

2. THE RELATIONSHIP BETWEEN TRANSPORT AND HEALTH

Travel, particularly by private car, has increased at an incredibly rapid rate over the past fifty years. It has brought a level of mobility, independence and opportunities that were previously unknown and it has transformed the way in which land is used and people live (British Medical Association, 1997).

Use of private motorised transport is an integral part of a period of industrial and social change in the developed world that is associated with higher living standards and longer life expectancies. (Button, 1997). We have come to see it as essential to our economic and social well-being.

But as well as conferring considerable benefits, travel and car ownership have created new health and social problems. The way we travel – the individual choices we make concerning what form of transport we use, where we go and how frequently – and the government policies which influence those choices, have important implications for health.

The past two decades have seen a steady growth in the body of scientific evidence linking transport, particularly motorised road transport, with damage to human health through road accidents, air pollution and noise. At the same time, declining levels of physical activity induced by car travel and the fragmentation of neighbourhoods which heavy traffic and road infrastructure have generated, have been shown to pose additional health risks.

These health impacts affect society as a whole, not just transport users. They tend to fall disproportionately on certain groups of the population, often the most vulnerable, and affect both current and future generations. Damage to health can occur as a direct consequence of vehicle accidents and exposure to emissions or indirectly through soil and water contamination and changes to the world climate and ecology.

It is now accepted that the health risks posed by motorised transport are more diverse and complex than previously thought. Even so, the

magnitude of these risks may still be underestimated. The World Health Organisation

"We can no longer ignore the mass of evidence that transport and planning policies are having major effects on health, through road accidents, fumes, noise and our ever-diminishing physical activity."

*JE Asvall
WHO Regional Director for Europe
World Health Organisation, 1999b*

(WHO) recently expressed its concern that the health impacts of transport have not as yet been fully recognised and are being dealt with separately without regard for their cumulative and combined effects (World Health Organisation, 1999a).

There is sufficient evidence to indicate that transport related health concerns are real and should be taken seriously. Failing to acknowledge the full extent of the risks when making decisions relating to transport will be tantamount to putting the health and well-being of individuals and communities last.

2.1 Accidents and injury

The introduction of the motor vehicle was viewed at the outset with some concern because it was seen to pose significant danger to other road users. It was a telling observation. Traffic accidents have become a major cause of death and serious injury worldwide creating a significant health burden in most countries.

Each year, about one million people die in road traffic accidents with 10 million permanently disabled (Murray & Lopez, 1996). It is estimated that by 2020, road traffic accidents will be the third leading cause of disability adjusted life years lost worldwide (Murray & Lopez, 1997). Research funded by the UK Overseas Development Administration indicates that road accidents usually cost any nation about 1% of its Gross National Product. The World Bank has

estimated that road trauma accounts for over 2% of the estimated total global burden of impaired health (World Bank, 1993).

Road accidents account for most fatal transport accidents, in terms of absolute numbers of deaths and of deaths per kilometre travelled. In the European Union, death rates per thousand million kilometres travelled in 1995 were approximately three times higher for road than for rail (World Health Organisation, 1999a).

In 1996, just under 2,000 road users were killed and almost 22,000 were hospitalised in Australia as a result of road accidents (Federal Office of Road Safety, 1998). The 1996 road death rate per 100,000 population was 10.8 in Australia, the same as 1994 and about the average for all OECD countries. The lowest death rates in 1994 were Norway (6.5), UK (6.5), Sweden (6.7), Switzerland (7.0), Netherlands (8.5) and Finland (9.5) (Federal Office of Road Safety, 1996).

In Victoria, nearly 400 people are killed on the roads each year in addition to the 6,000 or so persons hospitalised and around 17,000 persons with other injuries; that is, there is about one fatality for every 15 seriously injured persons.

Road deaths and hospitalisations per 100,000 registered vehicles have trended downwards for Australia overall between 1993/94 and 1997/98. A similar downward trend has occurred in Victoria over the same period with the exception of 1995/96 when the rate increased slightly over the previous year (Victorian Road Safety Committee, 1999). The bulk of the reduction in Victoria has been attributed to the random breath testing and speed camera programs, each supported by publicity (Vulcan et al, 1995).

