm in particular, are sensitive to poorly maintained or poorly designed pedestrian amenities of which can form an environmental or perceived barrier. Such barriers not only reduce access and accessibility for such community groups, but can compound health issues by limiting opportunities for physical activity through transport. Such barriers need to be addressed to avoid isolating specific age groups and widening health burdens within this age group.

Physical Strain and Injury

- 4.54 There is limited evidence to suggest that increased physical activity from active transport or interchange with public transport presents a significant risk from physical strain and associated injury. It is generally the case that

individuals regardless of age and socio-economic status manage such risks to themselves by implementing a pace and journey distance that is appropriate to them and their specific commuter requirement.

Crime

- 4.55 In the context of developing and assessing LTPs, the key focus of transport crime is on prevention, and addressing barriers to more environmental and health conscious transport behaviour. Evidence suggests that a key barrier limiting levels of active and public transport use, is fear of personal safety on routes or while waiting for interchange. Research indicates that although all members of society express such concern, crime and fear of crime is likely to have the most significant impact upon older people and the infirm, with subsequent impacts upon their access and accessibility, behaviour (i.e. avoid active and public transport after dark) and levels of physical activity.
- 4.56 Evidence further suggests that improving the level of footfall and eyes on the street because of increased active and public transport can aid in reducing crime and improve perceptions of crime, thereby further reducing barriers to physical activity and social cohesion.

Congestion and Stress

- 4.57 As populations increase, so will the frequency of their relative transport requirements and subsequent risk of congestion. The potential impact to health largely includes the local level environmental impact from an increased number of stationary and slow moving road vehicles with subsequently higher concentrations and lower dispersion of vehicle emissions and noise along those routes.
- 4.58 Congestion leading to delay has the potential to increase stress to both the commuter and the communities that are subject to the environmental disruption. Congestion also presents a means to further compound environmental and behavioural community severance, leading to the isolation of vulnerable community groups (older people and the infirm), and can further reduce levels of physical activity as a key transport mode and recreation (through poor perceptions as to the quality and safety of the urban environment).
- 4.59 LTPs that manage risk of congestion within urban areas therefore presents an opportunity to reduce transport emission exposure (to commuters and recipient communities), improve access and accessibility and aid in

addressing the instance of commuter and community stress with mental and social health benefits

Air Quality

- 4.60 Research into the potential health effects of emissions is extensive and provides statistically significant associations between many classical air pollutants (e.g. Particulate Matter, Nitrogen Dioxide and Sulphur Dioxide) and effects on life expectancy and a wide range of cardiovascular and respiratory health outcomes. Such associations and the specific method to assess their impact on health are discussed in more detail within Chapter 6.
- 4.61 Transport is a leading source of emissions to air in the UK and the predominant exposure source within urban areas. At the strategic level, the health effect of air pollution is typically addressed through air quality standards and air quality management areas set to protect environment and health. However, the distribution, magnitude and significance of potential health outcome is also dependant upon local community circumstance and the existing burden of poor health.
- 4.62 Vulnerable community groups typically include older people, the infirm and those subject to relative socio-economic deprivation. In addition, disadvantaged community groups are also more likely to be subject to higher ambient concentrations of air pollution (through residing in proximity to main roads, congested areas and industrial sources and therefore being subject to higher concentrations of vehicle and industrial emissions). Such community groups are also less likely to have access to private vehicles. As such, disadvantaged communities typically bear the brunt of the environmental and health consequence of private vehicle use, are more sensitive to such impacts and are less likely to afford the associated convenience and health benefits. Transport planning therefore has a role to play in addressing and reducing pockets of health inequality throughout the UK, and need to consider the distribution of impacts and benefits upon local communities and their relative susceptibility.

Noise

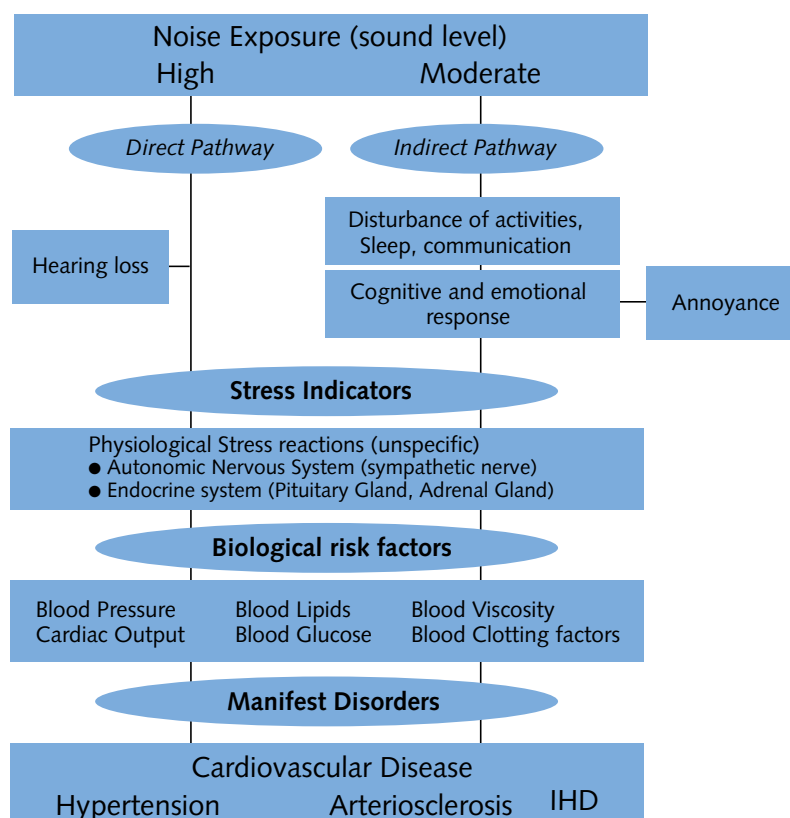
- 4.63 Similar to air quality, transport is a predominant noise exposure source within urban areas, and is associated with a range non-auditory health outcomes, including:
- annoyance;
 - stress anxiety and mental health;

- cardiovascular and physiological;
- cognitive function in children; and
- night time effects (sleep disturbance).

4.64 In addition, to the adverse effect that exposure to noise can cause on quality of life, there is emerging evidence that long term exposure to some types of transport noise can cause an increased risk of direct health effects

4.65 The potential causal pathway through which noise can affect health is shown in Figure 4.1. This mechanism is the basis of many of the epidemiological studies on health. As shown the potential clinical importance of the disease states increase towards the lower part of the diagram.

Figure 4-1 The Noise Health Pathway



Source: Exposure and Effect indicators of Environmental noise. Ising, Babisch et al (1992)⁽¹⁰⁸⁾

4.66 The Noise Policy Statement for England (NPSE)⁽²²⁾ includes the long term vision of noise policy to ‘promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development’.

- 4.67 A growing literature has developed around the links between noise and health most recently Environmental Noise and Health in the UK: a report by the Ad Hoc Expert Group on Noise and Health⁽²³⁾ and Estimating Dose-Response Relationships between Noise Exposure and Health in the UK⁽²⁴⁾ Evidence on the link between noise exposure and annoyance is commonly accepted and approaches to allow them to be reflected in analysis are commonly used in appraisal such as WebTAG⁽²⁵⁾.
- 4.68 Evidence on the links to other health impacts such as acute myocardial infarctions, sleep disturbances and hypertension are less developed. However, given the prevailing balance of evidence it is recommended that such effects should be considered in appraisal.
- 4.69 The World Health Organisation (WHO) Night Noise Guidelines for Europe report⁽²⁶⁾ proposes evidence based night time noise guidelines. In this recently published review the WHO state that 'environmental noise is a threat to public health, having negative impacts on human health and well being'.
- 4.70 The Department for Environment, Food and Rural Affairs (Defra) has produced Noise Action Plans⁽²⁷⁾, which have been prepared under the Environmental Noise Directive (2002/49/EC). Local transport authorities have been advised to consider the content of these plans and, where appropriate, integrate them with their LTPs to ensure a coordinated and systematic approach to the management of transport noise. As part of the LTP process, authorities could examine the options for addressing noise problems and any risks that policies might have on achieving targets and meeting the requirements of the Directive.

Transport Behaviour and Environmental and Health Consequence

- 4.71 Evidence suggests that the choice of transport and subsequent influence on the environment and health is in part defined by the commuter type and need, including the distance to be travelled, the speed in which the journey can be made, carrying capacity and the security and relative safety of the transport mode. However, modal choice invariably returns to convenience, comfort and control. Such convenience has led to the increase in private vehicle trips, including those over relatively short journeys that would be better served through active and public transport.

- 4.72 Such behaviour is not only unsustainable but presents significant long-term health implications to all members of society. Given the growing population, and the increasing older population in particular, a failure to address sedentary lifestyles through more active transport will incur increasing costs to the NHS and ultimately society, to treat preventable diseases and address current social issues (community severance, crime and fear of crime, inequality etc).
- 4.73 No single transport mode is solely good or solely bad, and a network of transport modes is necessary to ensure all journey types and community needs are addressed. Health conscious LTPs therefore need to work alongside LDF objectives to support the strategic development of healthy, sustainable, vibrant and cohesive communities, and encourage more environmental and health conscious transport behaviour.
- 4.74 This resource provides an appropriate balance between content and brevity, however it is recognised that the development of specific LTPs and studies may require additional information on particular elements of the available evidence base. Where this is the case, please also refer to the Bibliography Matrix in Appendix B, signposting to key literature and specific forms of transport.

5. Suggested Strategic Level Assessment Methods

- 5.1 LTPs have the opportunity to develop plans to reduce community and commuter health risks and facilitate environmental and socio-economic benefits to deliver healthy, vibrant and cohesive communities. However, this message is often lost in LTPs, where the distribution and significance of potential health outcomes can be lost within the environmental and economic objectives used to structure the strategies and their appraisal criteria.
- 5.2 In order to clearly demonstrate how human health and equality has been implicitly addressed from the onset, it is recommended that LTPs provide a brief section on establishing how human health is covered under the various environmental and economic headings. In the SEA it is recommended that there is an overarching section on human health which covers overarching issues such as health inequalities and refers to other sections where health may also be covered such as under air quality, water, soil. Such an approach will aid in more effectively addressing community and key stakeholder concerns, and demonstrates a more coordinated approach to transport, planning, environment and health.

Strategic Environment Assessment

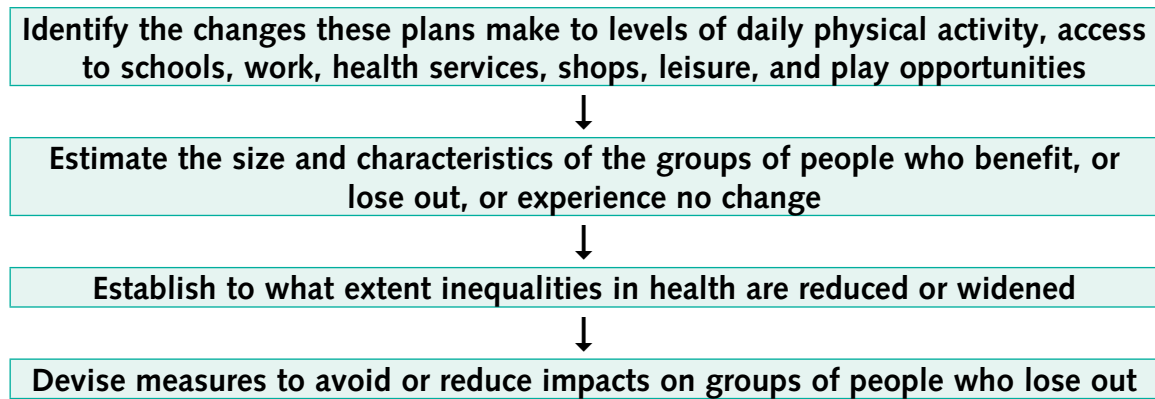
- 5.3 The SEA Directive requires consideration of the likely significant effects of a plan or programme on human health. Responsible Authorities may find it helpful to draw on the methods of HIA when considering how a plan or programme might affect people's health, and how positive effects could be enhanced and negative effects reduced.
- 5.4 The development of SEA objectives will be locally determined defined by the review of local policy, plans and programmes to establish local and regional environmental, socio-cultural and health priorities. In order to provide a more coordinated approach to transport, environment and health, it is suggested that there is a general introduction that would highlight how the SEA objectives are geared towards protecting human health and/or elements vital to delivering a healthy, vibrant and cohesive community. This will not only clearly establish how community health and health inequality has been addressed throughout the SEA, but also helps address common community concerns.

- 5.5 In addition to the broad environmental, cultural and socio-economic fields, there is a specific requirement to set objectives that appraise the influence upon resident populations and more specifically, human health. It will be necessary to establish appropriate health focused objectives to cover the human health element of the SEA guidance.
- 5.6 Although such SEA objectives will be tailored to local policy and circumstance, it is recommended that they broadly cover risk prevention, health promotion and the potential disproportionate distribution of both. The number of objectives should be realistic and human health may be covered under several, but some examples include:
- to reduce the potential health risks to communities and commuters;
 - to support and enhance access and accessibility crucial to maintaining a healthy vibrant and cohesive community;
 - to encourage healthier lifestyles and promote physical activity as a key mode of transport and recreation;
 - to manage transport risk and support improvements in health throughout the community;
 - to address the relative needs and support health improvements in all community and age groups; and
 - to close the gaps in socio-economic and health inequality.

Health Impact Assessment

- 5.7 Health Impact Assessment (HIA) can be beneficial for informing the health aspects of SEA to identify and inform health issues in Plans. A separate HIA would not necessarily be required, if health had been fully integrated in the SEA, unless there were very important health impacts which needed more detailed consideration than can be given within the Environmental Report.

Figure 5-1: Health Impact Assessment: Approach for Local Transport Plans



- 5.8 For each LTP there is a requirement to carry out an assessment of the plans impact on equalities, in line with equalities legislation and human rights legislation.
- 5.9 If coordinated appropriately the human health section of the SEA may be able to inform part of the assessment of the LTPs impact on equality preventing unnecessary repetition of effort, consultation fatigue and associated time and financial costs during the development and appraisal of LTPs.
- 5.10 Table 5.1 presents a recommended human health appraisal format that applies the key determinants of health as the basis to the appraisal criteria. The appraisal structure includes:
- the policy reference number, date and name: providing a point of reference to the iterative development of the relative transport options (i.e. as options are refined and re-appraised);
 - a summary paragraph of the transport option appraised: intended to provide the reader context to what is being appraised;
 - a health determinants / field column: providing the basis to the appraisal criteria;
 - a health pathway column: providing commentary and the rational to the potential health outcome;
 - a health outcome column: defining the potential direction and significance of health outcome (i.e. adverse –, beneficial +, unclear ? or neutral 0) during construction and operation of the transport option;
 - a sensitive group column: establishing any particular commuter type or community group that may demonstrate a particular susceptibility to

potential outcomes (both adverse or beneficial) to establish potential inequality impacts; and

- an actions and recommendations column: to address potential risks, enhance opportunities to improve community health and address inequality.

Table 5.1: Recommended HIA Appraisal Format and Criteria

Transport Option		Health Determinant/Field	Health Pathway	Potential Health Outcome		Sensitive Communities/ Groups	Potential Actions to minimise adverse impacts and inequality and enhance opportunities to improve health
				Construction	Operation		
Reference code and date	Option Name	Transport Option Summary Description					
		Demography Health Needs					
		Lifestyle					
		Services, amenities and leisure					
		Access and Accessibility					
		Income and Employment					
		Education					
		Crime and Safety					
		Housing					
		Transport					
		Built Environment					
		Natural Environment					
		Open space					

6. Assessment by Human Health Effects

- 6.1 This chapter sets out suggested assessment methods structured by the key transport health pathways established Chapter 4. It highlights how key transport health pathways are addressed within transport planning, and where appropriate, aids selecting and applying additional health assessment methods to inform and support decision-making.
- 6.2 Quantitative predictions of the effects of plans based on the epidemiological research and impact formulae presented below are not expected as part of local SEA's. They have been presented here to provide greater context to the information presented within this document and as an insight into the extent of analysis possible based on the available evidence.

Demography and People

- 6.3 To obtain information about the local demography and health profile of the population, refer to the following local sources of information:
- Health Profiles <http://www.apho.org.uk/default.aspx?RID=49802>
 - Joint Strategic Needs assessment
http://www.dh.gov.uk/en/Managingyourorganisation/JointStrategicNeedsAssessment/DH_086692
 - The Director of Public Health's Annual Public Health Report

Lifestyle (physical activity and inactivity)

- 6.4 The WHO has developed guidance to illustrate the principles outlined in the WHO document: 'Methodological guidance on the economic appraisal of health effects related to walking and cycling'⁽⁸²⁾ and to assist anyone who wishes to conduct an economic appraisal of the health effects specifically related to increased levels of cycling.
- 6.5 It is designed to complement existing tools for economic appraisals of transport interventions which have traditionally tended to focus on other issues such as emissions or congestion. The Health Economic Assessment

Tool for Cycling (HEAT for cycling) is available to download as an Excel spreadsheet from the WHO. The tool will produce an estimate of the mean annual benefit (per cyclist; per trip; and total annual benefit) due to reduced mortality as a result of cycling, and could be applied in a number of situations, including:

- when planning a piece of new cycle infrastructure. It will allow the user to model the impact of different levels of cycling and attach a value to the health benefit resulting from an estimated level of cycling when the new infrastructure is in place. This can be compared to the costs to produce a benefit:cost ratio (and help make the case for investment), or as an input into a more comprehensive economic appraisal;
- to value the mortality benefits from current levels of cycling, such as to a specific workplace, across a city or in a country; and
- to provide input into more comprehensive economic appraisals, or prospective HIAs. For example to estimate the mortality benefits from achieving national targets to increase cycling or to illustrate potential cost consequences to be expected in case of a decline of the current levels of cycling.

6.6 It is therefore geared for strategic decision making and is intended to aid in answering the following question:

If x people cycle y distance on most days, what is the value of the health benefits that occur as a result of the reduction in mortality due to their increased physical activity?

6.7 The tool is based on the relative risk data from the Copenhagen Centre for Prospective Population studies which found a relative risk of all-cause mortality of 0.72 among regular commuter cyclists aged 20-60 years relative to the general population. The study controlled for the usual socioeconomic variables (age, sex, smoking etc.) as well as for leisure time physical activity. It also took account of a possible activity substitution: i.e. whether an observed increase in rates of commuter cycling could be compensated by a reduction of leisure time physical activity.

6.8 The tool then applies the data entered by the user to calculate the total value of the economic savings due to reductions in all-cause mortality among these cyclists.

- 6.9 Key inputs include the total number of cycle trips per day and the mean trip length as a consequence of the proposed transport option. The tool then calculates the overall value of this level of cycling, based on a number of default values. These have been derived from the literature and agreed as part of the expert consensus process, and should be used unless more relevant or accurate data are available.
- 6.10 As discussed in more detail below, key outputs include:
- maximum annual benefit;
 - savings per km cycled per individual cyclist per year;
 - savings per individual cyclist per year;
 - savings per trip;
 - mean annual benefit;
 - present value of mean annual benefit.
- 6.11 The maximum annual benefit is the total value of reduced mortality due to the level of cycling entered by the user. This is a maximum value, as it assumes that the maximum possible benefits to health will have occurred as a result of the entered level of cycling. In reality, the health benefits are likely to accrue over time, and this build-up period can be adjusted.
- 6.12 The mean annual benefit is the key output of the model. It adjusts the maximum annual benefit (total value of lives saved due to the level of cycling entered by the user) by three main factors:
- an estimate of the timeframe over which benefits occur. There is evidence to suggest that mortality reductions are likely within five years of a change in level of cycling so this is the default value.
 - a build-up period for uptake in cycling, which allows the user to vary the projections in uptake (such as for a new cycle path which may see increasing use over time) and varies for full usage occurring between 1 and 25 years; and
 - Total time period. This allows the user to look at discounted benefits averaged over a period of between 1-25 years.
- 6.13 The present value of mean annual benefit adjusts the above outputs to take the diminishing value of costs and outcomes over time into account. The model suggests a discount rate of 5% but this can be varied by users.

