A Review of the Utility of Bus Services in London

A Literature Review for the London Assembly

Report

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Job No. MID2173

Report No. 001

Prepared by AC/SW

Verified SW

Approved by PJH

Status Draft

Issue No. 2

Date 4 December 2009

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Contents Amendments Record

This document has been issued and amended as follows:

Status/Revision	Revision description	Issue Number	Approved By	Date
Draft		1	PJH	30/11/2009
Final		2	PJH	04/12/2009

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Executive Summary

The bus is an important travel mode across the country, in urban and rural areas alike. The National Travel Survey 2008 indicated that 7% of all journeys made were by bus and coach. This is an average of 66 journeys per person per year. In these terms, the bus is used over twice as much as rail, which accounts for just 3% of journeys. The percentage of journeys by bus is not consistent across journey purposes; most importantly, it accounts for 10% of journeys for shopping or education and 8% of commuter journeys. It only accounts for 3% of business journeys and 5% of leisure journeys.

Buses are by far the most used mode of public transport in London with approaching 2 billion bus journeys each year. For comparison, just over 2 billion journeys are made on foot in London annually, around 1 billion on the Underground, some 800 million on the National Rail network and approaching 200 million by bike. Almost half of Londoners use buses on at least two days per week, compared with around a quarter who use the Underground at least twice a week and 13 percent who use National Rail services at least twice a week. Those on low incomes are the most likely to make trips by bus, whereas trips by car, rail, tube and bicycle are more likely to be made by those on higher incomes.

Compared with other public transport modes, the bus offers greater flexibility. It can change and deviate its route and can be altered to meet different or changing demands. It is highly available and can penetrate areas to provide good levels of accessibility. In London, the bus network covers the whole city, with over 90% of all households being within 400m of a bus service. The bus network offers more local connectivity than rail or tube through its relative richness of both orbital and radial links, with 24 hour per day availability.

In some respects the bus has a poor public image and is viewed by many as an unacceptable alternative to other modes, particularly the private car. Slower journey times, unreliability, infrequent services and poor quality of service are all often cited as reasons for not using a bus. There are, however, differences in how buses are viewed; bus users recognise the value and use of buses much more than non-users. The key drivers of people's views of bus travel are journey times, convenience, value for money and reliability. Research shows that whilst both car and bus users have a very positive perception of car travel; it is only generally bus users that have a very positive view of bus travel.

In recent years much has been done to improve the quality of buses. From a physical access point of view, the Disability Discrimination Act has led to the provision of low floor, step-free accessible vehicles. In parallel, operators have sought to improve services and pursue higher levels of passenger comfort and customer care through network modifications, vehicle design and improved customer care initiatives. In London, Transport for London (TfL) has improved services through its quality incentive contracts.

The utility of the bus is really seen in its contribution in a number of policy areas:

- Improving accessibility and social inclusion;
- Sustainability and addressing environmental concerns;
- Benefits for the economy; and
- Improvements in public health and accident prevention.

Buses are seen as having greater benefit for low income households and certain groups, in particular those with limited or no access to a car, such as young people, disabled people and older people. Many low-paid jobs involve people working hours that make access difficult using other public transport modes. Those people who are reliant on rail and underground services during these hours may be excluded from participating in employment, social and other necessary activities. The affordability of bus services, in relation to other public transport modes, results in households on low incomes being more likely to travel by bus.

The availability of bus services is a key issue for many young people, as it can be one of the main factors that determine which school or college they can attend, if they can participate in after school activities, how and where they access health care and employment, and whether or not they are able to see their friends out of school hours.

For older people, the bus offers high levels of utility. Research underlines the importance of transport generally in later life in enabling people to meet basic needs, such as access to shops and doctors, but also for meeting their social, psychological and emotional needs by providing the means to participate in their local community, maintain family and social networks, and travel more widely for recreation and leisure. Whilst older people make fewer trips when they stop driving, the bus is seen as an important means for continuing to enjoy these benefits.

Enabling all household groups to access facilities by bus is seen as critical at a time when the environmental impacts of car use are under increasing scrutiny. In London, 5% of carbon dioxide emissions released from ground-based travel are generated by buses. However carbon dioxide per bus passenger km has fallen in recent years and the bus compares very favourably against other modes per passenger km. Noise and emissions causing poor air quality are generally associated with buses rather than other public transport modes due to their proximity to pedestrians, level of frequency and the fact that other public transport modes are often electrified minimising the local air pollution impact.

The ability of the bus to substitute car journeys is also beneficial in economic terms and research suggests that wherever a bus is loaded more than 25% there is a net economic benefit, including journey time savings resulting from lower levels of congestion on the network. Additionally, for individuals using public transport there are benefits in being able to use their travel time more productively, as well as health benefits from greater activity levels than when using the car.