Despite this progress, road trauma is the single largest cause of death for persons aged between 1 and 44 years (*ibid*). Young people (especially males), the elderly, pedestrians and drivers of non-motorised vehicles are particularly vulnerable. One-third of road deaths occur in people aged less than 25 years while pedestrians and cyclists account for 30-35% of deaths (World Health Organisation, 1999a).

In Victoria, 20% of road fatalities in 1998, and 8% of all road injuries in 1996, were pedestrians.

Of total pedestrian fatalities in 1998, 6% were children under 14 years, 15% were aged 17-25 years, and 38% were over the age of sixty. In the last three years, 63% of all pedestrians killed were male. Pedestrian fatalities in Victoria have declined by 35% since 1989 but have not kept pace with the 50% reduction in the overall road toll. In the five years to 1997, the reduction rate in pedestrian deaths has slowed further to 16% (Victorian Road Safety Committee, 1999).

Compared to other road users, pedestrians are five times more likely to be killed than injured if involved in a crash (*ibid*). The severity of accidents among pedestrians is almost twice as high as that for car occupants (World Health Organisation, 1999a).

The cost of road trauma is significant. In Australia, it was estimated at \$6.1 billion per year in 1993 - more than 1% of GDP (Bureau of Transport and Communications Economics, 1993). In Victoria, the cost of pedestrian fatalities and serious injuries alone has been estimated to be over \$150 million per annum. This does not include the costs of pedestrian accidents not requiring hospitalisation (Corben & Diamantopoulou, 1996).

2.2 Air pollution

Around the world, cars are replacing industry as the major source of urban air pollution. In Australia, motor vehicles are responsible for 40-90% of the various pollutants in the air and are the largest source of man-made pollutant emissions in urban airsheds (Australian Academy of Technological Sciences and Engineering, 1997).

Of main concern are airborne particles, oxides of nitrogen (NOx), volatile organic compounds and their photochemical progeny (principally ozone), air toxics (for example, benzene) and lead. Motor vehicles are responsible for over 70% of total annual NOx emissions, over 50% of hydrocarbons, and 65-85% of carbon monoxide in the major urban areas. They are also responsible for virtually all the airborne lead (90-97%) in metropolitan airsheds. Diesel engines contribute a disproportionate amount of fine particles with up to 100 times the emission from a petrol vehicle (*ibid*).

Substantial epidemiological evidence exists linking air pollutants with adverse effects on health¹:

- (a) Particulate matter is associated with increases in mortality and respiratory symptoms, asthma attacks, reduction in lung function, lung cancer, and admissions to hospital for respiratory and cardiovascular disease.
- (b) Ozone has an effect on respiratory symptoms and lung function, increases bronchial reactivity in asthmatics, and may worsen respiratory and heart disease.
- (c) Carbon monoxide has an effect on hospital admissions for and mortality from cardiovascular disease, and has been associated with increased incidence of neurological disturbances, visual impairment, reduced ability to learn, and low birth weights.
- (d) Oxides of nitrogen inflame the surfaces and reduce the immune defence systems of the lungs, increasing the chance of respiratory illness, especially in young children.
- (e) Lead affects the functioning of most organs but especially the central nervous system of young children.
- (f) Benzene, toluene, formaldehyde and other organic compounds can increase the risk of cancers such as lung, leukaemia and lymphoma.

The health effects of pollutants include short term (acute) and long term (chronic) effects. While a direct causative relationship between the pollutants and all the effects is not generally claimed, it is accepted that the pollutants contribute to exacerbating or triggering an existing condition or tendency (Brindle et al., 1999).

In the US, the EPA has estimated that around 60,000 people die prematurely each year as a

result of small airborne particles (Bown, 1994). In the UK, air pollution is thought to be responsible for shortening the lives of as many as 24,000 lives each year. Particulates in the air are likely to be responsible for bringing forward the deaths of 8,100 people in the UK every year, and to contribute to an additional 10,500 hospital admissions for respiratory problems (UK Committee on the Medical Effects of Air Pollutants, 1998).

Long term air pollution from cars in Austria, France and Switzerland triggered an extra 21,000 premature deaths per year from respiratory or heart disease, more than the total number of annual traffic deaths in the three countries. It also caused 300,00 extra cases of bronchitis in children, 15,000 hospital admissions for heart disease and 162,000 asthma attacks in children in the three countries.