Access, Accessibility and Community Severance

- 6.14 LTPs are implicitly geared to improve access and accessibility to a range of facilities and amenities necessary to maintain and promote good health. However, it is the case that increased access and accessibility to commuters can result in the creation of environmental barriers at the community level, leading to community severance. LTPs therefore need to strike the appropriate balance of meeting both commuter and community needs.
- 6.15 The accessibility of trip destinations by each mode of travel will invariably affect the mode choice for each trip and the associated health effects of each. The DfT has prepared guidance in assessing accessibility to key opportunities⁽²⁸⁾ in order to identify accessibility problems faced by people from disadvantaged groups and areas through the use of Core and Local Indicators.
- 6.16 Each Core Indicator will allow a comparison between the accessibility of a relevant population for a journey purpose and those deemed to be an appropriate proxy for people at risk of social exclusion. For example, the proportion of a) households b) households without access to a car within 15 and 30 minutes of a GP by public transport.
- 6.17 The Core Indicators focus on journey times to jobs and services by public transport, walking and cycling (where appropriate), however, accessibility problems and solutions vary significantly between local areas and therefore journey time might not always be the most appropriate measure of local accessibility. The DfT therefore encourages Local Authorities to develop performance indicators based on their local priorities, such as areas associated with particular funding initiatives, rural and regeneration areas.
- 6.18 In particular, the Local Indicators provides Local Authorities with the toolkit to assess the accessibility for each mode for a specific transport option. The potential influence of transport options from accessibility should be based qualitatively using the Local Indicators and the effect of each mode assessed from the evidence base in Chapter 4.
- 6.19 Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. Severance is difficult to measure and by its subjective nature is likely to vary between different groups within a single community.

- 6.20 In addition to the volume, composition and speed of traffic, severance is also likely to be influenced by the geometric characteristics of a road, the demand for movement across a road and the variety of land uses and extent of community located on either side of a road. All these factors should be considered when determining the likely severance effect.
- 6.21 In general terms, guidance prepared by the Institute of Environmental Management Assessment (IEMA)⁽²⁹⁾ suggests that a 30% change in traffic flow is likely to produce a 'slight' change in severance, with 'moderate' and 'substantial' changes occurring at 60% and 90% respectively. The effect of severance from transport options should be assessed qualitatively with reference to the IEMA guidance and from the evidence base in Chapter 2 and Appendix A.

Economic Health

- 6.22 Employment and income are potentially the most significant determinants of long-term health, influencing a range of factors including the quality of housing, education, diet, lifestyle, coping skills, access to services and social networks.
- 6.23 As a consequence, poorer socio-economic circumstances can influence health throughout life, where communities subject to socio-economic deprivation are more likely to suffer from morbidity, injury, suffer from mental anxiety, depression and tend to suffer from higher rates of premature death than those less disadvantaged⁽³⁰⁾⁽³¹⁾⁽³²⁾⁽³³⁾⁽³⁴⁾.
- 6.24 Although quantitative methods have been established to demonstrate the health benefit of employment and income, where a 10% rise in income can reduce the relative risk of mortality by 0.0035 in men and 0.03 in women, the intensive data requirements (i.e. the need for information on the relative change of an individual's pay range) limits this assessment to a qualitative appraisal⁽³⁴⁾.
- 6.25 LTPs that promote the potential for, and access to long-term, stable, quality employment will contribute in improving the health and wellbeing of communities. It is important to note however that increasing employment and income opportunities alone will not maximise health benefits. Increased support, training and community involvement is required in order to link and develop skills to employment and reduce the risk of inequality

Crime

- 6.26 There is currently insufficient evidence to quantify the change in crime and perceptions of crime from changes in the quality of the urban environment, or a modal shift towards active and public transport modes. However, there is sufficient evidence to suggest that such features will aid in addressing community barriers to physical and active transport modes, improve levels of physical activity through improved transport and recreation and contribute in fostering more cohesive communities. As such, the potential influence of transport options should be assessed qualitatively and supported by the evidence base in Chapter 4.

Risk of being Killed or Seriously Injured (KSI) from Collision

- 6.27 The calculation of injuries as a result of new journeys and increased traffic flows is not an exact science and as a result, local areas may find it more appropriate to present qualitative assessments of risk. As shown below, one approach for a quantitative calculation is to calculate an accident rate per journey, based on the gross national statistics.

According to UK Department for Transport statistics¹², there were 26,912 people killed or seriously injured on all Great Britain roads for all forms of transport in 2009.

The annual number of vehicle journeys or 'trips' per person per annum can be estimated by the following method; there are currently 60 million people in Great Britain and an average of 973 trips per person per year. Taken together, the result is an estimated 58.38 billion trips per year in road vehicles.

Therefore, the incidence of a road user (including pedestrians) being killed or seriously injured per trip can be calculated by dividing the number of KSI by the number of trips.

$$= (26,912 / 58,380,000,000) \times 100,000 = 0.461 \text{ KSI per } 100,000 \text{ journeys}$$

An estimate of the extra number of accidents can then be calculated by applying the rate of KSI per injury to the number of new trips expected.

A similar calculation can be made to estimate the number of casualties per journey.

- 6.28 The advantage of this method is that the number of accidents can be calculated without a detailed knowledge of road traffic movements on particular road types or the number of kilometres travelled. This method also takes into account the additional risk associated with the whole trip and not just the additional vehicle kilometres in the area.
- 6.29 The disadvantages are that it applies a standard rate to the population and does not consider any of the more sophisticated data that is available about particular road types or the effect of the number of kilometres. Notwithstanding this, it is consistent with the approach adopted on a national basis.
- 6.30 The alternative approach is to make use of national statistics relating to accidents by distance travelled. As shown below, in the instance the total change in kilometres travelled is available, it is possible to quantify a gross change in the number of KSI on those road networks.

	Road Type						
	Urban roads			Rural roads			Motorways
	A road	Other	All roads	A road	Other	All roads	
Accident rate – all vehicles	58	52	54	21	36	26	7.2
User casualties	66	52	57	30	47	36	11
– of whom killed	0.3	0.2	0.2	0.6	0.7	0.6	0.1
– of whom seriously injured	5.1	4.2	4.6	3.9	6.2	4.7	0.8
Pedestrian casualties	11	14	13	0.8	3.3	1.6	0.1
– of whom killed	0.3	0.2	0.2	0.1	0.1	0.1	0
– of whom seriously injured	2.6	2.7	2.6	0.2	0.7	0.4	0

Source: Department for Transport statistics: Reported road casualties Great Britain – Annual report 2008

- 6.31 The advantage of this approach is that if required, the depth of assessment can be expanded by road vehicle or road type, of which both have varying levels of KSI frequencies and severity.
- 6.32 The primary input to such assessments defining the type and detail of the method is road transport modelling and estimates of trip generation.
- 6.33 Key outputs will include high-level annual estimates of potential risk as a consequence of the change in vehicle trips, and, or the change in the number of vehicle kilometres travelled. Such information will aid in

establishing the potential change in risk or benefit to communities, the requirement and value of traffic calming and aid in selecting health conscious transport options.

Air Quality

- 6.34 Research into the effects of air pollutants, including those emitted from transport, is extensive and provides statistically significant associations between many classical air pollutants and effects on a wide range of cardiovascular and respiratory health outcomes.
- 6.35 However, assessments typically concentrates on risk from particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) which are key transport emissions, and Ozone (O_3) which are key transport emissions and generally the primary focus for research by the UK Committee on the Medical Effects of Air Pollutants (COMEAP)⁽³⁵⁾, Clean Air for Europe⁽³⁶⁾ and the World Health Organisation⁽³⁷⁾.
- 6.36 The approach to quantifying the potential health outcome associated with a relative change in concentration exposure is discussed for each of these pollutants below.

Particulate Matter

- 6.37 The UK Department of Health's Committee on the Medical Effects of Air Pollutants (COMEAP), have recommended risk coefficients for health impacts following exposure to particulate matter. There are two types of health impacts that can be assessed. Firstly, there are effects following short-term exposures, and secondly, effects resulting from long-term exposure.
- 6.38 In their 1998 report, COMEAP used the data from time-series studies (i.e. epidemiological studies assessing the impacts of daily variations in air pollution on mortality and/or hospital admissions on the following (or subsequent) days) and recommended coefficients that can be used to calculate the health impacts of short-term exposures. For particulate matter, PM_{10} (particulate matter with a respective mean aerodynamic diameter of 10 microns or less) data are the basis of the risk coefficients for short-term exposure. In 1998, COMEAP recommended coefficients of:
- 0.75% increased risk of death from all causes per $10 \mu g.m^{-3}$ increase in PM_{10} (24 hour mean)

- And 0.8% increased risk of respiratory hospital admissions per $10 \mu\text{g.m}^{-3}$ increase in PM_{10} (24 hour mean)

In 2001, COMEAP were able to recommend a coefficient for cardiovascular hospital admissions following short-term exposure to PM_{10} of:

- 0.8% increased risk of cardiovascular hospital admissions per $10 \mu\text{g.m}^{-3}$ increase in PM_{10} (24 hour mean)

Since the COMEAP evaluations, WHO (2006)⁽³⁸⁾ have used a coefficient of 0.5% for calculating the increase in all cause acute mortality per $10 \mu\text{g.m}^{-3}$ PM_{10} (24-hour average).

- 6.39 In 2009, COMEAP recommended a coefficient that can be used to calculate increases in mortality due to long-term exposure to particulate matter measured as $\text{PM}_{2.5}$. They concluded a 6% increase in relative risk of all-cause mortality associated with a $10 \mu\text{g.m}^{-3}$ increase in $\text{PM}_{2.5}$. Health benefits from changes in annual average concentrations of $\text{PM}_{2.5}$ resulting from a policy change are best evaluated using a life table approach (e.g. IOMLIFET⁽³⁹⁾). It is likely that some of the health impacts calculated using this coefficient are a reflection of the impacts of short-term exposure to particulate matter. Therefore, if the long-term $\text{PM}_{2.5}$ coefficient is used in a calculation of health impacts, it is suggested that the coefficient for 24-hour PM_{10} averages is not also used in the central estimate, to avoid double-counting of effects
- 6.40 The depth of the exposure response assessment should be appropriately set to meet the project requirements. To clarify, project level assessments typically have access to detailed air dispersion modelling outputs, enabling an assessment of risk at the finest spatial resolution (i.e. applying population density and ward level morbidity and mortality data to quantify relative risk at the lower super output areas). In contrast, strategic level assessment will not typically have access to such information, where a high-level assessment will suffice.
- 6.41 On this basis, quantifying the relative change in health outcome at the strategic level requires the following information:

For changes in long term exposure

- all age all cause mortality rate;
- the relative change in $\text{PM}_{2.5}$ concentration exposure; and

- the total number of people subject to such changes in exposure.

For changes only affecting short term exposure

- all age all cause mortality rate;
- total respiratory hospital admission rate;
- total cardiovascular hospital admission;
- the relative change in PM_{10} concentration exposure; and
- the total number of people subject to such changes in exposure.

6.42 The health statistics can be obtained through the Public Health Department or other sources of local health intelligence, and should be requested at the Local Authority level.

6.43 The relative change in PM concentration exposure may be available from the air quality specialists in regards to specific transport options. If only the change in the local emissions of PM is available then it will be necessary to estimate the likely change in concentration resulting from these changes in emissions. Ambient PM concentrations typically include a large contribution from regional background sources; the proportional change in ambient concentration is therefore likely to be smaller than the change in local emissions from road traffic. The change in concentrations could be calculated using an air dispersion model or a simpler screening method⁽⁴⁰⁾. The change in concentration will then need to be combined with information on the number of people affected by this change in order to estimate the change in overall health impact.

6.44 The 2010 report "Report on estimation of mortality impacts of particulate air pollution in London" for the Mayor of London provides a worked example of a health impact assessment⁽⁴¹⁾.

Nitrogen Dioxide

6.45 Although research indicates that a statistical relationship with NO_2 exists, doubt remains as to whether the associations represent a toxic effect of NO_2 , per se, or whether they reflect a surrogate effect. Some epidemiological investigations have suggested that the reported associations between exposure to concentrations of NO_2 and health outcomes might be confounded by concentrations of particulate pollution. In addition, some epidemiological studies investigating the effects of particulate matter (PM) have shown that, in some geographic locations,

the adverse effects of particulate pollution can be enhanced when concentrations of NO₂ are elevated, thus suggesting the possibility of effect-modification.

- 6.46 The inconsistencies in the evidence base on NO₂ have resulted in the tendency for many researchers and policy-makers to regard NO₂ as a surrogate of the pollution mixture emitted by combustion sources (primarily vehicular traffic).
- 6.47 On the basis of the available evidence, following short term exposures COMEAP do not consider that the evidence on NO₂ is sufficiently robust for quantifying changes in mortality, but provides a caveated risk coefficient to be used for sensitivity analysis purposes only of 2.5% per 50 µg.m⁻³ (24 hour average) increase for an effect on respiratory hospital admissions. This was not recommended for use in central estimates of health impacts as it was considered less soundly based than recommended coefficients for short-term effects of other pollutants⁽³⁵⁾.
- 6.48 As stated by COMEAP in their 2009 report on long-term effects of air pollution, there is currently insufficient evidence to attempt to quantify the possible but unproven effects of exposure to ambient concentrations of nitrogen dioxide on mortality. Likewise, in their 2009 statement of nitrogen dioxide and respiratory morbidity in children, a direct effect of NO₂ on respiratory morbidity in children could not be clearly identified but a small effect could not be ruled out. Overall, it was concluded that it was not possible to quantify the direct effects of NO₂ on respiratory morbidity in children⁽⁴²⁾.
- 6.49 However, since NO₂ is converted to nitrate, a secondary particulate, which forms part of PM_{2.5}, the quantification of effects of long-term exposure to NO₂ is typically addressed through the COMEAP PM_{2.5} calculation previously discussed.

Sulphur Dioxide (SO₂)

- 6.50 COMEAP, in their 1998 report, provided risk coefficients of 0.6% per 10 µg.m⁻³ (24 hour mean) increase in SO₂ for acute mortality and 0.5% per 10 µg.m⁻³ (24 hour mean) increase in SO₂ for respiratory hospital admissions⁽³⁵⁾. However, similar to NO₂, in their 2009 report on long-term effects, COMEAP concluded that although some research indicates a positive and statistically significant association for sulphur dioxide and all-cause long-term mortality, it is not possible to distinguish between a direct

effect of sulphur dioxide and an apparent effect due to sulphur dioxide acting as a marker for broader combustion sources. Therefore, COMEAP does not recommend quantifying the possible long-term effects of sulphur dioxide directly.

- 6.51 Instead, COMEAP recommends that the $PM_{2.5}$ coefficient should be applied irrespective of the relative contributions of sulphate, nitrate or any other component to the total. This is not to say that all components of $PM_{2.5}$ have the same toxicity, but that there is not, at present, evidence to quantify the effects of different components separately.
- 6.52 The quantification of potential health outcomes from relative changes in exposure to transport emissions can therefore be applied to establish the distribution, magnitude, likelihood and overall significance of potential health outcomes as a consequence of LTPs. The depth of such assessments will be largely defined by the level of air quality modelling available, and the desired depth of the analysis (i.e. high level estimates or sub ward level analysis).

Ozone (O_3)

- 6.53 As established by COMEAP, there is sufficient evidence to quantify the potential change in both mortality and morbidity from relative changes in exposure to ozone⁽³⁵⁾. Such evidence can be summarised as following:
- there is a 3.0% increased risk in the background rate of all cause mortality per $50 \mu\text{g.m}^{-3}$ increase (8 hour mean) in ozone; and
 - there is a 3.5% increased risk in respiratory hospital admissions per $50 \mu\text{g.m}^{-3}$ increase in (8 hour mean) in ozone.

Since these 1998 COMEAP recommendations, WHO (2006)⁽³⁸⁾ and Defra in the 2007 Air Quality Strategy⁽⁴³⁾ have used coefficients of 0.3-0.5% increase in acute mortality per $10 \mu\text{g.m}^{-3} O_3$ (8-hour average) and 0.3% increase in acute mortality per $10 \mu\text{g.m}^{-3} O_3$ (8-hour average) respectively.

- 6.54 Quantifying potential health outcomes from relative changes in ozone exposure would require the same information as that discussed for particulate matter above.
- 6.55 In their 2009 report on long-term effects of air pollution, COMEAP did not recommend quantification of effects of long-term exposure to ozone.

Evaluation of health effects of air quality

- 6.56 Based on the health links set out above the Interdepartmental Group on Costs and Benefits Air quality subject group (IGCB(A)) have developed economic tools to estimate and value changes in air quality. These tools have been developed with involvement across Whitehall and represent best practice appraisal from the Green Book.
- 6.57 The two key methodologies presented by the IGCB(A) are:
- Damage cost – providing a indicative estimate of the health impacts based on the level of emissions from a range of sources.
 - Impact Pathway – provides a robust bespoke analysis of the air quality impacts of a policy, project or programme.
- 6.58 The Damage Cost Approach provides a reasonable approximation of the damage imposed on society when various pollutants are released into the air. This approach to air quality valuation is appropriate when the breach of a prescribed minimum standard is not at issue and both of the following conditions are met:
- the total air quality impacts are estimated to be less than £20m
 - the impacts are expected to last for less than 20 years
- 6.59 Damage costs have been developed for four key pollutants: particulate matter (PM_{10}), oxides of nitrogen (NO_x), sulphur dioxide (SO_2), and ammonia (NH_3). Because the impact of particulate matter varies hugely depending on the sector it is produced by, values are provided for this pollutant for a number of sectors: electricity supply industries (ESI), domestic, agriculture, industrial, waste, and road transport (which is, in turn, broken down by National Transport Modal Area). These are all available in the table below.

Air Quality Damage Costs per tonne (2010 prices)

	Sensitivities				
	Central Estimate (1)	Low Central Range (2)	High Central Range (2)	Low Sensitivity (3)	High Sensitivity (3)
NOX	£955	£744	£1,085	£187	£2,164
SOX	£1,633	£1,320	£1,856	£520	£3,452
Ammonia	£1,972	£1,538	£2,241	£733	£1,069
PM Domestic	£28,140	£22,033	£31,978	£3,033	£79,131
PM Agriculture	£9,703	£7,598	£11,027	£1,046	£27,286
PM Waste	£20,862	£16,335	£23,708	£2,248	£58,666
PM Industry	£25,229	£19,753	£28,669	£2,720	£70,945
PM ESI	£2,426	£1,900	£2,757	£495	£6,257
PM Transport Average	£48,517	£37,987	£55,133	£9,897	£125,134
PM Transport Central London	£221,726	£173,601	£251,961	£45,229	£571,859
PM Transport Inner London	£228,033	£178,540	£259,129	£46,516	£588,126
PM Transport Outer London	£148,949	£116,621	£169,261	£30,383	£384,160
PM Transport Inner Conurbation	£117,899	£92,309	£133,975	£24,050	£304,074
PM Transport Outer Conurbation	£73,261	£57,362	£83,252	£14,944	£188,951
PM Transport Urban Big	£87,332	£68,377	£99,241	£17,815	£225,240
PM Transport Urban Large	£70,351	£55,081	£79,944	£14,351	£181,443
PM Transport Urban Medium	£55,310	£43,305	£62,853	£11,283	£142,652
PM Transport Urban Small	£34,932	£27,351	£39,696	£7,126	£90,096
PM Rural	£15,041	£11,776	£17,091	£3,068	£38,791

6.60 To support the use of damage costs the IGCB provide the Damage Cost Calculator which is a spreadsheet tool that assists in the calculation of the monetary values to be attached to changes in emissions over time. The following pieces of information need to be inputted, and all other calculations will then be performed automatically

- The length (in years) of the policy appraisal
- The base year for the appraisal

- The pollutant being assessed
- The annual change in emissions (in tonnes)

The calculator is available from www.defra.gov.uk/environment/quality/air/airquality/panels/igcb/documents/igcb-damage-cost-calculator.xls

- 6.61 The Impact Pathway methodology provides a fuller assessment than the Damage Cost Approach of the likely impacts of a proposal, allowing local factors such as the local level of pollution, the local height of emission sources, and the local population density and meteorology to be reflected. This more robust approach should be considered if Damage costs are not appropriate.
- 6.62 Application of the full Impact Pathway Approach is a time and resource intensive piece of analysis. Full modelling can take around 3 months and can cost between £5,000 and £20,000, depending on the scenario. In the first instance Defra should be contacted if an Impact Pathway assessment is required. For more information on this approach please contact igcb@defra.gov.uk.