1 Introduction

Aim of the Research

1.1 JMP Consultants Ltd was commissioned by the London Assembly to produce a literature review of *'existing research into the social, environmental and economic utility of bus services'*. The research includes evidence relevant to London on the benefit of enhanced accessibility via bus services to jobs, services and social networks for people on low incomes and/or without access to a car or the Underground network.

Report Structure

1.2 The following sets out the structure of this document:

- Section Two provides a profile of journeys made by bus (nationally and in London) and an overview of research examining the public image of bus services;
- Section Three examines the accessibility of bus services and its impact on different social groups of people, including children and young people, disabled and older people, unemployed and low income groups;
- Section Four considers the environmental impacts of buses, including climate change, local air quality and noise.
- Section Five considers the utility of bus services and the economy, including their impacts on congestion, journey times, cost efficiency, employment, tourism and travel time productivity; and
- Section Six contains a review of the health and safety research associated with buses.

2 Profile of journeys made by bus and its public image

National Bus Use

2.1 The bus is an important travel mode across the country. The National Travel Survey 2008 indicated that 7% of all journeys made were by bus and coach[1]. This is an average of 66 journeys per person per year. In these terms, the bus is used over twice as much as rail, which accounts for just 3% of journeys. The percentage of journeys by bus is not consistent across journey purposes; most importantly, it accounts for 10% of journeys for shopping or education and 8% of commuter journeys. It only accounts for 3% of business journeys and 5% of leisure journeys.

Bus Use in London

2.2 Buses are by far the most used mode of public transport in London with approaching 2 billion bus journeys each year. For comparison, just over 2 billion journeys are made on foot in London annually, around 1 billion on the Underground, some 800 million on the National Rail network and approaching 200 million by bike. Almost half of Londoners use buses on at least two days a week compared to around a quarter who use the Underground at least twice a week and 13 percent who use National Rail services at least twice a week. Those on low incomes are the most likely to make trips by bus, whereas trips by car, National Rail, the Underground and bicycle are more likely to be made by those on higher incomes.[2]

2.3 Between 2000 and 2008 there was a significant expansion of bus provision in London. Improvements to service coverage, frequency and quality facilitated a rapid increase in demand for bus travel – passenger kilometres rose by 74 per cent to 7.7 billion annually over the eight years. However, this expansion came at a considerable cost with the annual operating subsidy for London Buses rising from £41 million in 1999/2000 to £653 million in 2007/08.[3]

2.4 A survey by the Passenger Transport Executive Group (PTE) found that 85% of trips within metropolitan areas (outside of London) are made by bus[4]. And in London, looking at bus, underground, DLR and Tramlink, 66% of all journeys made in 2007/08 were by bus[5]. This had gradually risen to this level from 57% in 1999/2000, despite the increased usage of underground and DLR, and the introduction of Tramlink.

2.5 Journeys by all modes on weekdays clearly have peaks, which are linked to main work and education start and finish times. In London, analysis of journeys made throughout the day highlights that the bus experiences less of a peak effect than other modes[6]. This indicates the wider use of bus for various purposes, particularly its importance in respect of shopping journeys, compared with other public transport modes. Also, through the night (0100-0500) the bus accounts for almost as many journeys as by car. This indicates the overall utility of the bus, particularly in

[1] Department for Transport (2008) *National Travel Survey*, London
[2] TfL, Travel in London, Report number 1, April 2009, pp. 24 & 146
[3] KPMG LLP, Independent strategic review of the provision of bus services in London, 16 July 2009, pp.14 & 22.
[4] Passenger Transport Executive Group (2006) *A Fresh Start for the Urban Bus*.
[5] Transport for London (2009) *Travel in London*, London
[6] LTDS *2006/07 Household Survey*.

London, where it is available 24 hours per day. Equally, it highlights the relative even intensity use of buses, compared with rail and underground which experience more of a peak effect.

Public Image of Bus Services

2.6 In some respects the bus has a poor public image and is viewed as an unacceptable alternative to other modes, particularly the private car. Slower journey times, unreliability, infrequent services and poor quality of service are all often cited as reasons for not using a bus. There are, however, differences in how buses are viewed; bus users recognise the value and use of buses much more than non-users. The key drivers of people's views of bus travel were: journey times, convenience, value for money and reliability. Research by Harrison *et al* showed that while both car and bus users had a very positive perception of car travel; it was only bus users that had a very positive view of bus travel.[7]

2.7 Research by Stradling *et al*[8] compared the views and opinions of bus users in Edinburgh. A number of positive views are expressed about bus travel, in particular the ability to just sit back and relax, in comparison to driving, which requires a high level of concentration. Other interviewees said that they enjoyed being able to watch out of the window and 'switch off' into their own personal space. The research found that they liked the fact that they could arrive in close proximity to their destination therefore saving them time.