In European cities as a whole, an estimated 80,000 adult deaths per year are related to long-term exposure to traffic-related air pollution.

World Health Organisation, 16 June 1999.

In Australia, the number of premature deaths attributable to particulate pollution has been quoted as 1,000 (Smogbusters). Another estimate based on US figures suggests that the figure in Australia is likely to be closer to 4,000 (Parker, 1995a). A study conducted for the NSW Environment Protection Authority concluded that approximately 400 people are dying each year in Sydney from air pollution-related respiratory illness (Morgan et al., 1998). Based on the Sydney figures, deaths in Melbourne are likely to be in the order of 200-220 per year². Estimates of the health costs of vehicle emissions in Australia range as high as \$5.3 billion per annum (i.e. more than 1% of GDP), in the same order as the estimated costs of road trauma (Brindle et al., 1999).

¹ Studies undertaken are too numerous to cite here. References are available in Schwartz (1997), McMichael (1997), Dora (1999), Morgan et al. (1998).

² Smogbusters personal communication

Evidence of the hazards posed by particulates present in traffic pollution has been mounting since 1993 when the Harvard Six Cities epidemiological study found a clear association between mortality and fine particulate matter in the atmosphere. A similar relationship was discovered from an investigation of the records of 500,000 people from the American Cancer Society and data on fine particles from 50 cities (Fisher, 1999).

Particles most injurious to health are small (at or below 10 micrometres in diameter, called PM10s) and ultrafine (2.5 micrometres or less) in size. Small particles emitted by diesel engines can travel long distances and are more likely to get past filtering systems in the human body and in buildings.

Ultrafine particles produced by newly developed diesel engines with lower carbon dioxide emissions are now suggested as the real cause of health damage from particulate matter (Dora, 1999). Ultrafine particles are capable of penetrating deep into the lungs and may even be small enough to enter the bloodstream causing multi-chemical sensitisation and increasing the risk of heart and lung disease. Rashes, nausea, changes in red or white blood cells, bleeding, liver damage and the degeneration of the nervous system have been attributed to multiple chemical sensitisation (Fisher, 1999).

Particulate pollution is of growing concern as the number of four wheel drive and light commercial vehicles on urban roads in Australia increases. Diesel vehicles comprise only 5% of the total number of registered vehicles in NSW but contribute 60% of the particulate matter and 39% of nitrogen oxides emissions (NSW Department of Transport, 1998). They are responsible for up to 80% of vehicle-derived ultrafine particles.

The risk to health is compounded by the fact that 60% of Australia's light commercial fleet (much of which is diesel) is at least 10 years old; there are currently no effective nitrogen oxides catalysts for diesel engines; and heavy duty diesels (buses, large trucks and semitrailers) produce 25 times more particulates than light diesels. In addition, Australian diesoline has a high sulphur content which is a contributing

factor to particulate emission. Sulphur levels in Australian diesel are 3-4 times those in the US (the Australian permissible level is 10 times the US level) and 5 times the EC level. Low sulphur diesel is necessary for the introduction of nitrogen oxide catalysts and particulate traps and yet Australia is proposing a relatively slow switch to Ultra Low Sulphur Diesoline (Fisher, 1999).

In 1998, the Californian Air Resources Board identified diesel exhaust as a "Toxic Air Contaminant" based on epidemiological evidence that strongly suggests a causal link between occupational diesel exhaust exposure and lung cancer. In the same year, California's Attorney-General and the US National Resources Defence Council announced that they were suing the owners of five grocery distribution centres over the exposure of nearby residents to high levels of diesel exhaust (*ibid*). Nine years earlier, the International Agency for Research on Cancer concluded that diesel engine exhaust is "probably carcinogenic to humans" while gasoline engine exhaust was classified as "possibly carcinogenic to humans" (World Health Organisation, 1999a).

Carbon monoxide, nitrogen and sulphur dioxide do not normally exceed what is regarded as acceptable levels in Australia (Brindle et al., 1999). Nevertheless, underlying day long concentrations of ozone and other smog components can be substantial in Australian capital cities even when levels of smog and/or airborne particulates do not exceed air quality standards (Australian Academy of Technological Sciences and Engineering, 1997).