Noise

- 6.63 Managing the potential health effect of noise at the strategic level will be largely addressed by developing transport options set to achieve current policy guidance. The Noise Policy Statement for England (NPSE)⁽²²⁾, includes the long term vision of noise policy to “promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development”. This long term vision is supported by the following aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

Evaluation of environmental noise

- 6.64 As recommended by the Interdepartmental Group on Costs and Benefits (IGCB) there is sufficient evidence to quantify and in some cases value some morbidity and mortality impacts associated with environmental noise. Specifically the IGCB recommends the valuation of annoyance and acute myocardial infarctions and the quantification of hypertension and sleep disturbances.
- 6.65 The approach to quantifying the potential health outcome associated with a relative change in noise exposure is discussed for each health effect below.

Annoyance

- 6.66 Noise annoyance is defined by the WHO as 'a feeling of displeasure evoked by noise'. The UK has well established procedures for assessing the annoyance to people caused by road and rail traffic-related noise and vibration. These procedures have been developed from surveys of the impacts of noise from transport on people, including dissatisfaction, annoyance and disturbance.
- 6.67 This approach allows for both the quantification of the proportion of the exposed group being annoyed and allows for a valuation of these changes. Guidance on the estimation and quantification of these impacts is available from <http://www.dft.gov.uk/webtag/documents/expert/unit3.3.2.php#013>

Acute Myocardial Infarctions (AMI)

- 6.68 Based on the work of Berry and Flindell the IGCB recommend the use of the work carried out by Babisch in Germany and van Kempen et al in the Netherlands as the best approach to link changes in environmental noise with the prevalence of acute myocardial infarction. While uncertainties remain around the precise quantitative link between these factors this work is seen to provide the best available link.
- 6.69 Using this function the IGCB provide approaches to both quantify and value the impacts of changes in environmental noises by household. This guidance is available from www.defra.gov.uk/environment/quality/noise/igcb/publications/noisehealthreport.htm

Sleep disturbances

- 6.70 The links between noise and transient sleep disturbances are seen to be a well developed area of research with statistically robust data and dose-response relationships. Based on the recommendations of Berry and Flindell the IGCB recommend using the relationships published in the 2004 EU position paper to quantify self reported sleep disturbances.
- 6.71 These functions are based on analyses of 15 data sets with more than 12,000 individual observations of exposure-response combinations from 12 field studies which had included a questionnaire containing questions regarding sleep disturbance. Based on this data, functions were derived for three levels of sleep disturbance (highly sleep disturbed, sleep disturbed and lowly sleep disturbance) for three major sources road, aircraft and railways. Guidance on the use of these functions is available from www.defra.gov.uk/environment/quality/noise/igcb/publications/noisehealthreport.htm

Hypertension

- 6.72 The IGCB guidance also recommends the quantification of changes in hypertension associated with changes in environmental noise. To undertake such a quantification a linear relationship has been identified based on the work of Babisch and van Kamp.

Guidance on the use of these functions is available from:

www.defra.gov.uk/environment/quality/noise/igcb/publications/noisehealthreport.htm

- 6.73 Managing the potential health effect of noise at the strategic level will be largely addressed by developing transport options that achieve current policy guidance as contained in NPSE (see earlier paragraph). When interpreting NPSE regard may be had to published WHO guidelines such as the Guidelines for Community Noise (GCN)⁽⁴⁴⁾ and the Night Noise Guidelines for Europe (NNG)⁽⁴⁵⁾ reproduces guideline values that have been recommended by the WHO GCN to aid in addressing the immediate consequences of noise on communities and to specific vulnerable groups.

Table 6.1: Guideline Values for Community Noise in Specific Environments

Specific Environment	Critical Health Effect(s)	LAeq (db)	Time Base (hours)	LA max (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	–
	Moderate annoyance, daytime and evening	50	16	–
Dwelling, Indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	–
Inside bedrooms	Sleep disturbance, night time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	During class	–
Pre-school bedrooms, indoors	Sleep disturbance	30	Sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	During play	–
Hospital, ward rooms, indoors	Sleep disturbance, night time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	–
Hospitals, treatment rooms, indoors	Interference with rest and recovery	As low as possible		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing Impairment	85	1	110
Music through headphones/earphones	Hearing impairment (free-field value)	85 Under headphones, adapted to free-field values	1	110

Specific Environment	Critical Health Effect(s)	LAeq (db)	Time Base (hours)	LA max (dB)
Impulse sounds from toys, fireworks and firearms	Hearing impairment adults	–	–	140 peak sound pressure (not LAmax, fast), 100mm from the ear
	Hearing impairment children	–	–	120 peak sound pressure (not LAmax, fast), 100mm from the ear
Outdoors in parkland and conservation areas	Disruption of tranquillity	Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low.		

Source WHO Guidance for Community Noise⁽⁴⁴⁾

- 6.74 Challenging guideline values for night time noise are also contained in the more recently published NNG document which is considered by WHO to be complementary to the GCN. The NNG states that “For the prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than 40 dB of L_{night} outside during the part of the night when most people are in bed.” An interim target of 50 dB L_{night} outside is recommended in the situations where the achievement of the 40 dB guideline is not feasible in the short run for various reasons.
- 6.75 The key limitation of such WHO guidance in transport and noise appraisal is practicality. In a feasibility study by Porter et al it is noted that the WHO inspired guidelines fail to consider the practicality of actually being able to achieve any of the stated guideline values⁽⁴⁶⁾. The report goes on to state that:

'around 56% of the population in England and Wales are exposed to daytime noise levels exceeding 55 dB L_{Aeq} and that around 65% are exposed to night-time noise levels exceeding 45 dB L_{Aeq} (as measured outside the house in each case). The value of 45 dB L_{Aeq} night-time outdoors is equivalent to the 1995 WHO guideline value of 30 dB L_{Aeq} night-time indoors allowing 15 dB attenuation from outdoors to indoors for a partially open window (for free air ventilation to the bedroom). The percentages exposed above the WHO guideline values could not be significantly reduced without drastic action to virtually eliminate road traffic noise and other forms of transportation noise (including public transport) from the vicinity of houses. The social and economic consequences of such action would be likely to be far greater than any environmental advantages of reducing the proportion of the population annoyed by noise. In addition, there is no evidence that anything other than a small minority of the population exposed at such noise levels find them to be particularly onerous in the context of their daily lives.'

- 6.76 An element of caution is therefore recommended if the WHO guideline values are to be applied to appraise transport options.
- 6.77 Very recently the UK Ad Hoc Expert Group on Noise and Health published their report on Environmental Noise and Health in the UK which should also be considered in any assessment of noise and health⁽²³⁾.

Annoyance

- 6.78 The contemporary rationale for assessing the effects of transportation noise on communities is based upon a descriptive dose response relationship as proposed by Schultz in 1978. The curve has since been updated to include new studies with varying criteria by both Fidell and Finegold, and has been further investigated by specific transport type by Miedema. Here, it was shown that aircraft noise produces a consistently stronger annoyance response than road transport, followed by rail.
- 6.79 The recommended approach to calculating changes in people highly annoyed can therefore be applied to specific transport mode, or apply a more conservative approach that applies the stronger annoyance response associated with aircraft noise. Applying the latter approach, the calculation of the total number of people said to be 'highly annoyed' is achieved by multiplying the number of people within each 3 dB contour band by the appropriate percentage provided in Table 6.2.

Table 6.2: Percentage of Highly Annoyed People

Mid Points of Leq 3 dB Intervals	% Highly Annoyed
55.5	6.6
58.5	11.1
61.5	18.0
64.5	28.0
67.5	40.7
70.5	54.9
73.5	68.2

Source: CAA. (2007) The Revised Airspace Change Process: Draft Cap 725. CAA Guidance on the Application of the Airspace Change Process.

- 6.80 Applying the above conversion factors to high-level noise modelling or aspirational targets provides a means to estimate potential changes in individuals highly annoyed, providing additional community health context to the technical noise section. The depth of assessment is largely defined by the level of noise modelling available or the aspirational targets set (i.e. a 5db reduction for a given population).

Sleep Disturbance

- 6.81 The WHO GCN conclude that sleep disturbance is a major effect of environmental noise and that exposure may cause primary effects during sleep and secondary effects after the exposure. Sleep disturbances can result in decreased daytime efficiency and long-term health impairment. The WHO further indicate that certain groups are more likely to be affected by sleep disturbance such as older people, newborn, shift workers and persons with physical or mental disorders.
- 6.82 As indicated by the WHO GCN⁽⁴⁴⁾, it is typically specific noise events that have the greatest potential to interrupt sleep (i.e. 45 LA_{max} dB within the bedroom and 60 outdoors). LTPs that seek to reduce such noise episodes therefore present the potential to reduce sleep disturbance and the associated short and long-term consequence to health.

Mental Health Effects

- 6.83 The WHO GCN consider that the findings on mental health and environmental noise are inconclusive, However, Stansfeld⁽⁴⁷⁾ in a review of the literature believes that there is a relationship between environmental noise exposures (particularly at a higher level) and mental health symptoms but little evidence of a relationship with more severe mental health problems.

- 6.84 It has also been suggested that certain groups are more vulnerable to mental health effects induced by noise. These include children, older people and people with pre existing illness in particular depression. Overall, the evidence is not sufficiently convincing for this aspect to be quantified, however adherence with guidance levels set to prevent community exposure and annoyance can be qualitatively assessed to benefit mental health.

Children's Learning

- 6.85 The RANCH study researched the effects of road traffic and aircraft noise on the cognitive performance and health of children. During this study, road and aircraft noise exposure was associated in a linear exposure-effect with reading comprehension, episodic memory and working memory. It was estimated that a 5 dB(A) increase in noise was associated with a 2-month impairment in reading age of UK children aged 9-10⁽⁴⁸⁾.
- 6.86 In addition to applying the WHO GCN for schools, and given the linear exposure effect, it is therefore possible to quantify what relative changes in noise exposure at schools may have upon cognitive performance in children. Such an assessment will require the change in air noise contours mapped over schools to establish the relative change in exposure, and the number of children aged 9-10 within the schools identified.
- 6.87 However, please note that the RANCH study typically measures changes in cognitive performance in 5dB (A) increments (i.e. a perceptible change in noise). Government guidance advise that 3 dB(A) is the minimum perceptible under normal conditions. Changes of this order of magnitude therefore do not warrant assessment.

7. Delivering Local Transport Plans: Key Performance Indicators

- 7.1 This chapter presents suggested Key Performance Indicators (KPI), mitigation and community support initiatives by transport mode, and for specific community groups, providing inform for the development of specific initiatives and programmes and aid the delivery of LTPs.

Monitoring Programme and Key Performance Indicators

- 7.2 Key Performance Indicators (KPIs) are required to measure overall success in achieving core objectives and to ensure support programmes and initiatives are appropriately targeted and effective. Due to the multidisciplinary nature of health (being influenced by a range of key determinants of health and further influenced by lifestyle, behaviour and genetic predisposition), it is often not possible to directly attribute changes in community health to specific policies or projects. This issue is often compounded by the significant lead in time before a health outcome is made apparent and the changing nature of populations (i.e. migration).
- 7.3 As such, it is suggested that as part of the SEA monitoring process, key environmental indicators that are precursors to potential health outcomes, supported by high-level health KPIs are used to measure general success and inequality. Table 7.1 presents suggested health KPI by transport mode, and is supported by an appropriate rationale.

Table 7.1: Suggested Health Indicators

Indicator	Rationale	Transport Mode			
		Active	Public	Private	Freight
Environmental Precursors to Health Outcome					
Air Quality (Particulate matter, nitrogen dioxide, ozone and air quality management areas)	By setting indicators on environmental precursors to potential health outcomes, it is possible to implement more effective and ethical monitoring programmes. To clarify, by monitoring changes in key pollutants such as PM ₁₀ or NO ₂ it is possible to gauge the overall success of a transport option/mitigation, but also identify the relative benefit or risk to local communities. This therefore provides the means to monitor, and where appropriate, amend transport options and their mitigation before the onset of an adverse health outcome.		X	X	X
Noise	Similar to air quality, it is recommended to set noise indicators to environmental thresholds set to prevent annoyance and protect health. It is currently not possible to monitor the adverse health effect of transport noise (i.e. depression through to cardiovascular health outcomes), of which is further confounded by vehicle emissions.	X	X	X	X
Total trips by mode	By monitoring the rates of modal transport it will be possible to establish trends in growth, any modal offset and the relative effectiveness of transport options. This will not only provide the means to monitor overall success, but can be used as a means to gauge the modal offset to active transport and the subsequent benefit to health. Such monitoring will also aid in establishing if additional intervention is required to improve benefit uptake (in general or within specific community groups), manage risk or address inequality.	X	X	X	X
Distance of trip by mode	Monitoring the distance of trip by mode will further aid in monitoring changes in transport behaviour, the effectiveness of the transport option, and any need for additional intervention.				
Economic Prosperity	Transport, access and accessibility are vital to delivering and maintaining viable services, amenities and economic prosperity. The monitoring of key economic indicators is therefore recommended to establish the influence of LTP, and the requirement for further intervention.	X	X	X	X

Indicator	Rationale	Transport Mode			
		Active	Public	Private	Freight
High-Level Health Indicators					
<p>Transport Collision and KSI (all modes)</p> <p>National statistics are available from the Department of Transport website, local data is available from Local Authority transport teams</p>	<p>Collisions resulting in killed and serious injuries are one of the few health statistics that can be directly attributed to transport. Monitoring KSI trends and their distribution is therefore an effective means to establish the success of transport options, and their disproportionate impact to children, and children from ethnic and socio-economic groups in particular.</p>	X	X	X	X
<p>Levels of Physical Activity</p> <p>Such data is typically available in lifestyle surveys and annual public health reports available from local public health departments</p>	<p>Monitoring levels of physical activity or inactivity provides a key means to establish general lifestyle trends within a population. Although it will not be possible to directly attribute such changes to transport options, it will provide a high-level indication as to the change in trend and the possibly need for further community support or intervention.</p>	X	X		
<p>Hospital Admission Rates (cardiovascular and respiratory rates per 100,000 people)</p> <p>Such data is available upon request from local public health departments for a range of geographic areas (Local Authority, ward and super output areas)</p>	<p>The monitoring of cardiovascular and respiratory hospital admission rates can be applied as a means to monitor trends in community health. Although such statistics cannot be directly attributed to LTP, they can be applied to complement and correlate transport mode statistics and air quality monitoring to health. In so doing it will be possible to monitor overall success and establish if further intervention is required.</p>	X	X	X	X

Indicator	Rationale	Transport Mode			
		Active	Public	Private	Freight
<p>Life Expectancy</p> <p>Such data is available upon request from local public health departments for a range of geographic areas (Local Authority, ward and super output areas)</p>	<p>Monitoring life expectancy provides a means to monitor the overall improvement in the health of populations contrasted against regional and national trends.</p> <p>Although such changes in life expectancy cannot be directly attributed to LTPS, they are key to monitoring general health improvements, pockets of inequality and the possibly need for further community support or intervention.</p>	X	X	X	
<p>Standardised Mortality Rates</p> <p>Such data is available upon request from local public health departments</p>	<p>The (SMR) is a method of comparing mortality levels in different years, or for different sub-populations in the same year, while taking account of differences in population structure. Monitoring ward level SMR therefore provides a means to monitor high-level changes in community health and changes in health inequality.</p>	X	X	X	
<p>Project Level Health Impact Assessment</p>	<p>It may be the case that specific transport options warrant further investigation as to the magnitude, distribution and likelihood of potential health outcome.</p> <p>LTP may therefore prompt the requirement for HIA to be commissioned and submitted as a supplementary planning document as part of the planning consent process.</p> <p>Where such HIA are deemed necessary, it is recommended to monitor that they have been appropriately scoped. This resource can be applied to inform the scope, focus and specific assessment methods to be applied.</p>	X	X	X	X

8. Suggested Transport Mitigation and Community Support Initiatives

- 8.1 The focus of Strategic Environmental Assessment is at plan or programme level. As part of the implementation of the LTP, there may need to be Environmental Impact Assessments as part of the consenting process for certain projects under EU Directive 85/337/EEC (as amended). The Directive does not specifically refer to human health, but requires EIAs to address effects on “human beings”, and Environmental Statements accompanying applications should cover population, which is understood to include human health issues where these arise.
- 8.2 HIAs are now being commissioned on a voluntary basis by developers to demonstrate healthy urban design features, in compliance with LTP health objectives, and promote their bids. Local Public Health departments are often able to assist with carrying out HIAs on a range of subjects.
- 8.3 Where LTPs decide to make HIA a requirement on specific projects, or as a blanket requirement to supplement all transport-planning submissions, it is suggested that a review of any complementary policy in the LDF be carried out to establish if there is already a local requirement for HIA to which the LTP can signpost to or build upon.

Transport Mode

Active Transport

Risk of Collision

- 8.4 The key health risks associated with active transport includes an increased risk of collision with other transport modes with the potential to result in serious and fatal injuries. LTPs will typically be designed to further remove or manage such risks by making cycling safer in line with the hierarchy of measures as set out on the DfT publication ‘Cycle Infrastructure Design’⁽⁴⁹⁾:
- providing road calming features intended to protect pedestrians and cyclists in sensitive locations (i.e. in proximity to schools, nurseries and recreational areas);
 - providing safe, visible crossing points for pedestrians and cyclists;

- raising awareness as to cyclists, pedestrians and children (passive and active signage);
- providing cycle training for children and adults; and
- encouraging a transfer away from private vehicle use, reducing the level of exposure and frequency of risk from road traffic collision, vehicle emission, noise and community severance.

8.5 However, additional mitigation may be required to manage residual risks, and in particular the disproportionate level of risk to other road users (e.g cyclists) and within communities (i.e. children and children from deprived and ethnic families in particular). It will also be necessary to address the personal barriers limiting uptake within specific community groups (older people, the infirm, socio-economically deprived etc) and for specific commuter trips (school and shopping run, work commute etc).

8.6 Such mitigation and initiatives are bespoke, tailored to LTPs and the communities they are intended. However, it is recommended that the following key points are always considered:

Collision risk management

- the likelihood and severity of collisions varies within communities and between transport modes. An appreciation as to local circumstance, demography, age structure and existing accident black spots is required to fully address potential risks and their disproportionate impact upon communities;
- that traffic calming measures complement cycle and pedestrian paths and do not impact upon them (i.e. that they do not reduce the quality or safety of cycle or pedestrian routes); and
- that road calming measures are designed with the needs of cyclists and pedestrians in mind and do not impact upon them (i.e. that they do not reduce the quality of cycle or pedestrian routes, or cause erratic road vehicles movements such as swerving).

Personal barriers

- personal barriers to active travel vary within community groups and between commuter types. Addressing and removing such barriers requires an appreciation as to local circumstance, demography, age structure, community and commuter needs and perceived risks (this can be achieved through community profiling and engagement);

- parental perceptions of risk is a common barrier limiting the level of active transport during the school run. Such perceptions can be managed through information on formal School Travel Plans and should be reinforced with information on the long term health benefits from increased physical activity. Cycle training can also give children skills and confidence and help ease parental perceptions of risk – research from Cycling England showed that whilst over three quarters of parents are uneasy about allowing their children to cycle independently, when asked what would make them feel more reassured about their child cycling, 52% said cycle training;
- barriers limiting the level of commuter active and public transport is influenced by conveyance, comfort and control. Such priorities can be addressed through real time transport information (i.e. signage at bus stations), clean, reliable and comfortable services and through formal Work Travel Plans. However, this should be reinforced by effectively communicating the personal benefits to commuters (i.e. equivalent to a pay rise, gym membership and facilitating a longer healthy life);
- barriers for older people and those with disabilities often include perceptions of safety and risk of injury on the way to public transport or while waiting for modal interchange. There is therefore a requirement to engage with such groups in order to ascertain such barriers and the best way in addressing them; and
- barriers limiting the uptake by vulnerable community groups may include concern of personal safety and crime. Defining such issues during consultation will aid in developing bespoke initiatives, aid in addressing health inequalities and support the delivery of LTPs.

Private

- 8.7 Private vehicle use presents a number of environmental health risks that are typically disproportionately dispersed within socio-economically deprived communities and vulnerable community groups. Such risks are in part being addressed through improvements in vehicle technology and safety features, and more strategically through LTPs. LTPs can also be applied to encourage more active and healthier lifestyles, with significant health protection and promotion benefits. However, it is important to note that transport options geared towards a modal shift away from private vehicle use, may have a particular impact upon vulnerable community groups (i.e. communities in rural and suburban areas, the older people, people with disabilities etc).