2.8 Guiver[9] analysed the transcripts of ten focus group discussing bus and car travel. The research found that the modes are talked about in different ways: bus travel being referred to as a series of episodes mostly focussing on worst-case scenarios whilst car travel is represented as a more consistent commodity.

2.9 In recent years much has been done to improve the quality of buses. From a physical access point of view, the Disability Discrimination Act has led to the provision of low floor, step-free accessible vehicles. In parallel, operators have sought to improve services and pursue higher levels of passenger comfort and customer care through network modifications, vehicle design and improved customer care initiatives. In London, TfL has improved services through its quality incentive contracts.

[7] Harrison S *et al* (undated) *Quality Bus Corridors and Green Routes: can they achieve a public perception of permanence of bus services?*
[8] Stradling, S., Carreno, M., Rye, T., Noble, A., (2007) 'Passenger Perceptions and the Ideal Urban Bus Journey Experience', *Transport Policy* 14, pp.283-292.
[9] Guiver, J.,(2007) 'Modal talk: Discourse analysis of how people talk about bus and car travel', *Transportation Research Part A: Policy and Practice*, Vol 41, Issue 3, pp.233-248.

3 Accessibility and Social Inclusion

Accessibility of Bus Services

3.1 Kennedy[10] notes that 'transport provision has a major impact on society affecting many characteristics such as access to amenities, recreation, employment and basic social interaction'.

3.2 Compared with other public transport modes, the bus offers greater flexibility. It can change and deviate its route and can be altered to meet different or changing demands. It is highly available and can penetrate areas to provide good levels of accessibility. In 2003, Transport for London noted that 'the bus network covers the whole city, with over 90% of all households being within 400m of a bus service.'[11] It went on to say that the 'bus network offers more 'connectivity' than rail or tube through its relative richness of both orbital and radial links, with more than 24 hours availability.' In considering the value of new services in deprived areas, Lucas *et al* (2008)[12] suggested that 'new services have created the opportunity for people to undertake wholly new activities through improved accessibility.'

3.3 The London bus network is very accessible for people with limited mobility as all buses are low-floor vehicles and are fitted with wheelchair ramps.[13]

3.4 At its most flexible, the bus can provide the ultimate in accessibility – a door to door, on demand service. Demand responsive bus services have proven to be effective in meeting the diverse travel needs of dispersed communities in rural areas and in serving particular demands in more urban settings. In Shropshire, the move in November 2008 to replace many conventional rural bus services with a countywide zonal network of 'ShropshireLink' demand responsive services has led to a 56% increase in patronage.[14] Whilst on Deeside, the Deeside Shuttle has been effective in opening up employment opportunities for those where bus services did not previously exist.[15]

Social Inclusion

3.5 The logic of the social exclusion approach, according to Stanley *et al* the way of including people with disadvantages (e.g. disability, lack of educational opportunity, inadequate housing, ethnic minority status, unemployment, age and lack of transport) is through the provision of improved social policies, which specifically address their sources of disadvantage; including strategies to improve accessibility through improvements to bus services'[16].

[10] Kennedy, C. (2002) 'A comparison of the sustainability of public and private transportation systems: Study of the Greater Toronto Area', *Transportation* 29 pp.459-493.
[11] Transport for London (2003) *The case for investing in buses*, London
[12] Lucas *et al* (2008) *The Value of New Transport in Deprived Areas*, Joseph Rowntree Foundation.
[13] http://www.tfl.gov.uk/gettingaround/transportaccessibility/1171.aspx
[14] Hayes J (2009) *ShropshireLink DRT*, presentation to Mercia Group of the Chartered Institute of Logistics & Transport, Shrewsbury, 26th October 2009
[15] Blainey D (2004) *The Deeside Shuttle*, 3rd annual Demand Responsive Transport Conference, London, 2004
[16] Stanley, J., Vella-Brodrick, D., (2009) 'The usefulness of social exclusion to inform social policy in transport', *Transport Policy*, Vol 16, Issue 3, pp.90-96.

3.6 The importance of buses in promoting social inclusion is reinforced in the Government's reports Making the Connections: Final Report on Transport and Social Inclusion[17] and A Sure Start to Later Life[18].

Benefits of buses to social groups

3.7 The popularity of buses is due to both the relative affordability of bus fares and greater geographical coverage of the bus network compared to the Underground and National Rail. For many whose journeys are not served by the rail networks or who find the fares unaffordable, buses play a significant role in providing access to jobs and services and supporting social inclusion.[19]

3.8 In 2003, the Social Exclusion Unit[20] reported on social exclusion from the following perspectives: income, employment, education, health housing, crime, social support/social capital, the impact of the neighbourhood and the impact of inaccessible transport services. This report led to local authorities undertaking a programme of accessibility mapping to key services as part of their Local Transport Plan 2 strategies. The study drew links between the exclusion of people who do not have access to a car and their needs for education, employment, access to health and other services, food shopping as well as to sporting, leisure and cultural activities.