Levels of pollutants reported as part of air quality monitoring may not fully reflect the extent of health risk. Most air quality reporting is of background or ambient levels of pollutants but there can be substantial differences in readings according to the traffic level, its composition, atmospherics and season, recording height, proximity and height of road side buildings and vegetation, as well as distance from the road (Fisher, 1999). For example, air pollution at the kerbside on busy roads can be two to three times urban background levels (Great Britain Royal Commission on Environmental Pollution, 1994). The first metre up from the ground at kerbside is particularly high in small particles

which poses a serious health risk for young children. It also casts a shadow on the attractions of kerbside cafes on busy roads. Places where there are interruptions to traffic flows and queuing traffic (for example, road junctions) are especially hazardous when average daily traffic flows are in excess of 20,000 vehicles (Fisher, 1999).

According to the World Health Organisation, evidence is emerging that children living near roads with heavy vehicle traffic have about a 50% higher risk of suffering from respiratory symptoms than children living in areas with low traffic (World Health Organisation, 1999a). In August 1999, results of a study of 3,500 men conducted by the Institute of Environmental Medicine in Stockholm revealed that there was a 40% higher chance of contracting lung cancer for 30 year residents of heavily trafficked areas, and a 20% higher chance for 10 year residents. The results were the same whether or not the men were smokers (Fisher, 1999).

Exposure to vehicle emissions is not restricted to periods spent outside vehicles or buildings. Air pollutants (particularly nitrogen dioxide and carbon monoxide) can be inhaled more readily by car users than walkers, cyclists or people using public transport on the same road (Van Wijnen & van der Zee, 1998). Inside cars on busy roads, concentrations of pollutants are on average five times background levels (Great Britain Royal Commission on Pollution, 1994). Vehicle-generated pollutants such as nitrogen dioxide, benzene and particulates can also infiltrate and accumulate in buildings.

By engaging in their normal daily activities, people are being exposed to a variety of different levels and mixes of pollutants. It has been suggested that living in the inner city could be equivalent to smoking as much as a pack of cigarettes per day. The Australian Academy of Technological Sciences and Engineering found that living in a high density city could be up to three times more hazardous for particulates than in sprawling suburbs (Fisher, 1999).

Improvements in vehicle technology have had a positive impact on vehicle emissions. However, in metropolitan areas, increased emissions from the rapidly rising light commercial fleet, growth in vehicle ownership, higher vehicle kilometres

travelled and traffic congestion, are tending to offset these improvements. The deterioration of catalytic converter efficiency will also have an effect (Brindle et al., 1999).

The high incidence of short vehicle trips in Australia - around 50% of vehicle trips are less than 5 kms - will be an additional negative influence on emissions levels given that the majority of pollutants from a motor vehicle are emitted during the first 8-10 minutes of a journey.

2.3 Climate change

"It is not just that motor vehicles have transformed the physical environment and the quality of its air; they also contribute increasingly to global pressures on the world's atmosphere and future climate and to the declining sustainability of expanding cities."

Fletcher & McMichael (eds), 1997

In 1996, transport was responsible for 17% of Australia's net greenhouse gas emissions (Australian Greenhouse Office, 1998a). Cars were the largest single contributor, being responsible for 51% of domestic transport greenhouse gas emissions. However, light commercial vehicles and air traffic are fast growing areas.

The main direct greenhouse gases emitted are carbon dioxide, methane, nitrous oxides and chlorofluorocarbons. Other gases such as carbon monoxide, oxides of nitrogen (other than nitrous oxide), and non-methane volatile organic compounds influence atmospheric concentrations of the main gases but do not have a strong radiative effect themselves.

Per capita, Australians have the third highest greenhouse gas emissions from transport use in the world. In 1990, 3.87 tonnes of carbon dioxide per person were produced in Australia compared with 5.46 tonnes in Canada and 6.11 tonnes in the US (Australian Greenhouse Office, 1998b). One source quotes current greenhouse gas emission levels from each Australian

household as being about 20 tonnes, of which 33% emanates from cars (Smogbusters).