- 8.8 In order to not widen socio-economic and health inequality, additional initiatives may be required to ensure that such community groups do not result in a decrease in access and accessibility or become isolated. The primary means of addressing such issues is through effective consultation with such groups to establish their relative transport needs and current barriers limiting access and accessibility.
- 8.9 LTPs are implicitly geared towards influencing more environmental and health conscious transport behaviour, balancing the relative needs of both commuters and the communities they pass through. Initiatives to support the delivery of LTP may include:
- real time parking signage, to prevent unnecessary congestion and aid commuters in making alternative travel choices;
 - real time Estimated Time of Arrival (ETA) traffic signage indicating the likely time spent in traffic, contrasted against the ETA to park and ride schemes;
 - targeted information programmes indicating how increased levels of active transport can:
 - to the average work commuter: be equivalent to a pay raise, gym membership and facilitating a longer healthy life for the average commuter;
 - to parents: have life long health benefits to children who walk and cycle to school (often constituting more exercise than is provided as part of the school PE curriculum);
 - to the general public: improves the quality of the local urban environment and significantly contributes in reducing the UKs greenhouse emissions; and
 - to employers and organisations: can be applied to minimise carbon emissions, and facilitate a healthier and more effective workforce;

Public

- 8.10 The potential health risks associated with Public transport are again, in part being addressed through improvements in vehicle technology and safety features, and more strategically through LTPs to ensure they meet commuter and community needs. Potential health benefits are largely associated with the modal offset from private vehicles, and the modal interchange with active transport modes. However, barriers limiting the use of public transport vary between demographic and vulnerable community

groups, therefore requiring bespoke initiatives to support the delivery of LTP strategic objectives. These may include:

- addressing poor perceptions and misconceptions of public transport;
 - ensuring high quality public transport systems to address perceptions of over crowding, dirty and uncomfortable transport;
 - providing real time signage to improve perceptions of reliability and improve control of trip planning;
 - ensure public transport systems are appropriately costed and, clearly establish concessions for vulnerable community groups; and
- ensure inter-modal areas (i.e. bus stops and train stations) are safe, meet the requirements of vulnerable community groups and address concerns of personal safety and crime.

8.11 Targeted information programmes can also be applied to reinforce the benefits (socio-economic and health) and convenience of public transport, in particular, where such transport modes share road networks (i.e. bus signage).

References

1. Value for Money: An Economic Assessment of Investment in Walking and Cycling. Department of Health and Government Office for the South West March 2010.
2. Department of Health. (2007). Draft guidance on health in strategic environmental assessment: A consultation.
3. World Health Organization. (1948). Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) entered into force on 7 April 1948. Geneva: World Health Organization.
4. Christl, B. et al., 2009. A Review of the Evidence of the Impact of Public Transport on Population Health in Australia. Australia: UNSW
5. Bourn, J., 2001. *Tackling Obesity in England*, London: National Audit Office
6. SQW (2007) *Valuing the Benefits of Cycling: A report to Cycling England*
7. Department for Transport. (2009). Collisions Involving Cyclists on Britain's Roads: Establishing the Causes. TRL Report PPR 445
8. Douglas, M., et al., 2007. *Health Impact Assessment of Transport Initiatives: A Guide*. Edinburgh: NHS Health Scotland
9. Besser, L. & Dannenberg, A. 2005. Walking to public transit – steps to help meet physical activity recommendations. *American Journal of Preventive Medicine*, 26,(4)
10. Gorman, D., et al. 2003. Transport policy and health inequalities: a health impact assessment of Edinburgh's transport policy. *Public Health*, 117, pp.15-24
11. Kavanagh, P., et al., 2005. *Health Impacts of Transport: A Review*, Dublin: IPHI
12. Department for Transport (2010). Reported Road Casualties Great Britain, 2009

13. Department for Transport. (2003). The Future of Air Transport White Paper
14. The Marmot Review (2010). Fair Society, Healthy Lives. The Marmot Review, Strategic Review of Health Inequalities in England post 2010
15. National Institute for Clinical Excellence (2009). Promoting Physical Activity for Children and Young People. Public Health Guidance PH17.
16. Grundy C, Steinbach R, Edwards P, Green J and Wilkinson P (2008) The effect of 20mph zones on inequalities in road casualties in London: A report to the London Road Safety Unit. London: LSHTM. http://www.tfl.gov.uk/assets//downloads/the-effect-of-20-mph_-zoneson-inequalities_in-road-casualties-inlondon.pdf
17. Littman. T. 2003. Economic Value of Walkability. Transportation Research Board of the National Academies, Vol. 1828
18. Edwards, P. & Tsouros, A., 2006. *Promoting Physical Activity and Active Living in Urban Environments, The Role of Local Governments*, Denmark, WHO Europe
19. Sustrans, 2007. *Creating the Environment for Active Travel*, Information Sheet FH09. Bristol: Sustrans
20. Department of Health, 2004. *At least five a week: evidence on the impact of physical activity and its relationship to health*, London: Department of Health
21. Office National Statistics, 2009. Transport Statistics Great Britain: 2009 Edition. London: DfT
22. Department for Environment, Food and Rural Affairs. (2010). Noise Policy Statement for England (NPSE). March 2010
23. www.hpa.org.uk/ProductsServices/ChemicalsPoisons/Environment/Noise
24. www.defra.gov.uk/environment/quality/noise/igcb/publications/healthreport.htm
25. www.dft.gov.uk/webtag
26. http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf
27. <http://www.defra.gov.uk/environment/quality/noise/environment/actionplan/index.htm>
28. Department for Transport (2006). Accessibility Planning Guidance

29. The Institute of Environmental Assessment (now the Institute of Environmental Management & Assessment). (1993). Guidelines for the Environmental Assessment of Road Traffic (Guidance Note No. 1)
30. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *J Epid Comm Health* 2001;55:111-22
31. Van Lenthe FJ, Borrell LN, Costa G, Diez-Roux AV, Kauppinen TM, Marinacci C, Martikainen P, Regidor E, Stafford M, Valkonen T. (2005). Neighbourhood unemployment and all cause mortality: a comparison of six countries. *J Epidemiol Community Health* 2005;59:231
32. Montgomery SM, Cook DG, Bartley MJ, Wadsworth ME. Unemployment pre-dates symptoms of depression and anxiety resulting in medical consultation in young men. *Int J Epidemiol.* 1999 Feb;28(1):95-100
33. Beland F, Birch S, Stoddart G. Unemployment and health: contextual-level influences on the production of health in populations. *Soc Sci Med* 2002;55:2033-52
34. Kemm J (2006) Towards quantification of HIA: the example of income, presented at the 7th International Health Impact Assessment Conference Wales 2006)
35. Department of Health (1998). Committee on the Medical Effects of Air Pollutants. The quantification of the effects of air pollution on health in the United Kingdom, London: The Stationery Office
36. European Commission (2001) Clean Air For Europe
37. World Health Organization. (2000). Evaluation and use of epidemiological evidence for environmental health risk assessment. Guideline document. Copenhagen: World Health Organization Regional Office for Europe
38. http://www.who.int/phe/health_topics/outdoorair_aqg/en/
39. <http://www.iom-world.org/research/iomlifet.php>
40. <http://www.defra.gov.uk/environment/quality/air/airquality/local/guidance/policy.htm>
41. http://www.london.gov.uk/sites/default/files/Health_Study_%20Report.pdf

42. COMEAP (2009). Statement on the Quantification of the Effects if Long Term Exposure to Nitrogen Dioxide on Respiratory Morbidity in Children. A report by the Committee on the Medical Effects of Air Pollutants. October 2009
43. <http://www.defra.gov.uk/environment/quality/air/airquality/strategy/>
44. World Health Organization. (1995). Guidelines for Community Noise. Edited by Birgitta Berglund Thomas Lindvall and Dietrich H Schwela
45. Night Noise Guidelines For Europe, World Health Organization, 2009 ISBN 978 92 890 4173 7
46. Porter, N.D., Findell, I.H. and Berry, B.F. (1998). Health effect based noise Assessment methods: A Review and Feasibility Study. NPL Report CMAM 16. National Physical Laboratory. September 1998
47. Stansfeld et al. 2000. A review of environmental noise and mental health. *Noise and health* 2000 8 1-8
48. Clark. C, Martin. R, van Kempen. E, Alfred. T, Head. J, Davies. H.W, Haines. M.M, Barrio. I.L, Matheson. M, and Stansfeld. S.A. (2005). Exposure-Effect Relations between Aircraft and Road Traffic Noise Exposure at School and Reading Comprehension: The RANCH Project
49. Department for Transport. 2008, Local Transport Note 2/08 Cycle Infrastructure Design. London: DfT.
50. Foresight. 2007. *Tackling Obesities: Future Choices – project report*, 2nd Ed. London: Government Office for Science
51. NICE. 2009. *Depression, the treatment and management of depression in adults*. London: NICE
52. Davis, A. et al., 2005. *Making the Case: Improving Health through Transport*. London: Health Development Agency
53. Craig, R. & Mindell, J., 2008. *Health Survey for England 2006*. London: the NHS Information Centre
54. Allender S et al. (2007) 'The burden of physical activity-related ill health in the UK', *Journal of Epidemiology and Community Health* 61: 344–348
55. Ossa D and Hutton J (2002) The economic burden of physical inactivity in England. London: MEDTAP International
56. Cerin, E. et al. 2007. Destinations that matter: Associations with walking for transport. *Health and Place*. 13 713-724

57. Craig, R. & Shelton, N., 2008. *Health Survey for England 2007*. London: the NHS Information Centre
58. Sustrans, 2009. *Active Travel and Adult Obesity*, Information Sheet FH14. Bristol: Sustrans
59. Poortinga, W., 2006. Perceptions of the environment, physical activity, and obesity. *Social Science & Medicine*, 63, (11), 2835-2846
60. Watkiss, P. et al., 2000. *Informing Transport Health Impact Assessment in London*. London: NHS Executive
61. Wunsch, H., 1999. Risk of type 2 diabetes reduced by regular brisk walking. *The Lancet*, 354, (9189), pp.1532
62. Gulve, A. 2008. Exercise and Glycemic Control in Diabetes: Benefits, Challenges, and Adjustments to Pharmacotherapy, *Physical Therapy*, 88, 11, 1297-1321
63. Sundquist, K. et al. 2005. The long-term effect of physical activity on incidence of coronary heart disease: a 12 year follow-up study. *Preventive Medicine*, 41, 219-225
64. Dora, C. & Phillips, M., 2000. *Transport, Environment and Health*. Geneva: World Health Organization
65. Berlin, J.A., Colditz, G.A. 1990. A meta-analysis of physical activity in the prevention of coronary heart disease. *Am J Epidemiology*, 132, 612-628
66. NHS, 2007. *Cancer Reform Strategy*, London: Department of Health
67. Mutrie, N. et al. 2002. "Walk in to Work Out": a randomised controlled trial of a self help intervention to promote active commuting. *Journal Epidemiological Community Health*. 56, 407-412
68. Leyden. M., 2003. Social Capital and the Built Environment: The Importance of Walkable Neighbourhoods, *American Journal of Public Health*, 93, (9)
69. Johansen A and Stone M (2000) 'The cost of treating osteoporotic fractures in the UK female population (letter), *Osteoporosis Int* 11: 551-552
70. NAO. 2009. *Improving road safety for pedestrians and cyclists in Great Britain*, London: DfT
71. Roberts. I. & Power, C. 1996. Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. *British Medical Journal*, 313, 784-786

72. Social Exclusion Unit, 2003. Making the connections: final report on transport and social exclusion. London: Office of the Deputy Prime Minister
73. Department of Transport: Road Casualties Great Britain: 2007 Annual Report. London.
74. Lavin, T. et al. 2006. *Health impacts of the built environment: a review*. Dublin: Institute of Public Health in Ireland
75. Duncan, M. et al. 2005. Perceived environment and physical activity: a meta-analysis of selected environmental characteristics. *International Journal of Behavioral Nutrition and Physical Activity*, 2, 11
76. WHO, Regional Office for Europe (2002) a Physically Active Life through everyday transport with a special focus on children & older people & examples and approaches from Europe
77. Woodcock J, Edwards P, Tonne C, Armstrong B.G, Ashiru O, Banister D, Beevers S, Chalabi Z, Chowdhury Z, Cohen A, Franco O.H, Haines A, Hickman R, Lindsay G, Mittal I, Mohan D, Tiwari G, Woodward A. 2009. Health and Climate Change 2: Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *The Lancet*. Vol 372 December 5, 2009
78. Department for Transport, 2008. Transport Statistics Bulletin: road casualties in Great Britain Main Results, 2008. London: DfT
79. Rutter H. (2000). A policy report on the health benefits of increasing levels of cycling in Oxfordshire
80. Transport HIA Working Group. *Health Impact Assessment of the City of Edinburgh's Council Urban Transport Strategy – Scottish Needs Assessment Programme*
81. Department for Transport. (2009). Collisions Involving Cyclists on Britain's Roads: Establishing the Causes. TRL Report PPR 445
82. Cavill, N. Rutter, H. & Hill, A., 2007. Action on Cycling in Primary care trusts: results of a survey of Directors of public health. *Public Health*, 121, pp.100-105
83. Zuurbier M, Hoek G, Oldenwening M, Lenters V, Meliefste K, Hazel P, Brunekreef B. (2010). Commuters' Exposure to Particulate Matter Air pollution is Affected by Mode of Transport, Fuel Type and Route. *Environmental Health Perspectives*. 25th February 2010
84. Department for Transport. 2009. Transport Statistics Bulletin – National Travel Survey: 2008. London: DfT

85. Beirão, G. & Cabral, J. 2007. Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy*, 14, 478-489
86. Whitley, R. & Prince, M. 2005. Fear of crime, mobility and mental health in inner-city London, UK. *Social Science & Medicine*, 61, 1678-1688
87. Hine, J. 2003. Transport disadvantage and social exclusion in Urban Scotland. *Built Environment*, 30, 2
88. Krzyzanowski, M. et al. (Ed.) 2005. *Health effects of transport-related air pollution*. Denmark: World Health Organization Europe
89. Grant M, Barton H, Coghill N, Bird C. (2009). The Spatial Determinants of Health in Urban Settings. WHO Collaborating Centre for Healthy Urban Environments. University of the West of England, Bristol
90. Imperial College, Mott MacDonald & University of Leeds. 2007. *Social Inclusion: Transport Aspects (UG320)*
91. Stafford, J. & Pettersson, G., 2002. People's perceptions of personal security and their concerns about crime on public transport, literature review. London: DfT
92. Office National Statistics, 2008. *Transport Trends: 2008 Edition*. London: DfT
93. Roberts. I. & Power, C. 1996. Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. *British Medical Journal*, 313, 784-786
94. Mayou, R. et al. 1993. Psychiatric consequences of road traffic accidents. *British Medical Journal*, 307
95. Mayou, R. & Bryant, B. 2002. Consequences of road traffic accidents for different types of road user. *Injury: International Journal of the Care of the Injured*, 34, 197-202
96. Andersen, L., Schnohr, P., Schroll, M. and Hein, H. (2000). All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. *Archives of Internal Medicine*, 160, 1621 – 1628
97. Hiscock, R. et al. 2002. Means of transport and ontological security: Do cars provide psycho-social benefits to their users? *Transportation Research Part D*, 7, 119-135
98. Department for Transport, 2008. Delivering a sustainable transport system: the logistics perspective. London: DfT
99. Rye, T. 2002. Travel Plans: Do they work? *Transport Policy*, 9, 287-298

100. NICE. 2008. *Workplace health promotion: how to encourage employees to be physically active*. NICE Public Health Guidance 13. London: NICE
101. Department for Transport, 2005. *Transport Energy Best Practice. A guide on how to set up and run travel plan networks*. London: DfT
102. Department for Transport, 2008. *The Essential Guide to Travel Planning*. London: DfT
103. Davis, A. 2005. Transport and health – what is the connection? An exploration of concepts of health held by highways committee Chairs in England, *Transport Policy*, 12, 324-333
104. Department for Transport. Personalised travel planning: evaluation of 14 pilots part funded by DfT. Web resource, available at : <http://www.dft.gov.uk/pgr/sustainable/travelplans/ptp/personalisedtravelplanningev5774> last accessed March 2010
105. Department for Transport. (2007). Travel Training Schemes- a review of travel training schemes in England
106. Pronk, N. & Kottke, T. 2009. Physical activity promotion as a strategic corporate priority to improve worker health and business performance. *Preventive Medicine*, 49, 316-321
107. Roby, H. 2010. Workplace travel plans: past, present and future. *Journal of Transport Geography*, 18, 23-30
108. Sustrans. 2008. *Active travel and healthy workplaces*. Information Sheet FH06. Bristol: Sustrans
109. Timperio, A. et al. 2005. Perceptions of the local neighbourhood environments and their relationship to childhood overweight and obesity. *International Journal of Obesity*, 29, 170-175
110. Health Development Agency (2003) Prevention and reduction of accidental injury in children and older people
111. Department for Transport (2005). Making residential travel plans work: good practice guidelines for new development
112. Department for Transport. (2008). Making Personal Travel Planning Work: Practitioners' Guide
113. Department for Transport. 2006. *High Occupancy Vehicle Lanes*. Traffic Advisory Leaflet 3/06. London: DfT

114. Gardner, B. & Abraham, C. 2007. What drives car use? A grounded theory analysis of commuters' reasons for driving. *Transportation Research Part F*, 10, 187-200
115. Ellaway, A. et al. 2003. In the driving seat: psychosocial benefits from private motor vehicle transport compared to public transport. *Transportation Research Part F*, 6, 217-231
116. Sustrans, (2009). *The national cycle network route user monitoring report to end of 2008*. Bristol: Sustrans

Appendix A: Supplementary Transport and Health Evidence

Introduction

- A.1 This section provides a more in-depth discussion of the transport and health evidence base, and is intended to aid, transport planners, public health specialists and SEA practitioners in developing their own bespoke evidence base to support the LTP and SEA process. For this reason, the following section has been structured to provide a brief discussion on transport modes and specific transport management initiatives, their associated health issues/opportunities and their potential disproportionate influence upon vulnerable community groups.
- A.2 The discussion of the potential interventions in this document deliberately focuses on the pros and cons from a health perspective. It does not go into detail of wider issues local authorities may want to consider before implementing them. These could include the impacts on local businesses, the ability of measures to contribute to compliance with statutory targets, the need to consult affected stakeholders, and the uncertainties around the effects of some of the measures.

Transport Modes

Walking

- A.3 Over relatively short distances, walking is one of the most widely accessible forms of transport for the majority of the population regardless of gender, age and socio-economic status. Walking provides a form of physical exercise that can be easily incorporated into most people's daily commuting or recreational routine. Walking and other forms of active transport have continued to decline over the last 30 years, with an increased reliance on private car use⁽⁵⁰⁾⁽⁵¹⁾. This is despite many car journeys being of a distance which could be typically completed through a more active mode of transport such as walking⁽⁵²⁾⁽¹⁸⁾.

The Health Opportunities from Walking

- A.4 Evidence suggests that increased levels of walking presents a wide range of physical, social and mental health benefits, including:

- improved health and general wellbeing;
- a reduced risk of coronary heart disease and stroke;
- a reduced risk of obesity;
- lower rates of all-cause mortality;
- the prevention and management of type 2 diabetes; and
- reduced prevalence of some types of cancers.

A.5 Each of these potential health benefits are discussed in more detail below.

Physical Activity and General Health

- A.6 The general health benefits achieved through regular physical activity include a 20-30% reduced risk of premature death for adults and a 50% reduced risk of developing chronic diseases such as coronary heart disease, cancers, stroke and type 2 diabetes⁽⁵²⁾. To put this into context, people who are not sufficiently physically active run twice the risk of a fatal heart attack as compared to those who are.
- A.7 Despite an improvement in levels of physical activity since 1997⁽⁵³⁾, only a small proportion of the population (39% of men and 29% of women) say they achieve the recommended levels of at least 30 minutes of moderate activity for adults at least five times a week⁽¹³⁾. Around 14 million adults fail to achieve even one 30-minute session per week. Similarly, only 31% of boys and 22% of girls aged 4-15 meet the Chief Medical Officer's recommendations for children's physical activity (5 x 60 minute sessions per week)⁽²⁰⁾. Estimates for the annual costs to the NHS as a result of physical inactivity are between £1 billion and £1.8 billion. The costs of lost productivity to the wider economy have been estimated at around £5.5 billion from sickness absence and £1 billion from premature death of people of working age. Taken together, these costs total approximately £8.3 billion every year⁽⁵⁴⁾⁽⁵⁵⁾. Addressing levels of physical activity within transport and planning policies is therefore a national imperative. In particular, walking as a local transport mode is increasingly seen as a significant opportunity to contribute towards achieving the recommended levels of physical activity and improving the health of populations. Cerin et al (2007) estimated that on average, an individual who walks to work would accumulate 166 minutes of walking per week, which would meet the recommended physical activity targets set to protect and promote good health⁽⁵⁶⁾.