3.9 Buses are seen as having greater benefit for certain groups, and in particular those with limited or no access to a car, such as children and young people, disabled and older people, unemployed and low income groups.

Children and Young People

3.10 Research carried out for the DfT found that walking is the most common mode choice for travel to school, followed by car use, although bus-travel increases at secondary school age, reflecting increased distances travelled to secondary as compared to primary schools[21]. The research also examined parents' attitudes to children's use of buses and benefits include: giving children more social contact with their friends; fostered independence; cost benefits; better for the environment; and children were delivered directly and safely to school.

3.11 Research carried out by Mackett *et al*[22] examined the health benefits to children associated with everyday travel. Within the article the health benefits to bus travel are shown, detailing the number of calories that children burn when travelling by bus combined with two hours of physical education or games lessons a week. The results of the study showed that the extra bit of physical activity required to walk to and from a bus stop plays an important part in increasing fitness levels.

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[17] Office of Deputy Prime Minister (2003), *Making the Connections: Final Report on Transport and Social Inclusion*

[18] Office of Deputy Prime Minister (2006) *A sure start to later life: ending inequalities for older people,* London

[19] See, for example, Karen Lucas, Sophie Tyler, Georgina Christodoulou, The benefits of providing new public transport in deprived areas, Joseph Rowntree Foundation, July 2008

[20] Social Exclusion Unit (2003) *Making the Connections: Final Report on Transport and Social Exclusion*, Office of the Deputy Prime Minister.

[21] Department for Transport (2006) *Evidence base review on mobility: Choices and barriers for different social groups*, London.

[22] Mackett, R.L., Lucas, L., Paskins, J., Turbin, J., (2005) 'The Therapeutic Value of Children's Everyday Travel', *Transportation Research Part A* 39, pp.205-219.

3.12 Dependent escort travellers are mainly primary school children aged 5 – 10/11. Scottish Executive research found that this group had positive attitudes towards buses seeing them as fun, 'cool and attractive'[23]. Department for Transport research also quotes a number of studies which show that primary aged children recognise the negative aspects of car-travel and are enthusiastic about ideas to reduce congestion and encourage the use of more sustainable transport modes[24].

3.13 The Scottish Executive research also found that overall, secondary school aged children found buses reliable, cheap and convenient. However, older children suggested that bus running times could be improved to better suit their travel needs and help them to reduce dependence on lifts from others. In addition, the attractiveness and fun of the bus identified by primary school children, declines steadily amongst this group. Secondary school aged children had considerable experience of using cars and recognised many personal advantages to their use, despite also being aware of negative effects such as congestion and pollution[25].

3.14 Department for Transport research quotes a range of studies which summarise the varying opinions of this group towards public transport. Many were positive about the independence bus-travel provided and young teenagers, particularly girls, saw public transport as a social experience where they could chat to their friends[26].

3.15 Transport is a key issue for many young people, as it can be one of the main factors that determine which school or college they can attend, if they can participate in after school activities, how and where they access health care and employment, and whether or not they are able to see their friends out of school hours at times that are convenient to them[27].

3.16 People aged 16-25 travel further than other age groups by foot, bus, rail and taxi. Even so, the top three modes used overall are car driver or passenger or by foot[28]. Those young people who are most dependent on buses are those living in urban areas, or on the outskirts of inner city areas. Research carried out for the Department for Transport showed that buses were seen as offering greatest benefit to avoid traffic, the Congestion Charge in London, or overcoming a lack of affordable parking. The availability of buses in the evening was an important influence on whether young people socialised with friends at pubs, gigs and nightclubs, particularly when they could not afford taxis.

3.17 The research went on to highlight how the availability of buses improves the opportunities to take up employment, particularly in urban areas where there were more public transport options. Likewise, the availability of public transport was an influence on decisions regarding further education choices. Research amongst young people in a number of locations across England showed how important the bus was at the point where they moved from school to further

[23] Scottish Executive (*2003) Children's Attitudes to Sustainable Transport*
[24] Department for Transport (*2006a) Evidence Base Review on Mobility: Choices and Barriers for Different Social Groups*, London.
[25] Scottish Executive (*2003*) *Children's Attitudes to Sustainable Transport*
[26] DfT, (*2006a*) *Evidence Base Review on Mobility: Choices and Barriers for Different Social Groups*, London.
[27] Wixey *et al*, (2005) *Measuring Accessibility as Experienced by Different Socially Disadvantaged Groups: Working Paper 1 – User Needs Literature Review*, University of Westminster, London
[28] Department for Transport (2007) *Understanding the travel aspirations, needs and behaviour of young adults*, London

education[29]. Due to greater independence, less opportunity for lifts from parents and longer travel distances, students commencing further education had a high reliance on buses. During their period in further education, the proportion using buses reduced as students obtained a driving licence.