About 86% of the greenhouse gas emissions from the transport sector are from road transport. From 1990 to 1996, national transport emissions grew by 15% - the fastest growth of any sector – and are expected to rise by 35% by 2010 (Australian Greenhouse Office, 1998a).

Greenhouse gas emissions from road freight vehicles are projected to more than double between 1994 and 2015. Emissions from light commercial vehicles will double between 1996 and 2010, accounting for 22% of road transport emissions in 2010. There will also be significant growth in greenhouse gas emissions from articulated trucks (*ibid*).

By affecting the heat trapping properties of the lower atmosphere, greenhouse gas emissions (especially carbon dioxide) from road traffic is a major contributor to global changes in the environment. Work undertaken for the World Health Organisation suggests that these changes will have important health consequences, extending far beyond the location of traffic (McMichael et al., 1996) and current generations.

Potential health effects of climate change may be direct or indirect, immediate or delayed. While some of the anticipated effects may be beneficial (for example, warmer temperatures could reduce mortality among older people in winter), most would be adverse.

Direct effects would include changes in mortality and morbidity from heatwaves and thermal stress; impacts on respiratory health of altered concentrations of aeroallergens and of air pollutants whose production is temperature sensitive (for example, ozone); and the health consequences of extreme weather events. Indirect effects are potentially more important in health terms. They include changes in the range and activity of infectious diseases borne by vector organisms; altered transmission of infections from person to person; the nutritional and health consequences of regional changes in agricultural productivity; and consequences of rising sea levels (McMichael & Haines, 1997).

2.4 Noise

Transport is the most pervasive source of noise in the daily environment and the major source of nuisance noise (Great Britain Royal Commission on Environmental Pollution, 1994).

There are two types of traffic noise, bulk noise and individual noise. Bulk noise is due to overall traffic volumes and is influenced by speed, proximity and composition. Individual noise comes from single vehicles. Sources of noise from vehicles at low speeds are the engine, transmission and exhaust, while at higher speeds, tyre and wind noise tend to predominate.

Noise has an impact on amenity, causes annoyance and stress, and interferes with speech. Epidemiological studies have shown that noise disturbs sleep patterns and consequently mood, functioning, and symptoms (headaches, fatigue) (McMichael, 1997). It can affect attention, memory, analytical and problem-solving ability (Berglund & Landvall, 1995).

Children exposed to continuing loud noise show impaired acquisition of reading skills, attention and problem-solving ability. Adaptation strategies (tune out/ignore noise) and the efforts needed to maintain performance have been associated with high levels of stress hormones and blood pressure. There is emerging evidence of an association between hypertension and ischaemic heart diseases and high levels of noise (World Health Organisation, 1999a).

In Sydney, it is estimated that 10% of the population is exposed to 'excessively high' levels of noise (68 dB LAeq over 24 hours) and 42% to 'undesirable' levels of noise (58 dB LAeq over 24 hours) or more (ANZECC, 1992). In the European region, about 65% of the population is exposed to noise levels from 55-65 dB LAeq over 24 hours (World Health Organisation, 1999a).

The health effects of noise are influenced by location, time of day or week, and physical attributes of the site. An individual's response to noise type and level is also highly varied.

2.5 Traffic congestion

Most urban areas are facing increasing traffic congestion resulting in lengthy travel time delays, increased pollutant concentrations in densely trafficked corridors, and higher energy use.

Through its effect on pollution levels, congestion increases the risk of respiratory and other illnesses. Traffic congestion can also contribute to increased stress levels, more aggressive driver behaviour, and increased traffic and accident risks on residential streets as drivers attempt to avoid congested areas.

2.6 Physical activity

In recent decades, there has been a general and significant decline in the level of physical fitness in affluent countries while obesity in adults and children is on the rise.

In Australia, there has been a steady increase in the proportion of men and women who are overweight or obese. Women were 3kg heavier on average in 1989 than in 1980, and men were 1.7kg heavier. Recent data suggest that the trend towards increased weight has continued into the 1990s. In 1989, 9% of men were considered obese; by 1995, this had increased to 18%. A 1997 study indicated that 63% of men and 48% of women were overweight (Parker, 1998).

In the case of children, a 1985 study indicated that 3.5% were 'overweight' and a further 10% were 'at risk of being overweight' (National Health and Medical Research Council, 1997).