- A.8 Detailed costs by Primary Care Trust of physical inactivity by disease category are available at http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_094358

Obesity Prevention & Management

- A.9 Obesity is a major health concern throughout the UK and is defined by the point at which the weight gain of an individual has the potential to seriously endanger health⁽⁵⁾. Levels of obesity in the UK have continued to increase for both males and females since 1993. In 2007, 24% of men and women were classed as obese⁽⁵⁷⁾. The Foresight Report (2007) estimated that by 2050, 60% of the UK population could be obese and that the estimated economic costs of obesity and individuals overweight could rise to £9.7 billion to the NHS, with a wider cost to society being £49.6 billion at current prices⁽⁵⁰⁾.
- A.10 Obesity also underpins the increasing rates of mortality from chronic diseases and illnesses and increases the risk of mortality at any age. There is an established association between obesity and cardiovascular disease, cancer, type 2 diabetes and lower life expectancy⁽⁵⁷⁾. Based on the increasing rates of obesity in the UK, the prevalence of these diseases are predicted to increase, including an increase of over 70% in the incidence of type 2 diabetes and 20% for coronary heart disease by 2050⁽⁵⁰⁾. On average, deaths linked to obesity in the UK shortens lives by 9 years⁽⁵⁾.
- A.11 As previously discussed, lifestyles in general have become increasingly more sedentary in terms of occupation, transport choices and leisure activities⁽⁵⁰⁾⁽⁵⁸⁾. Studies have demonstrated an association between obesity and increased reliance in car use, suggesting that reduced overall physical activity levels, coupled with a preference for car journeys over active transport is a key contributing factor to the growing rate and cost of obesity in the UK⁽⁵⁸⁾.
- A.12 The physical environment in which people live, including access to green spaces, recreational facilities and the 'walk-ability' of neighbourhoods have been found to affect the levels of obesity in populations. Evidence suggests that improving convenience and connectivity of amenities and networks will encourage physical activity and can have a positive influence on the management of people's weight⁽⁸⁾⁽⁵⁰⁾⁽⁵⁹⁾.

Diabetes (Type 2) Prevention & Management

- A.13 Diabetes affects the body's ability to store glucose. Unlike type 1 diabetes, type 2 diabetes generally develops later in life and occurs when organs and muscles in the body are unable to absorb and store glucose as a source of energy⁽²⁰⁾. The prevalence of type 2 diabetes continues to increase in the UK, and is closely associated with levels of physical inactivity and obesity⁽²⁰⁾⁽⁵⁰⁾.
- A.14 A number of studies have reported a relationship between levels of physical activity as an important contributor in type 2 diabetes prevention and improved blood sugar control for those who have the condition⁽²⁰⁾⁽⁶⁰⁾. The specific frequency, type and duration of physical activity required to reduce the risk of type 2 diabetes is unclear. Forms of intense physical activity have been shown to have a more significant improvement in glycaemic control. However, evidence also suggests that moderate, regular exercise such as walking and cycling can also generate the levels of physical activity required to reduce the risk of developing type 2 diabetes⁽²⁰⁾⁽⁶⁰⁾⁽⁶¹⁾⁽⁶²⁾.
- A.15 The GP Physical Activity Questionnaire (GPPAQ), a validated screening tool, health practitioners are able to identify adults and recommend interventions that are suited to the lifestyle and circumstances of patients. The universal adoption of the PACP approach would help to address inequalities in participation for all relevant groups irrespective of age, disability, ethnic group, religion or belief, gender and sexual orientation. The pilot showed that the PACP is effective in engaging particular groups such as older people, women and the ethnic minority groups who were prevalent in the pilot areas.

Cardiovascular Disease

- A.16 Cardiovascular disease, including Coronary Heart Disease (CHD), hypertension and stroke is the greatest cause of morbidity and mortality in the UK and is the cause for over 39% of deaths⁽²⁰⁾. A number of studies suggest that there is a strong correlation between reduced risk of developing CHD with increased physical activity for both men and women⁽⁶¹⁾⁽⁶³⁾.
- A.17 The reduced risk of cardiovascular disease is a key health benefit of regular physical activity, and can lead to nearly a 50% reduction in the risk of developing a fatal heart attack⁽⁶⁴⁾⁽⁶⁵⁾. It is also thought that one third of CHD cases and one quarter of incidences of stroke could be avoided by regular physical exercise such as walking⁽²⁰⁾⁽⁶⁰⁾.

Respiratory Health

- A.18 As previously discussed, increased physical activity and improved cardiovascular and respiratory health are closely associated. However, in addition to the preventative health benefits that can be achieved through more active transport modes, it has been reported that those with pre-existing respiratory symptoms can benefit from moderate forms of physical activity. A majority of people with asthma can benefit from physical activity and walking is considered a suitable form of exercise for those with asthma. Those with chronic obstructive pulmonary disease (COPD) and other respiratory diseases can also benefit from mild forms of physical activity to reduce deterioration of their condition⁽⁶⁰⁾. The provision of safe and appealing walking environments therefore encourages and promotes healthier communities, and provides an opportunity to treat and maintain the health of the infirm.

Cancer

- A.19 Sedentary lifestyles and obesity are closely associated with a relative risk of cancer where obesity in particular can increase the risk of many cancers especially of the kidney, colon, gallbladder, breast, uterus and oesophagus⁽⁶⁶⁾. While evidence suggests that increased physical activity could reduce the rate of all cause cancer rates in the UK by up to 46%⁽²⁰⁾⁽⁶⁰⁾. Physical activity has the greatest effect on protecting against colon cancer. It has been found that regular, moderate physical activity reduced rates of colon cancer amongst middle aged males, who have a 40-50% lower risk compared to those who are physically inactive⁽⁴⁾⁽²⁰⁾.
- A.20 Physical activity is also associated with a reduced risk of breast cancer amongst post-menopausal women and there are some links to reduced rates of lung cancer, although the association is unclear⁽²⁰⁾. Studies indicate that for the best protection against cancer, regular moderate to vigorous intensity physical activity should be maintained throughout a lifetime⁽²⁰⁾. The frequency of physical activity is a factor in the protection built against cancer.

Mental Health and Emotional Wellbeing

- A.21 In addition to the physical health benefits, evidence suggests that physical activity such as walking also fosters general improvement in the quality of life and has preventative and remedial benefits on mental health⁽²⁰⁾⁽⁶⁰⁾. Research indicates that those who are more physically active have higher

levels of self-esteem, confidence and improved cognitive functioning than those who are physically inactive⁽⁶⁴⁾.

- A.22 Regular physical activity is beneficial as a preventative measure to maintain mental wellbeing and can be effective in reducing the symptoms in people diagnosed as severely, moderately or mildly depressed, and in some cases can provide an alternative to medication⁽²⁰⁾. A study to increase the numbers of commuters walking to work showed significant improvements in both mental and general health for those who changed from private/public transport to walking or cycling to work⁽⁶⁷⁾.

Access to Social Networks

- A.23 Encouraging people to walk has been found to improve social inclusion by increasing access to social networks, services, amenities and recreation. Mixed-use urban areas with residential and easily accessible amenities and services, which favour pedestrians and reduce dependence on cars, have been found to increase social participation, levels of walking, the use of public spaces and local services, and ultimately good health and wellbeing⁽¹¹⁾⁽¹⁸⁾⁽¹⁹⁾⁽²⁰⁾⁽⁶⁸⁾.

Strengthening Bones/Muscles/Joints

- A.24 Osteoporosis is a condition in which low bone density and deterioration of bone tissue, makes bones more at risk of fracture. Osteoporosis is a common problem particularly for older people and post-menopausal women. Walking is a weight bearing activity, which can increase bone mineral density, thereby reducing the risk of osteoporosis and fractures⁽²⁰⁾. Studies indicate that bone density is typically higher in women who regularly walk, or who walk in combination with high intensity forms of exercise such as aerobic activity. This was also found to have a positive effect on improving bone and muscle strength⁽⁵²⁾⁽⁶⁰⁾. Evidence suggests that physical activity in older people can also protect against hip fractures by improving muscle strength, balance and co-ordination reducing both the risk and likelihood of falls and consequent bone fractures. Falls are the leading cause of accidental death in England of older people and fractured hips cost the NHS and social services £1.8 billion per year in England⁽⁶⁹⁾. Given the increasing ageing population in the UK, encouraging walking as a mode of local transport and addressing barriers limiting levels of walking by specific age groups is likely to aid in improving the health and wellbeing of communities throughout the UK, and older communities in particular (promoting good physical, mental and social health).

Crime and the Perception of Crime

- A.25 It has been suggested that increased 'walkability' within a built environment can also be applied to address both actual and perceived crime. To clarify, with more people walking and watching over neighbourhoods, areas of open space and main streets can discourage opportunistic crime and antisocial behaviour⁽⁶⁵⁾. This in turn can improve perceptions of safety, further encouraging walking and social networks within particularly vulnerable groups, including older people and the infirm.

The Health Issues from Walking

Road Traffic Accident and Injury

- A.26 The most significant health issue for pedestrians is the potential risk of collision with road users. In 2009, there was a reduction of 50% in the number of pedestrians killed or seriously injured and a reduction of 44% in the number of cyclists killed or seriously injured compared to the average between 1994 and 1998. A National Audit Office (NAO) report has estimated that in 2007, pedestrian and cyclist casualties as a result of road accidents cost the economy over £3.4 billion⁽⁷⁰⁾.
- A.27 The distribution of road traffic accidents throughout the population varies significantly according to age, type of road-user and socio-economic background. The rate of fatal and serious road traffic collisions from private vehicles continues to decline. However casualty rates are not evenly distributed, with those aged between 16 and 29 years of age (young drivers and their passengers) having the highest rates of death or serious injury in car accidents. Among pedestrians children and older people are most at risk from accidents, with nearly 40% of fatalities being children under 16 years of age. Road accidents involving children are disproportionately more likely to affect children from deprived families⁽⁷¹⁾⁽⁷²⁾
⁽³⁶⁾⁽⁶²⁾.
- A.28 The 2007 DfT report of Road Casualties looked at variations in casualties by deprivation⁽⁷³⁾. The report found the 10% most deprived areas were over represented in the casualty population for all age groups except 17-19 year olds, 20-25 year olds and those aged 60 and over. The largest difference between the casualty rate for the most deprived and least deprived areas was for pedestrians, from a rate of 70 casualties per 100,000 population in the most deprived areas to 21 casualties per 100,000 population in the least deprived areas. There are also observed differences in the rates of accidents involving child pedestrians of some

ethnic backgrounds, with children of a non-white background having higher accident rates than white children in the UK.

- A.29 Despite the significant reductions in the number of pedestrians involved in road traffic accidents, the perceived physical dangers associated with road traffic have been identified as a key barrier to walking and cycling for vulnerable community groups. This has resulted in a significant reduction in the number of children allowed to walk independently to school, and further influences recreational activities due to perceived safety concerns of parents. Evidence suggests that such behavioural influences during childhood may have a longer-term influence upon physical activity and associated health levels in adulthood⁽⁷⁴⁾. In contrast, meta-analysis undertaken in the USA demonstrated that if individuals did not perceive traffic as a problem, they were 20% more likely to be physically active⁽⁷⁵⁾.

General Accident and Injury

- A.30 In addition to road traffic accidents, injury to pedestrians can also result from slips and trips on pavements and crossings whilst walking. Whilst pavements and high quality walking routes can encourage walking as a key mode of local transport, the converse is equally true, and can have a particular impact on those most at risk, namely older people, the infirm and parents with children in pushchairs⁽⁷⁶⁾.
- A.31 Unlike physically intensive forms of exercise, walking is less likely to cause physical strain and injury and therefore is particularly suitable for people more at risk from injury. Moderate physical activity forms such as walking and cycling have a lower risk of adverse cardiovascular or orthopaedic conditions than more intensive forms of exercise⁽⁶⁴⁾.

Exposure to Poor Air Quality

- A.32 Pedestrian routes in urban areas are typically parallel to roads and therefore in proximity to the highest concentrations of associated transport emissions⁽⁸⁾. Research into the potential health effects of emissions is extensive and provides statistically significant associations between many classical air pollutants (e.g. Particulate Matter, Nitrogen Dioxide and Sulphur Dioxide) and effects on life expectancy and a wide range of cardiovascular and respiratory health outcomes. Such associations and the specific method to assess their impact on health are discussed in more detail within Chapter 3.

- A.33 In addition to the physical, social, mental and economic health benefits accrued through more active modes of transport, a modal shift towards more active forms of transport such as walking will also contribute in offsetting road vehicle emissions, and is regarded as a means to significantly reduce the nation's contribution of greenhouse emissions⁽⁷⁷⁾.

Cycling

- A.34 Cycling is a relatively inexpensive, quick, environmentally friendly and healthy mode of transport. Unlike walking, cycling requires both access to a bicycle, safety equipment and secure/appropriate storage at both home and the desired destination. As such, there is both an initial economic cost, a space requirement in homes and additional bicycle parking facilities at destinations (work, schools, retail, recreational and social areas) and at transport modal interchanges (e.g. at train stations, on trains etc).
- A.35 The health benefits of cycling are closely associated with the health benefits of walking, and include a reduced prevalence of cardiovascular disease, obesity, type 2 diabetes, improved psychosocial wellbeing and a generally improved quality of life. As with walking, cycling can be integrated as part of a daily routine including:
- a form of active commuting;
 - the school journey for children;
 - as a mode of transport to recreational facilities, local amenities; and
 - as part of multi-modal transport option (i.e. bike to bus or train).
- A.36 38% of car/van journeys in Great Britain (driver or passenger) are less than 5 miles, a distance that could be typically cycled. However, the number of people cycling as a transport mode remains small in the UK with an estimated 2% of all journeys taken by bicycle in 2009. In 2009, 14% of respondents of the National Travel Survey said they ride a bicycle at least once a week and a further 9% said they did so at least once a month. 68% said they use a bicycle less than once a year or never⁽²¹⁾.

Health Opportunities

Physical Activity, General Health and Wellbeing

- A.37 Cycling is a low impact exercise and provides a form of exercise with reduced risk of over-exertion or strain to joints and muscles. In a study, the health of people new to cycling was assessed to understand to what extent

regular cycling makes people healthier. It was found that even cycling short distances regularly can lead to significant health improvements⁽⁷⁸⁾⁽⁷⁹⁾.

- A.38 It has been suggested that for new cyclists, cycling short distances can reduce their risk of death, mainly reducing heart disease by as much as 22%⁽⁷⁹⁾. Evidence further suggests that the health gains from cycling significantly outweighs health risks such as accidents and exposure to air pollution by twenty to one⁽⁸⁰⁾. Similar to walking, cycling may also contribute in significantly reducing health care costs if more people can be encouraged to cycle regularly.

Health Issues

Risk of collision

- A.39 Cyclists are generally perceived as being more at risk of accident and injury from road traffic accidents than other road users. Such a perception is the key reason given by people for not cycling, particularly for those living in areas without specific cycle routes and for those cycling using busy roads in towns and cities.
- A.40 The Department for Transport commissioned research to provide a comprehensive understanding of collisions involving cyclists, with the objective of establishing the key causes. The programme of work involved an international literature review and a detailed analysis of cyclist casualties in Great Britain, drawing on both national and in-depth databases of road collisions and cycling⁽⁸¹⁾. The main findings include:
- A high proportion of collisions occurred at junctions (almost two-thirds of cyclists reported killed or seriously injured at or near junctions). In collisions involving a bicycle and another vehicle, the driver's having 'failed to look properly' was reported to be a key contributory factor for drivers and riders at junctions (reported in almost 60% of serious collisions at junctions).
 - The study found that rural roads present particular challenges for cyclists, as the risk of being killed is much higher than for other roads. Almost half of cyclist fatalities occurred on rural roads, and the proportion of collisions on these roads increases for those aged 40+ years. Casualty severity was found to increase with the posted speed limit, and so measures to reduce traffic speeds in rural areas may benefit cyclists.

- Collisions at night/in the dark were more likely to result in a fatality, and rural roads present particular difficulties, as not only are the speed limits generally higher but the roads are often unlit. A detailed examination of these accidents found that the bicycle was commonly impacted in the rear by the vehicle.
- HGVs present particular challenges for cyclists and are over-represented in cyclist fatalities (18% of fatal cycle accidents involved an HGV, compared with 4% of serious accidents). These accidents were more common at junctions where the main collision configuration was the HGV driver making a left turn while the cyclist was going ahead. 'Vehicle blind spot' and 'passing too close to the cyclist' were judged by the police to be key contributory factors.

A.41 It has been suggested that an increase in the number of cyclists can lead to a reduced risk of road traffic accidents for cyclists, known as the 'safety in numbers' hypothesis (see 4.8)⁽⁸¹⁾⁽⁸²⁾.

Exposure to Air Pollution

A.42 Similar to walking, cyclists are generally in close proximity, if not, on road networks and therefore subject to the highest concentration of roadside emissions. Furthermore, due to the aerobic nature of cycling, cyclists will respire a higher level of associated roadside emissions⁽⁸³⁾. However, evidence suggests that the relative risk from such exposure and heightened respiration is significantly lower than the health benefit to be acquired from improved levels of physical activity.

Public Transport

A.43 For many, including people with physical and learning disabilities, public transport is vital, providing affordable access to social networks, employment, services and amenities over a range of distances, and enables more significant carriage of belongings (shopping, pushchairs etc). Public transport encompasses a range of modes of travel from buses, trains, light rail, underground and taxis through to boats and ferries with varying strengths, weaknesses and associated health pathways. A brief overview of the individual public transport modes are discussed below, followed by a discussion of the associated health benefits and issues.

Bus and Coach

A.44 Buses are the most common form of public transport in the UK both within and between urban areas. In contrast, coaches operate for longer distances

(often intercity) and are typically cheaper than any other longer distance public transport modes (i.e. rail, domestic flights etc).

- A.45 Buses and coaches are accessible to all age, demographic and socio-economic groups, and depending on the vehicle type, must be compliant with the Disability Discrimination Act requirements by 2015/2017. Concessionary fare schemes such as the English National Concessionary Travel Scheme (ENCTS PASS) for the over 60s and disabled people, and other age focused concessions introduced at the discretion of local authorities further improve the affordability and accessibility of bus and coach use and typically offer a reliable cost effective transport system. However, as with other public transport modes, bus and coach services run to a fixed schedule and route, requiring some transport modal interchange (i.e. transport to the bus or coach stop) and reducing overall convenience to the user.
- A.46 Efforts to improve bus emission standards could benefit air quality in local communities

Rail

- A.47 Rail networks cover a majority of the country, providing a safe, fast and relatively cost effective travel choice, particularly for longer distance journeys. Rail accounts for 13% of all trips in the UK of 50 miles and over⁽⁸⁴⁾. However, rail requires significant infrastructure increasing the relative cost, requires modal interchange and follows fixed routes and times, which can again limit overall convenience to the user. Due to the higher associated costs, rail is typically less accessible to the socio-economically deprived, particularly during peak times.

Underground

- A.48 Underground systems provide a fixed route system for travelling around cities. In the UK, such modes are limited to London, Newcastle and Glasgow. Due to the isolated way in which they operate, the underground system is a convenient, rapid, cost effective and safe mode of public transport with limited opportunity for community exposure to noise, emissions or risk of accident and injury. However, commuters using the underground can be subject to overcrowding during peak periods, and a number of environmental stresses including exposure to heat, noise and particulate emissions (PM_{10} and $PM_{2.5}$). The underground is therefore one of the few transport modes where the commuter bears both the benefit and impact of the service. New stations and station upgrades typically

improve access and accessibility and further improve safety and emergency evacuation features improving commuter comfort and safety.