Disabled People and Older People

3.18 Research into the travel behaviour of disabled people showed how important public transport was to this group[30]. Estimates suggest that around one fifth of adults in Britain are disabled.

3.19 Schmöcker *et al*[31] focus on understanding mode choice decisions among older and disabled people. Their research found that mode choice amongst older and disabled persons is more sensitive to marginal cost than average cost (i.e. including the costs of car ownership). There was an apparent preference for car use and independent mobility over public transport modes, although the bus was the more preferred mode when compared to rail or underground. A spatial analysis showed that the higher bus stop density, the more likely older and disabled people will choose public transport.

3.20 The National Travel Survey shows that disabled people make fewer journeys overall than the general population; however, they are much more reliant on public transport. People with visual and hearing impairments and people with mental health illness are particularly reliant on public transport, compared with people with other types of physical disability.

3.21 For older people, the bus offers high levels of utility. DfT research[32] underlined the importance of transport and travel generally in later life in enabling people to meet basic needs, such as access to shops and GPs, but also for meeting their social, psychological and emotional needs by providing the means to participate in their local community, maintain family in social networks, and travel more widely for recreation and leisure. The report also demonstrated how older people rely on buses for travel and participation, and therefore for improved health.

3.22 Whilst older people reported a drop in the number and type of travel trips they made following driving cessation, the bus was seen as an important means for continuing to enjoy these benefits. The perceived benefits of bus use amongst older people included its low cost, compared with other modes and the wide coverage of services across many areas. Older people who chose to travel by bus saw it as beneficial for a number of reasons: convenience, socialable experience and a low cost option (obviously assisted by the presence of concessionary fares). Older bus users and car drivers alike described the sense of freedom that being able to travel afforded them.

3.23 The above certainly points to the bus having significant social inclusion benefits in improving people's accessibility. This is echoed in research into the value of new transport services in deprived areas, which concluded that a major benefit of new bus services was that people could

[29] Hardy P (2005) *Understanding the Travel Patterns of Students aged 15-19 years*, 3rd UK Transport Practitioners Meeting, Aston University, July 2005
[30] Department for Transport (2008) *Travel behaviour, experiences and aspirations of disabled people*, London
[31] Schmöcker, J.D., *et al*, (2008) 'Mode Choice of Older and Disabled People: a case study of shopping trips in London', *Journal of Transport Geography*, Vol 16, pp. 257-267
[32] Department for Transport (2007) *Understanding the travel needs, behaviour and aspirations of people in later life*, London.

simply get out and about more[33], and this provided more opportunities for social networking. It also helped people improve their confidence in travelling and to expand their travel horizons. Furthermore, new bus services were shown to have cost savings for those using them. One such service, the Braunstone Bus in Leicester, was shown to have an aggregate value of travel cost and journey savings worth £661,000pa. These cost savings were considered to be higher than those that would have normally arisen, therefore suggesting that the new services had created the opportunity for people to undertake new activities through improved accessibility.

Ethnic Minority Groups

3.24 Current patterns of bus service provision can discriminate against particular ethnic minority groups of people[34]. Radial routes into town centres can over look accessibility to out of town shopping centres, requiring people to take two buses and pay two fares. Information provision is an area for improvement in tailoring transport services to minority groups. Fares and ticketing need to be considered within the context of different cultures. For example, generally family tickets are based on a price for two adults and two children; this makes travel for larger families more expensive.

Low income groups

3.25 Although adults on low income share the same broad travel needs as the general adult population, they are likely to have a disparate experience of accessing opportunities and services. The key theme running through the literature is that people on lower income are less likely to have access to private vehicles and are more likely to be dependent on public transport. The Social Exclusion Unit study found that walking was the most frequently used mode of transport of people on low income.

3.26 On the basis of the findings from the Lucas *et al*[35] study, the authors conclude that 'public transport for services are a vital component in the social inclusion of individuals and for maintaining the vitality and vibrancy of low-income neighbourhoods'. The research also found that transport is a key consideration for unemployed people when trying to find and taking up new employment opportunities. The study case studies showed that the introduction of new buses services resulted in people on low incomes, without access to a car, being able to access new opportunities including employment and healthcare.

[33] Lucas *et al* (2008) *The Value of New Transport in Deprived Areas*, Joseph Rowntree Foundation.
[34] DfT (2003) Public Transport Needs of Minority, Ethnic and Faith Communities Guidance Pack, London.
[35] Lucas *et al* (2008) *The Value of New Transport in Deprived Areas*, Joseph Rowntree Foundation

4 The Environment

4.1 The introduction of initiatives to encourage people to use the bus rather than cars as a travel to work solution, can also help councils to meet their transport targets, such as reducing car use, air quality targets and improving sustainable travel[36].