According to the former US Surgeon General, C Everett Koop, inactivity and obesity have reached epidemic proportions in the US where more than 60% of adults do not engage in regular physical activity and over one-third of the adult population are overweight or obese. Annual health care costs of obesity in the US, estimated by the National Institute of Medicine, approach \$100 billion a year (Seeley, 1997).

The decline in fitness and rise in obesity is the result of a significant reduction in physical activity in developed countries. Increased use of private motor vehicles for transport has contributed to a decline in walking and cycling while the introduction of new technologies in the home and workplace has dramatically reduced the amount of energy needed to be expended on daily activities.

Reduced physical activity and obesity can lead to increased risk of heart disease, stroke, osteoporosis, asthma, some types of diabetes, some forms of cancer (including breast and colon), loss of muscle mass and injury (particularly in the elderly), weakening of the immune system, hypertension, depression and anxiety (Commonwealth Department of Health and Family Services, 1998; Hillman 1994, UK Department of Health, 1996). For example:

- people who do little physical activity are 20%-100% more likely to have a heart attack than people who are moderately active;
- moderate physical activity can reduce the risk of blood clots (and hence stroke) from 67% (low activity) to 33% (moderate activity);

"In Australia, costs associated with obesity are now around \$1 billion per year, with a further \$500 million being spent by consumers on weight control programs each year...Physical activity is now the major risk factor for heart disease, which in Australia claims a life every 10 minutes."

*The Hon Dr Michael Wooldridge, MP,
Minister for Health and Aged Care,
Media Statement, 19 February, 1999*

Only 20% of Australians exercise enough for optimal heart health.

National Heart Foundation

- one-third to one-half of new cases of diabetes mellitus could be prevented by physical activity (Commonwealth Department of Health and Family Services, 1998).

The US Centres for Disease Control and Prevention estimates that 250,000 deaths (12% of total deaths in the US) are attributable to a lack of regular physical activity (Seeley, 1997).

Exercise has also been associated with increased longevity. Studies in both the US and UK have found that men who do not exercise have a much higher death rate from heart attack than those who undertake moderate or more vigorous exercise (Paffenbarger et al., 1986; Morris et al., 1990).

The dominance of cars has made many urban environments hostile to walking and cycling. Concerns for safety have prompted parents to restrict children's independent travel, thereby reducing levels of physical activity at a time when habits of regular exercise are most readily instilled. Physical and/or parental limitations on children's freedom to walk or cycle can help to determine children's attitudes to these forms of activity in later life. Active adults are much more likely to have been active children.

The focus of health promotion has been on physical activity as leisure rather than as part of the daily travel routine. Time and other pressures has meant that adherence to exercise regimes that are an 'extra' to the daily routine are often not maintained in the longer term.

Surveys indicate that the physical activities most likely to be undertaken and continued throughout life are those that are incorporated into everyday habits and lifestyle. Over 50% of the daily trips that people make are short, providing an opportunity for physical activity that does not entail an 'add-on' to a leisure or work schedule, and is free and accessible.

2.7 Social interaction

Roads and freeways divide residential communities hindering social contact. The presence of busy motorised traffic inhibits residents from socialising, and children from playing, on the street. Having an environment

that is conducive to walking contributes to a feeling of community spirit. Social connectedness and relationships are an important part of feeling secure and safe (National Heart Foundation, 1997).

Streets with heavy traffic have been associated with fewer neighbourhood social support

"Urban living would be more enjoyable without the drone of traffic, the smell of exhaust, and the danger. Bumping into someone in the street could be a welcome opportunity for interaction, not the precipitant of road rage. Less traffic might regenerate the supportive social networks of community interaction and revitalise our inner cities."

*Ian Roberts, Institute of Child Health
British Medical Journal Editorial, January 1998*

networks which has been linked to adverse health outcomes (Dora, 1999) and higher mortality and morbidity in the elderly.

Lack of flexible and accessible forms of motorised transport for people who cannot or are no longer able to drive (for example, older people and those with disabilities) increases feelings of isolation, helplessness and dependence. Distances and reduced physical capacity often preclude walking.

Through independent mobility, children learn how to make responsible decisions and how to behave in different environments, and they develop a relationship with the environment and a sense of place in their neighbourhood (Tranter, 1994; Engwicht, 1992).