Light Rail

- A.49 Light rail provides an over ground option for travel, similar to bus services on fixed routes facilitated by significant infrastructure (i.e. rail and electric lines). However, being typically electric, light rail provides the benefit of a bus service with no local combustion emissions to air. However, being a fixed route system, the infrastructure costs of light rail systems are higher than alternatives (such as bus services), are less flexible in terms of route change and similar to bus services there is potential for collision with people and other vehicles. Although electric powered vehicles are typically quieter than combustion engines, light rail does not completely remove associated transport noise, with wheel screech presenting a key noise source.

Taxis

- A.50 Taxis provide the most convenient form of public transport, where the user can decide the route, time and destination of the journey. This makes taxis a more flexible form of public transport, particularly for those without access to a car. The benefits and health issues associated with taxis are similar to those of car use; namely, less modal interchange, convenience, freedom, and less time to travel. Taxis often fill a gap where there is no public transport available. However, taxis are a relatively expensive mode of transport and therefore are not as accessible to low-income groups. This can present a problem as often these groups do not own a car and rely heavily on public transport, which may be inaccessible to some groups, particularly for older people and the infirm.

The Health Opportunities of Public Transport

Increase in Physical Activity

- A.51 The use of public transport can contribute towards achieving recommended levels of physical activity. Travel by public transport will often consist of a number of transport modes, including active modes. For example, the use of public transport will tend to involve a small yet routine level of physical activity such as walking to and from bus stops and train stations⁽⁴⁾⁽⁸⁾. Studies have found that those in lower income groups and minority groups, without access to a car, have a significantly higher level of average walking time than car owners⁽⁹⁾.

- A.52 On average, each journey by public transport involves 6-10 minutes walking (to and from bus stops and train stations)⁽⁸⁾⁽⁹⁾. Assuming that public transport is used twice daily, physical activity will total 20 minutes per day, contributing to 66% of the 30 minutes of moderate exercise recommended each day⁽¹⁰⁾. Assuming that physical activity is undertaken to get to public transport there is an inverse relationship between public transport and obesity compared to those who commute by car, although this was found to be most relevant to male commuters⁽⁴⁾.

Economic Health

- A.53 Evidence suggests that although the cost of travel is important and can significantly influence the level of disposable income that can be spent on enriching and improving lives, it is not necessarily a key defining feature affecting the majority of people's travel choices⁽⁸⁵⁾.
- A.54 Although transport surveys indicate that both regular passengers and private vehicle users regard public transport as the cheaper option, the key drivers for using public transport include the opportunity to not drive and relax, conveniently located stops and a fast and reliable journey⁽⁸⁵⁾.
- A.55 However, for socio-economically disadvantaged groups, without access to a car and limited resources, public transport can often prove the only viable means to regularly access services, amenities and social networks. Such groups therefore have fewer transport alternatives and are more sensitive to the economic costs of transport (further impinging on economic health).
- A.56 Similarly, specific age groups with limited incomes (including older people, single parent families and young adults) and limited access to a car are also sensitive to transport costs, but as previously discussed are typically eligible for travel concession (ENCTS PASS for the over 60s, and other concessions introduced at the discretion of Local Authorities). As such, although the cost of public transport is not a key issue for the majority of the population, it can have a disproportionate impact and exclude socio-economically disadvantaged groups, in particular during peak transport periods (peak rates). This in turn can present another barrier to income and employment, can reduce social networks and support and contribute in widening pockets of inequality, deprivation and poor health.

Access to Social Networks

- A.57 Access to affordable, convenient and accessible transport can play a major part in increasing access to social networks and social inclusion⁽¹¹⁾.

Transport enables people to move outside of their own community, can improve access to social networks and in doing so positively influence both physical and mental health. Public transport is particularly important to maintaining access and accessibility to social networks, employment, goods and services within socio-economically disadvantaged groups, and for older people and the infirm⁽⁸⁶⁾. Hine (2003) found that in deprived urban areas, public transport alongside walking was the most important form of transport to allow access to social networks⁽⁸⁷⁾. Such community groups are therefore sensitive to changes in the availability and affordability of public transport (both adverse and beneficial).

Health Issues of Public Transport

Risk of Collision Accident and Injury

- A.58 As shown in Table A.1, the number of serious and fatal injuries per billion kilometres travelled in the UK from public transport is significantly lower than private vehicle use⁽⁸⁾⁽²¹⁾.

Table A.1: Passengers killed or seriously injured (KSI) rates per billion passenger-kilometres travelled (1999-2008)⁽²¹⁾

Mode of Transport		1999	2002	2005	2008
Air ^(a)		0.02	0.00	0.00	0.01
Rail ^(b)	Killed	0.9	0.4	0.1	0.0
	Injured	19	13	12	8
Water ^(c)		29	50	36	74
Bus or coach		12	11	7	9
Car ^(d)		33	29	23	18
Van ^(d)		13	11	7	5
Motorcycles ^(d)		1,423	1,367	1,109	1,089
Pedal cycle		779	555	533	541
Pedestrian		564	471	384	358

^(a) Passenger casualties in accidents involving UK registered airline aircraft in UK and foreign airspace.

^(b) Passenger casualties involved in traffic accidents and accidents occurring through movement of railway vehicles.

^(c) Passenger casualties on UK registered merchant vessels

^(d) Report driver and passenger casualties

- A.59 Public transport therefore represents a relatively safe transport mode, which is mirrored by general commuter perceptions⁽⁸⁵⁾. However, for those who are less physically mobile and depend on public transport for accessing goods and services, the potential for accidents such as slips and trips on the way to utilising public transport can occur, and are not well reported. In particular, common concerns amongst older people relating to accessing public transport include the following:⁽⁴⁾⁽¹⁷⁾

- poor condition of pavements;
- inadequate crossing facilities;
- boarding/alighting buses and trains; and
- steps at railway stations.

A.60 This indicates that for older people and the infirm in particular, risks limiting the use of public transport are often more associated with the modal interchange aspect (i.e. walking to and from and waiting for public transport) than the transport mode itself. Although individual physical barriers to transport are largely addressed through the Disability Discrimination Act (1995 & 2005), the consideration of relative barriers to a range of community age groups are required to further increase patronage and improve access and accessibility.

Air Emissions

- A.61 Transport is a leading source of emissions to air in the UK. This is principally caused from the combustion of fuel, however, fugitive emissions of particulates from road transport include brake dust, tyre wear and re-suspended road dust. Studies suggest that brake dust and tyre wear may account for approximately one-third of the total particulate emissions from road transport and the re-suspended component may be as important as particulate emissions from exhausts. Improvements in vehicle technologies are reducing PM_{10} exhaust emissions. Therefore, the relative importance of fugitive PM_{10} emissions on health is increasing.
- A.62 Although there has been an increase in the volume of road transport, emissions of transport related pollutants decreased since the 1980s mainly as a result of policy driven technological improvements to vehicles, improvements in fuel quality⁽⁸⁸⁾ throughout the EU.
- A.63 The WHO estimated that 100,000 deaths a year in cities in the EU could be linked to ambient air pollution, shortening life expectancy on average by a year, and that the predominant source of such pollution is transport related⁽⁸⁸⁾. While this is the case background concentrations can be a significant contributor to ambient concentrations, e.g. for PM where 30-40% of ambient concentrations can be from regional background.
- A.64 Policies to promote cleaner vehicles, particularly in urban areas could help in improving air quality.

A.65 The Interdepartmental Group on Costs and Benefits includes an air quality subject group. Their guidance represents best practice on methodologies for assessing the impacts upon human health and the environment of policy options and provides tools to aid the application of these methodologies. More information and detailed guidance is available at: <http://www.defra.gov.uk/environment/quality/air/airquality/panels/igcb>

Table A.2: Pollutant Emissions from Transport in the UK (1997-2007) (thousand tonnes)

Transport Mode	1997			2007			Percentage reduction in emissions 1999-2007 (%)		
	Nitrogen oxides (NO _x)	Particulates (PM ₁₀)	Sulphur dioxide (SO ₂)	Nitrogen oxides (NO _x)	Particulates (PM ₁₀)	Sulphur dioxide (SO ₂)	Nitrogen oxides (NO _x)	Particulates (PM ₁₀)	Sulphur dioxide (SO ₂)
Passenger cars	479	9.4	18.4	137	5.9	1.8	71.4	37.2	90.2
Light duty vehicles	87	9.7	3.1	55	4.4	0.2	36.8	54.6	93.5
Buses	61	2.6	0.8	47	0.8	–	23.0	69.2	–
Heavy duty vehicles	262	11.0	6.0	201	3.8	0.3	23.3	65.5	95.0
Mopeds and motorcycles	1.2	0.2	0.1	1.3	0.1	–	-8.3	50.0	--
Automobile tyre and brake wear	N/A	8.5	N/A	N/A	9.6	N/A	–	-12.9	–
Railways	30	0.7	1.6	39	0.7	1.9	-30.0	0	-18.8

Source⁽²¹⁾

Noise Emissions

- A.66 Road traffic is a predominate source of noise in urban areas for the majority of the population⁽⁸⁹⁾. The UK National Noise Attitude Survey carried out in 1999 and 2000 indicates that 84% of respondents heard road traffic noise in their homes and 40% were annoyed or disturbed to some extent by road traffic noise.
- A.67 Noise has the potential to affect health in a variety of ways; some of the effects can be auditory and occur as a direct impact of the noise. Direct auditory effects usually result in damage to the ear, in particular damage to the inner ear, from intense and prolonged exposure. However, such risks are usually associated with occupational health or prolonged exposure to loud noises.
- A.68 There are a wide range of non-auditory health effects that may be associated with exposure to environmental noise, although the pathways

and strength of association for these are not fully understood. Examples of non-auditory health effects include:⁽⁸²⁾

- annoyance;
- mental health;
- cardiovascular and physiological;
- cognitive function in children; and
- night time effects (sleep disturbance).

A.69 The potential causal pathway through which noise can affect health is discussed in Chapter 2 (Figure 2.1). This mechanism is the basis of many of the epidemiological studies on health. As shown the potential clinical importance of the disease states increase towards the lower part of the diagram. Studies in Germany have demonstrated a link between noise levels and blood pressure, and suggest that traffic noise may increase the prevalence of ischemic heart disease by 9% per 5 dB increase of noise level⁽⁸⁾⁽⁸⁹⁾. As the pathways and strength of association for the health effect of noise is not fully understood, assessments and mitigation typically concentrate on preventing and reducing noise exposure and annoyance, as it is the precursor to subsequent physiological and manifest health outcomes and applicable to everyone (i.e. all age and socio-economic groups).

Poor perception, use and uptake of health benefits

A.70 One of the key issues associated with public transport is its poor perception by the general public, including, concerns of safety, cleanliness, overcrowding, reliability, speed and comfort⁽⁷⁷⁾⁽⁸⁵⁾. Such a barrier thereby limits the uptake of associated environmental, social, physical and mental health benefits. Interestingly, during interviews, regular bus users had more positive opinions of public transport compared to the attitudes of non-public transport users. This indicates that current transport behaviour patterns may be largely driven by previous experiences and or misconception⁽⁷⁴⁾⁽⁸⁵⁾.

Stress and Anxiety

A.71 The general perception of public transport often conjures up images of delays, overcrowding and an uncomfortable environment with subsequent stress and anxiety. However, surveys indicate that stress and anxiety associated with the use of public transport can typically be less than car

use⁽⁸⁵⁾. However, there remains little information on stress associated with the use of public transport and inconclusive results available on the impact of stress on the health of passengers⁽⁴⁾.

Community Severance

- A.72 Similar to private vehicle use, public transport can necessitate the demand for additional transport routes through or near to communities. This has the potential to cause community severance by creating either physical barriers, through the creation of new roads and railway lines) or perceived and social barriers, through the relative change in traffic frequency and nature, air quality and noise and perceived risks or the desirability to utilise the area. This can not only reduce access to local social networks and amenities, but can also reduce levels of physical activity and isolate specific community groups (older people and the infirm)
- A.73 The potential health impacts of community severance are not clearly understood, and the magnitude and significance of such severance can vary by the relative circumstance and coping skills of a community (i.e., relative age, demographic and socio-economic status)⁽⁸⁾. For this reason, consultation is required to further investigate local circumstance, to establish existing community severance issues and any barriers to access and accessibility when developing and appraising LTPs.
- A.74 A number of studies have shown that a lack of public transport can further disadvantage low-income populations because they are more likely to live in outer urban areas that may not be served as well by the transport network⁽⁴⁾. A lack of access to transport provision can impinge on health by denying access to social networks, goods and services⁽⁸⁰⁾. A University of Leeds study identified four ways in which people can be excluded⁽⁹⁰⁾:
- *spatially* – because they cannot get there;
 - *temporally* – because they cannot get there at the appropriate time,
 - *financially*, because they cannot afford to get there;
 - *personally*, because they are unable to personally use or access the transport mode.
- A.75 Poor or unequal provision to public transport within a community can exacerbate social exclusion. Communities experiencing socio-economic deprivation, older people and the infirm are particularly sensitive⁽⁷²⁾⁽⁸⁶⁾.

Crime and Personal Safety

- A.76 Personal safety, concerns of anti-social behaviour and security can present a barrier to using public transport and affect the travel choices made. Studies undertaken for the Department for Transport (1997) indicate that people (including men, women, younger and older people) felt most unsafe at night, when waiting at or walking to bus stops and train stations, but that such concerns reduced once on the transport mode⁽⁹¹⁾. This indicates that the key concern from crime and personal safety is more associated with the modal interchange between public transport than the mode of public transport itself.
- A.77 Women, older people, the infirm and people with disabilities are more likely to be affected by crime and also affected by the perception and fear of crime (particularly when travelling in the early morning or evening). In a study by the Social Exclusion Unit (SEU), approximately 53% of women and 23% of men reported feeling unsafe while waiting on train platforms after dark, while 44% of women and 19% of men feel unsafe waiting at a bus stop after dark⁽⁷²⁾.

Private Vehicle Use

- A.78 The ownership and use of private vehicles has brought enormous freedom and convenience to many people, reducing the level of modal interchange, the time spent travelling and enabling the user to plan the time and route of journeys around their specific requirements. Such convenience fosters mental health benefits and provides more time for family life, social networks and recreational activities⁽⁷⁴⁾.
- A.79 The extent and magnitude of such influence on life has led to vehicle ownership extending beyond a simple transport mode, and can now play a role in defining social status and as a recreational activity. However, such convenience is not without significant cost, of which are disproportionately borne by the most disadvantaged groups in society. The following section provides a brief introduction to the key modes of private transport followed by a discussion as to the key health advantages and issues associated with private transport.

Cars

- A.80 Between 1980 and 2007, the number of licensed cars in the UK increased by 77% from 19.2 to 34 million⁽⁹²⁾. Approximately 45% of households in Great Britain have access to at least one car and in 2008, car travel

accounted for 64% of all trips made and 79% of the total distance travelled.

- A.81 The growth in private car ownership/use, and the convenience that it provides has significantly influenced life in the UK, including the spatial planning of cities. Car ownership has increased the distances people are prepared and able to travel for daily activities ranging from employment, education, shopping and social networks. This has led to an increase in out of town development and facilities such as retail areas, recreational areas and office developments, which has in turn increased dependency on cars. For those living in outer-suburban and rural areas with limited or reduced public transport options, car ownership and use may present the only viable option to regularly access work and other services and amenities. Private car use may also be the only viable form of transport for disabled individuals, where initiatives such as the Motability Scheme has enabled disabled people to obtain a car, powered wheelchair or scooter through government-funded mobility allowances. Such community groups, with limited alternatives are particularly sensitive to initiatives geared towards encouraging a modal shift away from car use, and can result in compounding existing social, mental and physical health impacts.
- A.82 Although car use can be applied to combine journeys (i.e. linking the commute with school run and shopping), and can be applied to aid in travelling to preferred recreational and physical activities (i.e. travel to sports and exercise facilities). It remains the case that the growth in car use as a preferred mode of transport is consistent with a decrease in daily physical activity and a rise in obesity. Furthermore, evidence suggests that spatial planning, urban extensions and developments orientated towards cars as the key mode of transport can increase community severance and social exclusion.

Motorcycles/Mopeds

- A.83 Motorcycles and mopeds are an alternative form of private transport, providing increased levels of access and accessibility and a sense of freedom to users. Mopeds are limited to 50cc and around 30mph, but can be ridden from 16 year of age. Moped use is predominately limited to teenagers. Motorcycles are typically a more cost effective form of private transport than cars in terms of purchase, maintenance, fuel, tax and insurance. However, such benefits are countered by limited carrying capacity and an increased likelihood and severity of road traffic collision.

Key health issues are similar to that of car use, and described in more detail below.

Health Opportunities of Private Vehicle use

Lifestyle

- A.84 As previously discussed, the key health benefit associated with private vehicle use are largely geared towards convenience, offering freedom to plan journeys around individual requirements, on demand, securely and in relative comfort. Such freedom presents significant benefits to individuals, improving access and accessibility to a wide range of key health determinants including employment, education, social networks, housing, recreation and health care. Given the wide range in vehicle types (and associated cost to purchase and maintain), such benefits are open to a wide range of age and socio-economic groups and are typically designed to cater to a particular commuter need.

Health Issues from Private Vehicle Use

Road Traffic Collision

- A.85 The major and most obvious hazard of road transport is human injury as a result of collision. Although road traffic collisions remains one of the most significant causes of years of life lost in most European cities⁽⁷⁴⁾, the number of serious and fatal injuries per billion kilometres travelled in the UK has typically decreased since 1966 for all transport modes (with the exception of water). However, such a reduction is not uniform, where as shown in Table A.3, although car transport has seen a 45% reduction in the rate of car users (drivers or passengers) killed and serious injuries per billion passenger kilometres travelled, the rate remains significantly higher than that of passengers on public transport modes⁽⁸⁾⁽²¹⁾.

Table A.3: Passengers killed or seriously injured (KSI) rates per billion passenger-kilometres travelled (1999-2008)⁽²¹⁾

Mode of Transport		1999	2008	Percentage Difference
Air ^(a)		0.02	0.01	-50
Rail ^(b)	Injured	0.9	0.0	-100
	Killed	19	8	-57
Water ^(c)		29	74	+155
Bus or coach		12	9	-25
Car ^(d)		33	18	-45
Van ^(d)		13	5	-61
Motorcycles ^(d)		1,423	1,089	-23
Pedal cycle		779	541	-30
Pedestrian		564	358	-36

^(a) Passenger casualties in accidents involving UK registered airline aircraft in UK and foreign airspace.

^(b) Passenger casualties involved in traffic accidents and accidents occurring through movement of railway vehicles.

^(c) Passenger casualties on UK registered merchant vessels

^(d) Report driver and passenger casualties

- A.86 The casualty rates per mile travelled for motorcyclists peaked in 2001 and have been falling since. However the overall rate remains significantly higher than any other transport mode in the UK⁽²¹⁾. In 2008, 6,049 motorcyclists and motorcycle passengers were killed or seriously injured in Great Britain⁽⁹²⁾.
- A.87 As previously discussed, although pedestrians have also exhibited a significant reduction in the number of serious and fatal injuries per billion kilometres travelled, road accidents involving pedestrians are disproportionately more likely to affect children and children from deprived and some minority ethnic families in particular⁽⁷²⁾⁽⁷³⁾⁽⁹³⁾.
- A.88 The increased risk of road accidents from high traffic density can contribute towards long-term mental health problems experienced by drivers, passengers and victims⁽⁸⁹⁾. Following an accident, nearly 20% of participants experienced acute distress and 25% displayed mental health problems in the first year following the accident⁽⁹⁴⁾⁽⁹⁵⁾.

Exposure to Vehicle Emissions

- A.89 As previously demonstrated in Table A.2, transport is a leading source of emissions to air in the UK, of which private car use (passenger cars) in particular remains the key contributor⁽²¹⁾.

- A.90 It has been found that the concentration of many air pollutants has been found to be higher inside motor vehicles (cars and also buses) compared to general roadside pollution levels⁽¹⁾, resulting in those who drive or are passengers in cars and buses being exposed to higher concentrations of pollutants⁽⁸³⁾. There is some evidence that measures to reduce the volume of cars on the roads would significantly reduce air pollution⁽⁴⁾.

Noise

- A.91 As previously discussed, road traffic is a predominate source of noise in urban areas for the majority of the population. Although noise from individual vehicles has decreased over time due to improvements in technology (such as vehicle and tyre design), the noise reductions have been offset by the number of vehicles on the road.