4.2 The USA's Transportation Research Board in their report "Measuring and Valuing Transit Benefits and Disbenefits" lists reduced consumption of energy; reduced localized emissions; reduced exposure to noise; reduced intrusion into ecologically sensitive settings; and reduced land consumption as the general environmental benefits of public transport[37]. All of these aspects are relevant to bus transport.

Climate Change

4.3 Enabling all household groups to access facilities by bus is seen as critical at a time when the environmental impacts of car use are under increasing scrutiny.

4.4 The use of bus services, or more generally public transport as an alternative to the private car, is widely recognised as being more sustainable. For example, a study by Kennedy[38] demonstrates that the use of public transport, specifically in relation to bus travel, is far more sustainable than the use of private car in the Greater Toronto Area.

4.5 Romilly[39] finds that substitution of bus for car travel has a positive impact as CO, CO_2 and VOC emissions are generally reduced. Of carbon dioxide (CO_2) emissions released from ground based travel in London, 5% is generated by buses[40]. There has been a decrease in the amount of CO_2 per passenger kilometre released by buses between 2005 and 2008, although there was no decrease between 2006 and 2008.

4.6 Stead (1999) examined travel choices and emissions in Britain. His paper identified the main emissions from transport including their impacts and trends. From an analysis of the National Travel Survey and a model of vehicle emissions, the general observation made is that people who travel more generate more pollution, whilst the mode of travel and vehicle operating conditions are also considered to be important factors. The energy consumption by mode is calculated in **Table 4.1**. 'Stage Bus' is shown to use less energy per passenger kilometre than either rail or underground modes[41].

[36] Lucas *et al* (2008) *The Value of New Transport in Deprived Areas*, Joseph Rowntree Foundation
[37] Transportation Research Board National Research Council (1996) 'Measuring and Valuing Transit Benefits and Disbenefits' *TCRP Report 20*.
[38] Kennedy, C. (2002) 'A comparison of the sustainability of public and private transportation systems: Study of the Greater Toronto Area', *Transportation* 29 pp.459-493.
[39] Romilly, P (1999) 'Substitution of bus for car travel in urban Britain: an economic evaluation of bus and car exhaust emission and other costs', *Transportation Research Part D,* pp. 109-125.
[40] Transport for London (2009) *Travel in London: Key Trends Report Number 1,* London.
[41] Stead, D. (1999) 'Relationships between transport emissions and travel patterns in Britain', *Transport Policy* 6 pp. 247-258.

Table 4.1 Energy consumption per mode

Mode	Energy Consumption MJ / Passenger Kilometre
Car	1.96
Stage Bus	1.28
Express Bus	0.79
Rail	1.65
Underground	1.55
Van/Lorry	2.94
Walk	0.16
Motorcycle	0.99
Bicycle	0.06
Taxi	2.94

Stead (1999)

Noise

4.7 Noise is generally associated with bus rather than other public transport modes. It is the proximity of bus transport to pedestrians and the frequency that generates the noise impact, whereas rail operates on dedicated rights of way which are often distant from pedestrian facilities.[42]

Local Air Quality Emissions

4.8 Noise and fumes emitted are generally associated with bus rather than rail based public transport, as rail modes are often electrified minimising the localised air pollution impact. [43]

4.9 Buses are assumed to be powered by diesel engines although an increasing number of operators have introduced engines powered by alternative fuels including liquid petroleum gas (LPG) and compressed natural gas (CNG). Romilly[44] finds that the total emissions of NOx SO2, and PM10 are increased by a switch to bus, although it should be noted that European emissions standards have been tightened since this study was undertaken, which may affect the results. He also found that cars are generally petrol engined, although there is a trend towards the use of diesel engines because of their higher fuel efficiency and, to a lesser extent, their perceived environmental benefits.

[42] Currie, G (*2006) '*Bus Transit Oriented Development— Strengths and Challenges Relative to Rail', *Journal of Public Transportation,* Vol. 9, No. 4

[43] Currie, G (*2006) '*Bus Transit Oriented Development— Strengths and Challenges Relative to Rail', *Journal of Public Transportation,* Vol. 9, No. 4

[44] Romilly, P (1999) 'Substitution of bus for car travel in urban Britain: an economic evaluation of bus and car exhaust emission and other costs', *Transportation Research Part D,* pp. 109-125.

5 The Economy

Reduced Congestion

5.1 The findings of the Romilly paper is that the substitution of car for bus travel results in significant economic gains when accounting for traffic congestion, exhaust emissions, fuel consumption, noise pollution, road accidents and road damage. The most important gain from substituting car for bus trips is the reduction in congestion and resultant journey time savings from fewer cars on the network.

5.2 There are certain economic benefits from removing car trips from the road. The more efficient use of road space can lead to decongestion effects. The Department for Transport's WebTag unit sets out the calculation of economic benefits from abstracting car trips from the road network for the purposes of an economic appraisal[45]. Romilly finds that wherever a bus service is loaded more than 25% there is a net economic benefit[46].