Physical Inactivity

- A.92 The benefits of physical activity and use of active transport modes to reduce health risks and promote good health has been identified and discussed in the walking and cycling sections of this document. However the converse is equally true, and that a key health concern of high private vehicle use is that it is a sedentary form of transport, which can lead to an increase in:
- levels of individuals overweight and obese;
 - cardiovascular risk;
 - risk of diabetes type 2;
 - risk of some types of cancer; and
 - a reduction in general life expectancy.
- A.93 38% of car/van journeys in Great Britain (driver or passenger), and could typically be cycled in approximately 30 minutes⁽²¹⁾. A long-term study in Copenhagen found that there were significantly lower levels of mortality amongst those who undertook higher levels of physical activity. Mortality (from all causes of death) was 28% lower amongst those who regularly cycled to work compared with those who drove⁽⁹⁶⁾.

Stress and Mental Health

- A.94 Commuting by car has been linked to elevated stress levels and blood pressure⁽⁸⁾. Stress levels associated with car journeys can vary significantly depending on a number of factors including; journey time and duration, location and personal stress factors including job related stress⁽⁸⁾. In contrast, access to a car has also been found to improve mental health⁽⁸⁾⁽⁹⁷⁾. A study by Hiscock *et al* found that cars can provide psycho-social benefits including the perceived protection of car travel, improved access to social support, independence and prestige⁽⁸⁾⁽⁹⁷⁾.

Community Severance

- A.95 Similar to public transport, private vehicle use can necessitate the demand for additional transport routes through or near to communities and potentially cause community severance through the addition of physical barriers and perceived social barriers which affects access to social networks. Studies have shown that access to social networks decreases when living near roads with high traffic volumes⁽⁷⁴⁾.

Freight

- A.96 Road freight transport is the most common mode of transport used for freight haulage, and in 2008, accounted for 66% of all domestic goods transported in the UK. In contrast, water transport using canals accounted for 20% of total goods movements and rail accounted for 8%⁽²¹⁾. The number of freight vehicles has typically reduced over the last 40 years, which is thought to be largely due to a combination of more efficient freight transport management (i.e. more effective packing of freight, the use of freight consolidation centres etc), and the increased size of HGVs⁽⁹⁸⁾.
- A.97 However, freight continues to contribute a sizable number of vehicles on UK roads. The health benefits and issues associated with freight transport are not widely discussed in scientific literature, rather the environmental consequences associated with this sector particularly via road transport. The following discussion of freight associated health pathways therefore provides a brief discussion regarding the socio-economic necessity of freight, and expands upon the specific health issues associated with freight emissions to air, risk of collision and community severance.

Health Opportunities from Freight Transport

Socio-Economic Health and Sustainability

- A.98 The freight and logistics sector provides an essential service to the socio-economic health of the country, with implications to all areas of society, consumers and industry across the country. The freight and logistics sector contributes significantly to the economy with an estimated worth of £74.5 billion. The sector also provides employment to 2.3 million people across the country. Freight is therefore critical to delivering and sustaining vibrant communities throughout and beyond the UK

Health Issues from Freight Transport

Exposure to Vehicle Air and Noise Emissions

- A.99 Freight transport by rail over long distances has grown significantly, and although this is not as flexible as road freight travel, it has a number of social, health and environmental benefits. These include reduced congestion on roads (by removing large numbers of vehicles), and lowering the significant levels of air and noise pollution attributable to road freight. Such benefits are the key driving force behind freight inter-modal facilities, intended to transport materials over longer distances by rail (international and national) and redistribute via HGV at the regional level. Although such facilities reduce total emissions from freight and the overall economic cost of freight transport, they can result in local level changes along rail networks, at the interchange facility and on adjoining road networks, with the potential for local level community impacts.

Congestion and Severance

- A.100 Although levels of road freight have typically reduced over the last 40 years, their relative distribution on main freight routes can contribute to local levels of congestion, and given their visual and noise presence are often perceived as the main cause. Such perceptions can further lead to poor perceptions of the environment and safety, with subsequent environmental and behavioural community severance along high volume routes.

Risk of Collision Accident and Injury

- A.101 Although HGVs are involved in fewer accidents, due to their size and weight the severity of accidents are generally greater. In 2007, the rate of fatal accidents per vehicle kilometre was higher for HGVs (1.6 per 100 million vehicle kilometres) than the all vehicle average (0.9) and also cars

(0.8)⁽⁹⁸⁾. However, the number of people killed or seriously injured in accidents involving HGVs fell by 42% between 1997 and 2007. HGVs present particular challenges for cyclists and are over-represented in cyclist fatalities (18% of fatal cycle accidents involved an HGV, compared with 4% of serious accidents)⁽⁸¹⁾. Such collisions are more common at junctions where the main collision configuration was the HGV driver making a left turn while the cyclist was going ahead. 'Vehicle blind spot' and 'passing too close to the cyclist' were judged by the police to be key contributory factors.

Civil Aviation

- A.102 As discussed in Chapter 2, Local transport authorities are not required to develop or perform SEA on civil aviation projects. The following section on civil aviation is therefore geared to identify the key health pathways (both adverse and beneficial) associated with increased capacity and expansion at airports. Such information will enable Local Authorities to consider the wider influence upon their LTP, with the additional opportunity to inform any formal scoping exercise they are consulted upon as part of project level Environmental Impact Assessment (EIA) or Health Impact Assessment (HIA).
- A.103 UK air travel has increased five-fold over the last 30 years. Half the population now flies at least once a year, and freight traffic at UK airports has doubled since 1990. Britain's economy therefore increasingly depends on air travel, for exports, tourism and inward investment. The aviation industry directly supports around 200,000 jobs and indirectly up to three times that, with local, regional and national socio-economic benefits. The key health issues and opportunities associated with airports in general are summarised below.

Health Opportunities from Civil Aviation

Increased Access and Accessibility

- A.104 Similar to all modes of transport, aviation provides increased access and accessibility to a range of amenities, facilities, social networks and income and employment, albeit on a national and global basis. Airports link remote communities and helps people stay in touch with friends and family around the world. It brings businesses together and has given many affordable access to foreign travel with social, mental and physical health benefits.

Increased Direct, Indirect and Induced Income and Employment

- A.105 As previously discussed, civil aviation is important to the UK's freight, tourism and business sectors, directly influencing the national economy, with wider indirect and induced influences supporting the UK's tourism industry, inward investment and regional regeneration. As such and where appropriate, increased capacity and expansion of airports is necessary to cater to demand and secure such economic opportunities and associated health benefits at the local, regional and national level.

Health Issues from Civil Aviation

Change in Air Quality

- A.106 One of the core health pathways associated with airports and their expansion is the generation of additional emissions to air from fixed plant and from aircrafts (while stationary, taxiing to runway and during take off, flight and landings). However, airports are required to comply with air quality standards set to protect the environment and health, and continue to address such issues through improved operational activities designed to reduce emissions and their concentration exposure to local communities, including:
- the use of fixed ground electrical power (FGEP) thus avoiding the requirement for stationary aircraft on stands to power systems, with a subsequent reduction in fuel consumption and local emissions;
 - the minimisation of aircraft idle and taxi times prior to take off, further reducing fuel consumption and associated emissions;
 - the use of Combined Heat and Power (CHP) systems within airports to improve energy efficiencies and subsequent local emissions; and
 - the use of electric supporting vehicles, preventing the generation of local emissions.
- A.107 However, the more significant contribution and community exposure route of air pollution from airports is typically associated with surface transport movements, and private vehicle movements in particular.

Change in Noise Exposure

- A.108 As previously discussed there is a significant evidence base on the health effect of noise, and from aviation in particular, where the non-auditory health effects from aircraft can include:

- annoyance;
- stress, anxiety and poor mental health;
- performance (tasks and academic);
- night time effects (sleep disturbance); and
- cardiovascular and physiological.

A.109 However, the pathways and strength of association for these are not fully understood. As such, assessments and mitigation typically concentrate on preventing and reducing annoyance, as it is typically the precursor to subsequent health outcomes and applicable to everyone (i.e. all age and socio-economic groups).

Surface Transport and Risk of Collision

A.110 The most significant airport influence to consider in the development of LTPs is that of associated surface transport movements. Surface transport to and from airports will contribute towards congestion, noise, air quality and more significantly, risk of road traffic collisions along commuter routes. Wider transport and health issues to consider include:

- the potential influence upon transport behaviour and active transport modes, as an increase in local traffic volume may reduce perceptions of road safety;
- a potential impact upon the appeal and use of local amenities and facilities, impacting upon social capital, social networks, recreation and health; and
- a potential increase in fly-parking within resident areas, increasing risk of road traffic collisions, causing general disruption and creating animosity with subsequent risk of vandalism and antisocial behaviour.

Climate Change

A.111 Climate change issues associated with airports and their expansion are typically assessed at the project level by the proponent, and is being addressed by the aviation industry as a whole through the Sustainable Aviation Scheme and through the EU Emissions Trading Scheme.

A.112 Given the current evidence base, further consideration of the potential health impacts of climate change during the development and assessment of LTPs is not recommended. To clarify, there is insufficient evidence to

assess the distribution, magnitude and likelihood of specific health outcomes from climate change. Instead, it is recommended that LTPs concentrate on the precursor to potential health outcomes, namely reducing greenhouse gas emissions.

Transport Management Initiatives

A.113 Transport management initiatives seek to address specific environmental, socio-economic and health issues associated with transport. The following section provides a summary as to the key management initiatives, and the associated health issues and opportunities to be aware of when developing and delivering LTPs and associated management initiatives. Three categories of measures are identified; those that reduce demand for travel, either in total or by a particular mode, those that improve the performance of the vehicle fleet (in terms of emissions or efficiency) and those that seek to shift travel from one mode or from a certain vehicle type to another.

Travel Demand Reduction

A.114 Travel Demand Reduction measures seek to reduce the need to travel. This can refer to the following:

- measures that reduce the distance between trip origins and destinations (for example, by the introduction of facilities closer to the communities that use them);
- measures that reduce the need to travel by certain modes (for example by encouraging car drivers to car share);
- measures that reduce the number of trips (for example through home working or by combining trips)

A.115 Some examples of travel demand reduction measures are provided below:

Workplace Travel Plans

A.116 As the name suggests, workplace travel plans are organisation policy based strategies to manage the transport impact from and improve the uptake of benefits to staff. Workplace travel plans were identified as an important part of the UK's transport strategy in the Government's 1998 Transport White Paper 'A New Deal for Transport: Better for Everyone' and also the Scottish White Paper, 'Travel Choice for Scotland'⁽⁹⁹⁾. A number of guidance notes have been published to promote physical activity in the workplace and studies have further researched the effectiveness of

workplace travel plans for both employers and employees⁽¹⁰⁰⁾⁽¹⁰¹⁾⁽¹⁰²⁾. As an example, the 1998 Transport White Paper advocated the health sector to adopt work travel plans. In particular, the NHS had specific requirements for hospital trusts to implement travel plans⁽¹⁰³⁾.

- A.117 Workplace travel plans therefore provide the opportunity to reduce congestion and associated environmental impacts from transport, but also accrue health and socio-economic benefits to employees and employers. Although largely voluntary and best practice, it is important to consider that local authorities can drive the requirement for workplace travel plans (and construction traffic management plans) as part of planning applications. However, to ensure the effectiveness of such an approach, local authorities need to provide information and guidance to best utilise existing and new public transport and active transport infrastructure. Such information can be effectively delivered through Personalised Travel Planning⁽¹⁰⁴⁾, providing commuters with information on transport options for the regular commute to work, school or other local journeys. This can be further supported by Travel Training Schemes⁽¹⁰⁵⁾, intended to support the general uptake of public and active transport modes, and vulnerable community groups in particular, to further address pockets of local inequality.
- A.118 Walking and cycling to work provides a large proportion of the working population with an opportunity to integrate physical activity into their daily routine. Walking and cycling are accessible and affordable ways in which people can reduce risk from a wide range of non-communicable diseases and improve their general quality of life regardless of age or socio-economic status.
- A.119 Workplace travel plans provide an opportunity to influence staff travel behaviour and encourage staff to travel in more sustainable ways. By encouraging staff to be more active in their transport choices, employers can bring benefits to the company including; improved productivity, improved staff retention and reduced absenteeism⁽¹⁰⁰⁾⁽¹⁰⁶⁾⁽¹⁰⁸⁾. It is estimated that during the 2005/06 financial year, 30.5 million working days were lost as a result of work related injuries and preventable illnesses. A majority of working days lost were attributable to mental health issues (depression, stress and anxiety) and musculoskeletal problems. Both of these problems can be prevented, reduced and treated through increased physical activity⁽¹⁰⁰⁾. Workplace travel plans also have financial benefits for employees as active commuting can reduce the cost of commuting.

- A.120 By increasing the use of active and public transport modes through workplace travel plans, it is possible to achieve social and environmental gains. The associated contribution of road vehicles would reduce (particularly during peak travel periods), reducing congestion and associated air and noise emissions while also reducing the relative risk of accident and injury⁽¹⁰⁷⁾.
- A.121 There are a number of schemes and strategies in place to encourage active commuting. The 'Walk in to Work Out' programme in Glasgow aimed to increase active commuter travel amongst volunteers. As part of the programme, volunteers were given self-help packs including advice on choosing routes to work, personal safety, an activity diary and maps of local cycle routes. It was found that levels of walking increased amongst participants but the uptake of cycling as a regular transport mode did not increase at the same rate⁽⁶⁷⁾.
- A.122 The 'Well@Work', 'Cycle to Work' and more recent 'Cycle to Work Guarantee' government backed schemes are national health intervention programmes that address key barriers to utilising active transport modes. The employers that choose to sign up to the Guarantee, are signalling that they are committed to delivering the following five points:
- secure, safe, and accessible bike parking facilities for all staff who want them;
 - good quality changing and locker facilities for all staff who want them;
 - offset the cost of cycling equipment and save on the tax through the 'Cycle to Work scheme';
 - bike repair for cyclists on or near site; and
 - training, reward and incentive programmes to achieve targets for more cycling.
- A.123 Such schemes not only contribute in offsetting private vehicle trips during peak periods and their associated health risks, but aid in facilitating improvements in employee's health with personal and company benefits⁽⁶⁷⁾⁽¹⁰³⁾.
- A.124 The health issues associated with workplace travel plans increasing levels of active and public transport modes are similar to those previously outlined with the key risks associated with the safety of cyclists and pedestrians. However, workplace travel plans typically provide details of route options

and set out safety information to participants in order to reduce the risk of accident and injury.

School Travel Plans

- A.125 Each day millions of children travel to and from school. Many children walk, some travel by car and others, often those living further away travel by bus. The number of children walking or cycling to school has reduced over the last 20 years⁽¹⁰⁹⁾, where the 08:45 am term time school run now accounts for 20% of all car trips by residents of urban areas⁽⁸⁴⁾. There are a number of factors cited for this change including; further distances to travel and fears over safety and road traffic accidents.
- A.126 In 2009, over half of primary school children (aged 5-10) walked to school and 42% travelled by car. Amongst secondary school children (aged 11-16) 38% walked to school and 22% travelled by car⁽⁹²⁾. A greater proportion of secondary schoolchildren travelled by bus, indicating a further reduced reliance on parents to provide transport and the likelihood children typically have further distances to travel to attend secondary school. In 2009, only 3% of secondary school children cycled to school.⁽⁹²⁾
- A.127 According to the 2009 National Travel Survey, 84% children aged 7 to 10 years were usually accompanied to school by an adult. The main reasons cited by parents were dangers of traffic (56%) and the fear of assault (29%)⁽⁸⁴⁾. The study further established that nearly a third of children aged 11-13 years were usually accompanied to school with the main reasons given by parents being traffic danger (34%), convenience (33%) and the school being too far away (37%)⁽⁹²⁾.
- A.128 School travel was identified as a key areas in the White Paper "A New Deal for Transport: Better for Everyone (1998) as a means to increase regular physical activity in children. The National Healthy Schools Programme is a long-term initiative established in 2005 by the Department of Health (DH) and Department for Children, Schools and Families (DCSF) – now Department for Education (DfE) to improve the health and achievement of children and young people. The programme is based on a whole school approach demonstrating action in the following four core themes:
- personal, social and health education;
 - healthy eating;

- physical activity; and
 - emotional health and wellbeing.
- A.129 The 'whole school' approach involves working with children, parents, school staff and the wider school community, therefore presenting far wider benefits than just to students.
- A.130 School travel plans can therefore benefit schoolchildren and parents by identifying healthy travel options, improving children and adult health and overall wellbeing and relieve congested roads (and associated emissions to air, noise and risk of collision) during peak hours. By encouraging physical activity at an early age can influence a healthier lifestyle throughout adult life⁽¹⁰⁹⁾.
- A.131 Often parents are unable to walk their children to school every day due to time constraints, living too far away from school to walk and therefore relying on the car for the school run. Some schools have introduced 'walking buses' where children are dropped off along a pre-arranged route at an agreed time and escorted to school by designated volunteers. If children live too far away, their parents can drop them off at a convenient meeting place. There are now more than 500 walking buses in England⁽²¹⁾.
- A.132 School travel plans also provide an opportunity for children to learn about road safety and initiatives such as cycling proficiency tests, thereby improving awareness and safety amongst the most vulnerable group to road traffic collision.
- A.133 One of the key issues influencing the number of children walking and cycling to school is road safety and child safety. Road traffic accidents are one of the leading causes of fatalities amongst children and young people. It is estimated that vehicle traffic collisions account for nearly half of all accidental injury fatalities in children⁽⁹⁴⁾⁽¹¹⁰⁾. Though not designed to address safety directly school travel plans can aid in further addressing safety and thereby increase active travel by:
- establishing recommended safe pedestrian and cycle routes;
 - by raising awareness to both students and parents as to child safety (and life long health benefits);
 - by providing access to Bikeability training and basic cycle maintenance (e.g. when to replace brakes, how to change a tyre, how to maintain a bike etc);

- by providing guidance on cycle safety equipment (helmet, lights, clothing, locks etc); and
- where possible, organise a school discount with a local bike shop to support families in removing barriers to active transport.

Residential Travel Plans

- A.134 Residential Travel Plans can support sustainable development, particularly in new residential developments⁽¹¹¹⁾. Residential Travel Plans require partnerships between developers, local authorities, local communities and new residents to be successful. Residential Travel Plans have the ability to influence the layout of residential schemes, reduce congestion and associated environmental impacts from transport and to accrue health and socio-economic benefits to residents.
- A.135 By increasing the use of active and public transport modes through Residential Travel Plans, it is possible to achieve social and environmental gains. The associated contribution of road vehicles would reduce (particularly during peak travel periods), reducing congestion and associated air and noise emissions while also reducing the relative risk of accident and injury.
- A.136 The health issues from Residential Travel Plans are associated with increased levels of active and public transport modes and a subsequent risk of cyclists and pedestrians collisions. However, Residential Travel Plans typically provide details of route options and set out safety information to residents in order to reduce the risk of accident and injury.

Personalised Travel Planning

- A.137 Personalised Travel Planning is an important element of the travel planning process and seeks to provide specific travel routes and modes direct to an individual. Amongst the targeted population, Personalised Travel Planning has been found to reduce car driver trips by 11% and reduce the distance travelled by car by 12%⁽¹¹²⁾.
- A.138 Although Personalised Travel Planning can stand alone from a site-wide Travel Plan, it is becoming increasingly common amongst Workplace and Residential Travel Plans and brings the same benefits and dis-benefits set out above.

Car Clubs

- A.139 Car clubs are essentially a car sharing system whereby a user has access to a fleet vehicle and pays for its use only when required, thereby negating ongoing ownership. Car club cars are parked in their own dedicated spaces parking spaces at strategic places and are available to registered users. Car clubs are an increasing element of Workplace and Residential Travel Plans as they reduce car ownership, and therefore parking requirements, as well as unnecessary vehicular trips.
- A.140 Car Clubs are of greater benefit to those who drive a small or limited mileage per annum. For example, as demonstrated on the UK Car Club website, if you drive less than 6,000 miles per year then a car club could save you up to £3,500 a year. Replacing a second family car with car club membership is likely to bring even more cash savings costs.