Cost Efficiency

5.3 In certain circumstances, local bus services provide a more cost effective means of provision than alternative modes. In particular, local bus services are more cost-effective in areas of lower density population than rail.[47]

Employment

5.4 In 2006, there were 167,000 people employed in the bus and coach industry in the UK, more than were employed in the airlines and railways put together[48].

5.5 The 2001 Census[49] data showed that 10% of London commuters travelled by bus. This compared with 39% car drivers or passengers, 18% train and 17% underground or light rail. The largest proportions of bus commuters travel from some of the most deprived areas within London, including Hackney, Southwark, Lewisham and Haringey. This proportion is low compared to other UK cities because of the extra transport options available to Londoners including the underground and light railway. However, more recent data from 2009 has shown significant modal shift in journeys within London. Between 2001 and 2007, there was a 40% growth in bus commuting[50]. Research carried out for the DfT[51] found that 'an efficient public transport system contributes to stronger and deeper labour markets, by enabling employers to access a wider pool of potential employees, and individuals to access a wider range of jobs. Over 40% of all bus journeys made by working-age people are for commuting and business purposes and nearly 2 million people rely on buses and coaches as their usual means of travel to work'.

[45] http://www.dft.gov.uk/webtag/docs/expert/major-schemes/3.9.5.pdf
[46] Romilly, P (1999) 'Substitution of bus for car travel in urban Britain: an economic evaluation of bus and car exhaust emission and other costs', *Transportation Research Part D*, pp. 109-125.
[47] Currie, G (2006) 'Bus Transit Oriented Development— Strengths and Challenges Relative to Rail', *Journal of Public Transportation,* Vol. 9, No. 4
[48] Confederation of Passenger Transport (2006) *On the move: passenger growth partnerships*.
[49] Piggot (2007) *Commuting in London*, Greater London Authority
[50] Transport for London (2009) *Travel in London: Key Trends Report Number 1*, London.
[51] DfT (2006) *Putting passengers first: The Government's proposals for a modernised national framework for bus services*, London.

Tourism

5.6 According to Guiver *et al* 'transport remains a fundamental element of sustainable tourism development', and that there 'are clearly benefits which can be attributed to the retention or development of an attractive bus network which also facilitates access opportunities for residents and visitors without cars'.[52]

Travel Time Productivity

5.7 There is a body of research which suggests that the use of travel time for productive activities means that travel time is not 'lost' time it terms of social welfare. Mackie *et al* 2001 contains a discussion on the treatment of the valuation of productive travel time[53].

5.8 Research has tended to focus on travel time savings for business users of train transport, however there is an outlook which suggests that valuable activity can be undertaken which consists than more than just working. Lyons and Urry suggest the following list of useful activities which may be undertaken on a train. Many of these activities may also be undertaken on bus transport[54].

- Sleeping/snoozing;
- Reading for leisure;
- Working (reading/writing/typing/thinking);
- Talking to other passengers;
- Window gazing/people watching;
- Playing games (electronic or otherwise);
- Listening to music/radio;
- Text messages/phone calls – work;
- Text messages/phone calls – personal;
- Eating/drinking; and
- Entertaining children

5.9 Mokhtarian and Salomon suggest positive uses of travel time such as 'the ability to use the time for relaxing or thinking, including 'shifting gears' mentally between origin and destination activities and roles'. They undertook a survey which showed that nearly half disagreed that travel time is wasted time, and over a third use their commute time productively[55].

5.10 Lyons & Urry suggest that the increasing availability of information and communications technology has the potential to enable productivity in situations where this would be otherwise impossible. The

[52] Guiver, J. (2007) 'Do buses help meet tourism objectives? The contribution and potential of scheduled buses in rural destination areas', *Transport Policy* Vol.14 pp.275–282
[53] Mackie, P. J. Jara-Diaz, S. Fowkes, A. S. (2001) 'The value of travel time savings in evaluation', *Transportation Research,* 37, pp. 91-106.
[54] Lyons, G. and Urry, J. (2005) 'Travel time use in the in the information age', *Transportation Research Part A*. 39, pp. 257-276.
[55] Mokhtarian P.L. and Salomon I. (2001) 'How derived is the demand for travel? Some conceptual and measurement considerations', *Transportation Research* A 35, pp. 695–719

Office of National Statistics reports that some individuals will be equipped to making better use of their time[56]. They also note that some individuals will be more equipped to make use of travel time than others, which might be influenced by socio economic status, state of health or life stage. The ability to make use of travel time positively is also influenced by a number of environmental factors relating to the vehicle such as 'the degree of crowding in the vehicle; the availability of seating; the ride quality; the temperature and level of noise in the vehicle; and the degree to which the journey is familiar, reliable and straightforward to negotiate'.