Fleet Improvement Measures

- A.141 These measures seek to improve the composition of the vehicle fleet so as to reduce the emissions associated with vehicle use. Examples of these measures include the following:
- Fiscal Incentives: Incentives to improve the efficiency or level of emissions associated with vehicle use would include the road tax bands that favours smaller and more efficient vehicles. However, such initiatives are generally applied at the national level.
 - Emission Based Parking Policies: Parking policies that either allocate parking for low emission vehicles or incorporate a differential charging structure favouring low emissions vehicles.
 - Fleet renewal: Measures aimed at specific elements of the vehicle fleet, usually associated with a single organisation such as a Local Authority, waste contractor or bus operator can encourage the replacement of part of the vehicle fleet with more efficient or new technology vehicles.

Low Emission Zone

- A.142 A fleet improvement measure frequently considered by local transport authorities is the establishment of Low Emission Zones (LEZ). In its simplest terms a LEZ is a defined area that can only be driven within by specific vehicles meeting certain emissions criteria or standards. They are typically implemented to aid in achieving national and EU air quality targets by charging the most polluting vehicles, and encouraging the use of cleaner, less polluting vehicles. The primary objective of LEZs is therefore to meet

air quality standards set to protect health, reduce community exposure to vehicle emissions and the associated burden of cardiovascular and respiratory disease.

A.143 However, there are both wider health benefits and issues that need to be considered when developing bespoke LEZ. The final magnitude of both will be dependant upon the vehicles targeted and the rate in which the LEZ is implemented, and include:

Potential health benefits:

- by encouraging the use of newer, cleaner vehicles also improves the number of safer and quieter vehicles on roads (reducing the severity of road collisions and the contribution of road noise exposure);
- by encouraging the use of newer vehicles, and the retrofit of current vehicles creates income and employment opportunities with subsequent socio-economic health benefits for those individuals;
- depending on the vehicles targeted, LEZ may contribute in encouraging public and active transport modes, reducing the associated environmental burden, and improving levels of physical activity and health; and
- communities in proximity to main roads and in air quality management areas, tend to be less affluent, experiencing higher burdens of socio-economic deprivation, inequality and poor health. LEZs therefore contribute in addressing elements of inequality, including exposure to poor air quality, and the increased level and severity of vehicle collisions with children from less affluent communities.

Potential health issues:

- LEZ may result in redistributing the targeted vehicles and associated emissions elsewhere, compounding existing air quality, road vehicle collision and health issues;
- the cost to retrofit or replace targeted vehicles (to individuals, companies and the public sector) may:
 - have an opportunity cost (i.e. where resources might have been spent elsewhere to improve environment and health, or as a company, to improve commercial security and growth);
 - decrease economic viability (in particular where entire vehicle fleets are involved);

- increase costs passed on to consumers, reducing profit margins with broader impacts upon the local economy;
- not be a viable option for certain vehicle types;

A.144 Key difficulties with LEZ include monitoring success, as it is often not possible to attribute local or net changes in population health to such initiatives.

Shift in Travel Mode or Vehicle Type

A.145 These measures lead to a shift from one mode to another or a shift from one vehicle type to another. Examples would include the following:

Car Parking Strategies

A.146 This category would include area-wide car parking strategies linked to the provision of alternative modes such as enhanced opportunities to travel on foot, by bicycle or public transport. Car free developments would also fall within this category.

A.147 Car parking restraint is an important element of parking strategies. For example, the needs of shoppers and visitors could be given priority over the needs of commuters, all-day parking could be discouraged through time limits and/or an appropriate pricing regime or parking could be banned in some locations to provide for public transport, cycle or disabled facilities. The potential health opportunities include increasing a modal offset towards active and public transport modes for short journeys within urban areas, reducing associated risks from vehicles and increasing physical activity.

A.148 Key health issues relate to the varying community and commuter needs, and the potential impact upon vulnerable community groups reliant on private vehicles as their key mode of transport (i.e. older people, the infirm and disabled).

High Occupancy Vehicle Lanes

A.149 To combat high levels of single occupancy vehicles, a number of high occupancy vehicle (HOV) lanes have been established on a number of roads throughout the UK as a method of cutting congestion and speeding up motorway journeys. HOV lanes are created using the hard shoulder, using existing bus lanes or by widening roads and are intended to encourage driver to share cars.

- A.150 The UK's first high occupancy vehicle (HOV) was introduced in 1998 on the A647 Stanningley Road and Stanningley bypass, Leeds, forming part of a radial route around the edge of Leeds city centre, contributing to the ICARO (Increasing CAR Occupancy) research project, which aimed to investigate the measures that can increase car occupancy by encouraging car sharing. The road previously experienced severe congestion and there were few public transport priority measures. The scheme covers 1.5-2.0 km dual carriageway in two sections, operating in the morning and evening peak periods (07:00 – 10:00) (16:00 – 19:00) during Monday to Friday.
- A.151 Following introduction of the scheme there was a significant reduction in the number of cars on the A647 because drivers avoided the road. However, eighteen months after the scheme commencing flows returned to pre-scheme levels⁽¹¹³⁾.
- A.152 The HOV scheme in Leeds has resulted in
- a reduction in inbound journey times for buses and other high occupancy vehicles of 4 minutes in the morning peak;
 - a reduction in inbound non-HOV journey times of 1½ minutes in the morning peak;
 - increases in bus patronage and average car occupancy from 1.35 to 1.51 per car);
 - a reduction in the number of accident casualties; and
 - a low level of violation.
- A.153 The A647 HOV lane has since become permanent traffic management feature.
- A.154 Although car share schemes can prove to be effective at reducing congestion, not all drivers may consider this a favourable option. Car use can often represent a status symbol, independence and by encouraging people to share their car journeys would reduce this benefit⁽⁸⁵⁾⁽¹¹⁴⁾⁽¹¹⁵⁾.

Park and Ride Schemes

- A.155 Park and ride schemes connect car parks with public transport, allowing passengers to travel into city centres to leave their own vehicles in a car park and transfer by bus, rail or light rail for the remaining part of their trip. Park and ride schemes are typically located in the suburbs of cities.

- A.156 These schemes aim to make travelling easier for commuters and minimise many of the problems associated with travelling in city centres such as traffic congestion, cost associated with parking in city centres. A reduction of vehicles in city centres, which park and ride schemes can facilitate, can have benefits in terms of a reduction in the number of road traffic accidents, emissions to air and may encourage more people to walk and cycle in the city centre due to calmer roads.
- A.157 Although park and ride schemes reduce traffic problems in built up city centre areas, park and ride schemes will result in a local increase in traffic flows around parking areas, which may increase the potential for local changes in air quality, noise and road traffic accidents. Barriers to using park and ride schemes include travelling with children, carrying large amounts of shopping and less choice on the times for travel, being dependent on the park and ride timetables.

Cycle Networks

- A.158 Cycle networks, made up of dedicated cycle paths and lanes have been established throughout the UK. The National Cycle Network, established in 1995 by the sustainable transport charity Sustrans, currently provides 12,000 miles of cycling and walking routes. One third of the network is on traffic free paths and the remaining network follows quiet lanes or traffic calmed roads. In 2008, there were 386 million walking and cycling trips made on the cycle network. The National Cycle Network was established and is co-ordinated by Sustrans, the sustainable transport charity and is delivered by local authorities throughout the UK.
- A.159 Cycle networks allow cycling to become accessible, with reduced concern for the risk of road traffic accidents. The cycle networks also provide an alternative mode of transport, and through reductions in car travel as result, can reduce emissions to air from road transport, noise and improve health through increasing levels of physical activity.
- A.160 Using the World Health Organization (WHO) Health Economic Appraisal Tool (HEAT) for cycling, based on an average trip length of 7.4 km, the total health benefit to cyclists using the national cycle network in 2008 was worth £270 million⁽¹¹⁶⁾.

Area-Wide Travel Initiatives

- A.161 Area wide travel initiatives tend to be plans aimed at reducing congestion, improving accessibility, improving the environment and road safety and are

essentially a combination of the above in order to achieve sustainable travel throughout. For example, a number of Sustainable Travel Towns are being promoted which include a number of Travel Plans, education, walking initiatives, cycling initiatives, public transport initiatives, travel and safety awareness, policy measures and environmental measures such as improved pedestrian and cyclist facilities, pedestrian crossing improvements, traffic calming and speed restrictions.

- A.162 Such travel initiatives should all work and be planned as one, however, brings the same benefits and dis-benefits as is set out above.

Appendix B: Transport and Health Bibliography Matrix

Document	Mode of Transport													
	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Department of Health. (2007). Draft guidance on health in strategic environmental assessment: A consultation.														
WORLD HEALTH ORGANIZATION. (1948). Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) entered into force on 7 April 1948. Geneva: World Health Organization.														
Christl, B. et al., 2009. A Review of the Evidence of the Impact of Public Transport on Population Health in Australia. Australia: UNSW								✓	✓	✓				
Bourn, J., 2001. Tackling Obesity in England, London: National Audit Office														
Department for Transport. (2009). Collisions Involving Cyclists on Britain's Roads: Establishing the Causes. TRL Report PPR 445.		✓												
Douglas, M., et al., 2007. Health Impact Assessment of Transport Initiatives: A Guide. Edinburgh: NHS Health Scotland	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	
National Institute of Clinical Excellence., 2008. Promoting and creating built or natural environments that encourage and support physical activity. NICE public health guidance 8. London: NICE	✓													
Dora, C. & Phillips, M., 2000. Transport, Environment and Health. Geneva: World Health Organization														
Besser, L. & Dannenberg, A. 2005. Walking to public transit – steps to help meet physical activity recommendations. American Journal of Preventive Medicine, 26,(4)	✓													
Gorman, D., et al. 2003. Transport policy and health inequalities: a health impact assessment of Edinburgh's transport policy. Public Health, 117, pp.15-24	✓							✓						
Kavanagh, P., et al., 2005. Health Impacts of Transport: A Review, Dublin: IPHI	✓						✓							
Department for Transport. (2003). The Future of Air Transport White Paper												✓		

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Littman. T. 2003. Economic Value of Walkability. Transportation Research Board of the National Academies, Vol. 1828.														
Edwards, P. & Tsouros, A., 2006. Promoting Physical Activity and Active Living in Urban Environments, The Role of Local Governments, Denmark, WHO Europe	✓													
Sustrans, 2007. Creating the Environment for Active Travel, Information Sheet FH09. Bristol: Sustrans	✓													
Department of Health, 2004. At least five a week: evidence on the impact of physical activity and its relationship to health, London: Department of Health	✓													
Office National Statistics (2009) Transport Statistics Great Britain: 2009 Edition, DfT. London														
Department for Environment, Food and Rural Affairs. (2010). Noise Policy Statement for England (NPSE). March 2010.			✓					✓						
Department for Transport (2006). Accessibility Planning Guidance.	✓	✓	✓					✓						
The Institute of Environmental Assessment (now the Institute of Environmental Management & Assessment). (1993). Guidelines for the Environmental Assessment of Road Traffic (Guidance Note No. 1).			✓					✓						
Beland F, Birch S, Stoddart G. Unemployment and health: contextual-level influences on the production of health in populations. Soc Sci Med 2002;55:2033-52.														
Kemm J (2006) Towards quantification of HIA: the example of income, presented at the 7th International Health Impact Assessment Conference Wales 2006)														
Department of Health. Committee on the Medical Effects of Air Pollutants available at www.advisorybodies.doh.gov.uk/comeap/index.htm														
European Commission (2001) Clean Air For Europe available at http://ec.europa.eu/environment/air/cafe/index.htm			✓					✓						

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
World Health Organization. (2000). Evaluation and use of epidemiological evidence for environmental health risk assessment. Guideline document. Copenhagen: World Health Organization Regional Office for Europe														
COMEAP Secretariat. (2009). Statement on the Quantification of the Effects of Long Term Exposure to Nitrogen Dioxide on Respiratory Morbidity in Children. A report by the Committee on the Medical Effects of Air Pollutants. October 2009			✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
World Health Organization. (1995). Guidelines for Community Noise. Edited by Birgitta Berglund Thomas Lindvall and Dietrich H Schwela.			✓					✓						
Porter, N.D., Findell, I.H. and Berry, B.F. (1998). Health effect based noise Assessment methods: A Review and Feasibility Study. NPL Report CMAM 16. National Physical Laboratory. September 1998			✓											
Stansfeld et al. 2000. A review of environmental noise and mental health. Noise and health 2000 8 1-8			✓					✓						
Foresight. 2007. Tackling Obesities: Future Choices – project report, 2nd Ed. London: Government Office for Science	✓													
NICE. 2009. Depression, the treatment and management of depression in adults. London: NICE	✓	✓												
Davis, A. et al., 2005. Making the Case: Improving Health through Transport. London: Health Development Agency	✓													
Craig, R. & Mindell, J., 2008. Health Survey for England 2006. London: the NHS Information Centre	✓	✓												
Cerin, E. et al. 2007. Destinations that matter: Associations with walking for transport. Health and Place. 13 713-724	✓													
Craig, R. & Shelton, N., 2008. Health Survey for England 2007. London: the NHS Information Centre	✓													

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Sustrans, 2009. Active Travel and Adult Obesity, Information Sheet FH14. Bristol: Sustrans	✓	✓	✓	✓										
Poortinga, W., 2006. Perceptions of the environment, physical activity, and obesity. <i>Social Science & Medicine</i> , 63, (11), 2835-2846	✓													
Watkiss, P. et al., 2000. Informing Transport Health Impact Assessment in London. London: NHS Executive.														
Wunsch, H., 1999. Risk of type 2 diabetes reduced by regular brisk walking. <i>The Lancet</i> , 354, (9189), pp.1532	✓													
Gulve, A. 2008. Exercise and Glycemic Control in Diabetes: Benefits, Challenges, and Adjustments to Pharmacotherapy, <i>Physical Therapy</i> , 88, 11, 1297-1321	✓	✓												
Sundquist, K. et al. 2005. The long-term effect of physical activity on incidence of coronary heart disease: a 12 year follow-up study. <i>Preventive Medicine</i> , 41, 219-225	✓													
Berlin, J.A., Colditz, G.A. 1990. A meta-analysis of physical activity in the prevention of coronary heart disease. <i>Am J Epidemiology</i> , 132, 612-628	✓	✓												
NHS, 2007. Cancer Reform Strategy, London: Department of Health														
Mutrie, N. et al. 2002. "Walk in to Work Out": a randomised controlled trial of a self help intervention to promote active commuting. <i>Journal Epidemiological Community Health</i> . 56, 407-412	✓	✓												
NAO. 2009. Improving road safety for pedestrians and cyclists in Great Britain, London: DfT	✓	✓												
Roberts. I. & Power, C. 1996. Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. <i>British Medical Journal</i> , 313, 784-786								✓	✓	✓				
Social Exclusion Unit., 2003. Making the Connections: Final Report on Transport and Social Exclusion, London: Office of the Deputy Prime Minister	✓	✓					✓							

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Office of the Deputy Prime Minister. 2005. A practical Guide to the Strategic Environmental Assessment Directive.														
Lavin, T. et al. 2006. Health impacts of the built environment: a review. Dublin: Institute of Public Health in Ireland														
Duncan, M. et al. 2005. Perceived environment and physical activity: a meta-analysis of selected environmental characteristics. International Journal of Behavioral Nutrition and Physical Activity, 2, 11	✓	✓												
WHO, Regional Office for Europe (2002) a Physically Active Life through everyday transport with a special focus on children & older people & examples and approaches from Europe	✓	✓												
Department for Transport (2008) Transport Statistics Bulletin: road casualties in Great Britain Main Results, 2008. London: DfT														
Rutter H. (2000). A policy report on the health benefits of increasing levels of cycling in Oxfordshire.		✓												
Cavill, N. Rutter, H. & Hill, A., 2007. Action on Cycling in Primary care trusts: results of a survey of Directors of public health. Public Health, 121, pp.100-105		✓												
Zuurbier M, Hoek G, Oldenwenining M, Lenters V, Meliefste K, Hazel P, Brunekreef B. (2010). Commuters' Exposure to Particulate Matter Air pollution is Affected by Mode of Transport, Fuel Type and Route. Environmental Health Perspectives. 25th February 2010			✓					✓						
Department for Transport. 2009. Transport Statistics Bulletin – National Travel Survey: 2008. London: DfT	✓	✓	✓	✓	✓		✓	✓	✓	✓				
Beirão, G. & Cabral, J. 2007. Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy, 14, 478-489				✓					✓					
Whitley, R. & Prince, M. 2005. Fear of crime, mobility and mental health in inner-city London, UK. Social Science & Medicine, 61, 1678-1688								✓	✓	✓				

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Hine, J. 2003. Transport disadvantage and social exclusion in Urban Scotland. Built Environment, 30, 2	✓	✓						✓						
Krzyzanowski, M. et al. (Ed.) 2005. Health effects of transport-related air pollution. Denmark: World Health Organization Europe			✓	✓										
Grant M, Barton H, Coghill N, Bird C. (2009). The Spatial Determinants of Health in Urban Settings. WHO Collaborating Centre for Healthy Urban Environments. University of the West of England, Bristol.			✓					✓						
Imperial College, Mott MacDonald & University of Leeds. 2007. Social Inclusion: Transport Aspects (UG320),								✓	✓	✓				
Stafford, J. & Pettersson, G., 2002. People's perceptions of personal security and their concerns about crime on public transport, literature review. London: DfT								✓						
Office National Statistics (2008) Transport Trends: 2008 Edition, DfT. London														
Mayou, R. et al. 1993. Psychiatric consequences of road traffic accidents. British Medical Journal, 307			✓	✓										
Mayou, R. & Bryant, B. 2002. Consequences of road traffic accidents for different types of road user. Injury: International Journal of the Care of the Injured, 34, 197-202	✓	✓	✓											
Andersen, L., Schnohr, P., Schroll, M. and Hein, H. (2000). All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. Archives of Internal Medicine, 160, 1621 – 1628	✓	✓												
Hiscock, R. et al. 2002. Means of transport and ontological security: Do cars provide psycho-social benefits to their users? Transportation Research Part D, 7, 119-135				✓										
Department for Transport, 2008. Delivering a sustainable transport system: the logistics perspective. London: DfT														✓
Rye, T. 2002. Travel Plans: Do they work? Transport Policy, 9, 287-298	✓	✓												

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	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
NICE. 2008. Workplace health promotion: how to encourage employees to be physically active. NICE Public Health Guidance 13. London: NICE														
Department for Transport, 2005. Transport Energy Best Practice. A guide on how to set up and run travel plan networks. London: DfT	✓	✓												
Department for Transport, 2008. The Essential Guide to Travel Planning. London: DfT														
Davis, A. 2005. Transport and health – what is the connection? An exploration of concepts of health held by highways committee Chairs in England, Transport Policy, 12, 324-333			✓											
Department for Transport. Personalised travel planning: evaluation of 14 pilots part funded by DfT. Web resource, available at : http://www.dft.gov.uk/pgr/sustainable/travelplans/ptp/personalisedtravelplanningev5774	✓	✓					✓							
Department for Transport. (2007). Travel Training Schemes- a review of travel training schemes in England														
Pronk, N. & Kottke, T. 2009. Physical activity promotion as a strategic corporate priority to improve worker health and business performance. Preventive Medicine, 49, 316-321	✓	✓												
Roby, H. 2010. Workplace travel plans: past, present and future. Journal of Transport Geography, 18, 23-30														
Sustrans. 2008. Active travel and healthy workplaces. Information Sheet FH06. Bristol: Sustrans	✓	✓												
Timperio, A. 2004. Perceptions about the local neighborhood and walking and cycling among children. Preventive Medicine, 38, 39-47	✓													
Health Development Agency (2003) Prevention and reduction of accidental injury in children and older people			✓											
Department for Transport (2005). Making residential travel plans work: good practice guidelines for new development.	✓	✓	✓				✓							

Document	Mode of Transport													
	Walk	Cycle	General Road Transport	Car	Motorbike	Coach	Taxi	General Public Transport	Bus	Rail	Tram/Light Rail/Underground	Air	Ferry/Boat	Freight
Department for Transport. (2008). Making Personal Travel Planning Work: Practitioners' Guide.			✓					✓						
Department for Transport. 2006. High Occupancy Vehicle Lanes. Traffic Advisory Leaflet 3/06. London: DfT			✓	✓				✓						
Gardner, B. & Abraham, C. 2007. What drives car use? A grounded theory analysis of commuters' reasons for driving. Transportation Research Part F, 10, 187-200				✓										
Ellaway, A. et al. 2003. In the driving seat: psychosocial benefits from private motor vehicle transport compared to public transport. Transportation Research Part F, 6, 217-231				✓										
Sustrans, (2009). The national cycle network route user monitoring report to end of 2008. Bristol: Sustrans		✓												



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