5.11 Bus travel can provide time benefits for individuals and due to the many pressures that everyday life puts upon us, allows for pleasure and social time whilst making necessary journeys, arguing that 'travel time can be a gift, rather than a burden'.[57]

[56] Office of National Statistics Family Spending and Family Expenditure Survey 1997-2007 http://www.statistics.gov.uk/downloads/theme_social/Family_Spending_2007/FamilySpending2008_web.pdf

[57] Jain, J., Lyons, G., (2008) 'The Gift of Travel Time', *Journal of Transport Geography* 16, pp.81-89.

6 Health and Safety

Health

6.1 It is widely acknowledged that there are negative health affects linked to emissions from road traffic, including buses, as well as road traffic accidents. Health problems linked to exposure to transport-related air pollution include increased risk of death from cardiopulmonary issues and respiratory symptoms[58].

6.2 Research by the World Health Organisation in Europe indicated that the levels of air pollutants experienced by passengers in vehicles vary by mode and fall into three broad categories: highest exposure in underground railways, intermediate exposure in buses and cars and somewhat less exposure for cyclists and walkers. Developing this further, recent research by Zuubier *et al*[59] demonstrates that although exposure is lower for walkers and cyclists, the increased breathing rates of cyclists may make them more exposed to damaging airborne particulates. Altough at present it is difficult to determine which mode is healthiest in terms of exposure to air pollution whilst travelling, it is recognised that exposure on buses is less than that experienced on underground rail.

6.3 In contrast to this, there is evidence to suggest bus travel can be beneficial to health. The number of calories used per minute by children travelling to school by bus has been calculated as 1.5 calories per minute[60]. This compares to 2 calories per minute for cycling, 2.5 calories per minute for walking and 0.75 calories per minute for car travel. This data indicates that travelling by bus (for school children at least) is more beneficial in terms of health and active travel than travelling by car.

6.4 From a wider perspective, it could be argued that the main health benefits of buses are linked to their function as part of the wider transport network, allowing people to access essential services, including healthcare.

Safety

6.5 There are large social costs in terms of accidents from the use of private cars. These are demonstrated by the high cost of car insurance.[61] There is little research evidence available regarding bus accidents. Allsop and Turner[62] showed in their research that, in the case of Greater London, the decrease in the use of public transport linked to the sharp fare increases of 1982 led to an increase in the number of road traffic injuries.

[58] Krzyzanowski, M., Kuna-Dibbert, B., *and* Schneider, J., (2005) *Health effects of transport-related air pollution*, WHO Europe

[59] Zuurbier, M., Hoek, G., van den Hazel, P., and Brunekreef, B., (2009) 'Minute ventilation of cyclists, car and bus passengers: an experimental study', *Environmental Health.*

[60] Thornthwaite, S., (2009) *School Transport: Policy and Practice*, Local Transport Today, London.

[61] Kennedy, C. (2002) 'A comparison of the sustainability of public and private transportation systems: Study of the Greater Toronto Area', *Transportation* 29 pp.459-493.

[62] Allsop, R.E., Turner, E.D., (1986) 'Road casualties and public transport fares in London', *Accident Analysis and Prevention* 18, pp.147-156.

6.6 Research carried out by Schofield *et al*[63] examined the level of safety of different travel modes to school. The research found that walking, cycling and car travel accounted for the majority of personal injuries. Cycling was the highest risk activity and bus and train travel was the lowest.

6.7 Buses are advantageous over cars in that they produce fewer pollutants per passenger journey and in relation to traffic accidents, bus travel is considered the safest form of road travel[64]. Indeed, a study undertaken in South Yorkshire looking at the affect of increased bus subsidy on traffic accidents found that while increased bus subsidy did not reduced the rate of traffic accidents in the local area, 'the public transport subsidy in South Yorkshire benefited the health of the local population by providing the social amenity of additional travel at the least additional health cost'.

6.8 Research by Brenac and Clabaux[65] examined the scope and forms of accidents, which may involve buses either directly or indirectly (e.g. as a sight obstruction, collision etc). Their findings showed that the involvement of a bus was found in 3.6% of traffic injury accidents reported by the police in the French communities studied.

[63] Schofield, G.M., Gianotti, S., Badland, H.M., Hinckson, E.A., (2008) 'The Incidence of Injuries Travelling to and from School by Travel Mode', *Journal of Preventative Medicine* 46, pp.74-76.
[64] Nicholl, J.P., Freeman, M.R., and Williams, B.T (1987) 'Effects of subsidising bus travel on the occurrence of road traffic casualties', *Journal of Epidemiology and Community Health*, March 41(1) pp.50–54.
[65] Brenac, T., Clabaux, N., (2005) 'The indirect involvement of buses in traffic accident processes', *Safety Science*, Vol 43, Issue 10, pp.835-843.