Children who have the opportunity of playing unhindered by street traffic and without the presence of adults have been found to have twice as many social contacts with playmates in the immediate neighbourhood as those who could not leave their residence unaccompanied by adults due to heavy traffic (World Health Organisation, 1999a).

On the other hand, there is evidence that restricting children's freedom to get about on their own because of parental fears about safety can have harmful effects on their physical, social and emotional development (Hillman et al., 1991; Hillman, 1993a; Tranter, 1994).

The priority given to motorists on residential streets over other users bears no relation to usage. Interaction between neighbours, children playing and riding bikes, strolling, standing and sitting is responsible for 90% of the time that people spend on the street (Gehi, 1980). Coming and going by car takes up only 3% of time (Parker, 1995b).

2.8 Water and soil pollution

Transport accidents with dangerous goods can lead to localised environment and health risks from contamination of air, water and soil.

Photochemical oxidants and acid aerosols adversely affect crops and waterways which may then affect food and water supplies.

Transport infrastructure, heavy metals from vehicle exhaust, vehicle waste (tyres, batteries, old cars), fuel spillages, oil runoff from roads as well as tyre and road abrasion, can contaminate soil and ground water which may in turn affect drinking water and agricultural products (World Health Organisation, 1999a). It is estimated that, nationally, approximately 100 million litres of used lubricating oil is not accounted for each year (Australian Institute of Petroleum, 1998).

2.9 Groups at higher risk

The health effects of transport are not evenly distributed across the population. Groups at higher risk of traffic-related accident, injury or illness include:

- (a) the elderly, frail and those already ill;
- (b) children and young people;
- (c) people with disabilities, sight or hearing impairments;
- (d) people who ride motorbikes or bicycles or who walk because of financial or other

reasons;

- (e) people who live or work in areas where there are higher levels of air pollution and noise (due, for example, to specific geographical and topographical conditions and settlement characteristics).

Many disbenefits of transport can accumulate in the same communities, often those that already have the poorest socioeconomic and health status. The lack of access to transport is part of a pattern of deprivation in low income areas that has major and measurable health impacts. Studies have shown that localities with poor living conditions and deprivation of basic services (including transport) have significantly higher mortality and morbidity rates than areas with good living conditions (Goldstein, 1997).

Mobility, transport and pollution was identified in the UK Acheson Report on Inequalities in Health as one area for future policy development based on its potential impact on health inequalities and the weight of evidence (UK Department of Health, 1998). After 12 months investigation, the Inquiry concluded that unacceptable inequalities in health persist despite a fall in average mortality over the past 50 years, and that the weight of scientific evidence supports a socioeconomic explanation of health inequalities.

According to the evidence reviewed by the Inquiry, lack of access to transport is experienced disproportionately by women, children, people with disabilities, people from minority ethnic groups, older people and people with low socioeconomic status, especially those living in remote rural areas. It can result in limited work and training opportunities; higher prices and restricted range of goods for people unable to access larger retail outlets; limited access to health care facilities, particularly for people in rural areas; access to fewer places and activities for people with physical disabilities.

Disadvantaged urban areas tend to be characterised by high traffic volumes leading to increased levels of air pollution; higher rates of road traffic accidents; feelings of insecurity, especially amongst families with children and

older people; and lower levels of non-street level activity.

Evidence available to the Inquiry indicated that pedestrian injury death rates for children in the UK in social class V are 5 times higher than for those in social class I (Roberts & Power, 1996). Some disadvantaged groups, for example, children from families without a car, are more likely to walk and to cross more roads than those with access to a car, and are therefore more exposed to higher risks of a pedestrian accident. The risk of injury for children in families without a car is twice that of children in car owning families (Roberts et al., 1995). Based on the evidence, the Inquiry recommended the Government take further measures

to encourage walking and cycling, to increase safety of these modes, and to reduce the usage of motor vehicles (UK Department of Health, 1998).

The higher increase in public transport fares in the UK relative to motoring costs, particularly post-deregulation, has had most impact on those with lowest incomes, leading to a decline in journeys by the least well-off. In South Yorkshire where bus fares after de-regulation

support networks suffered as travel to undertake informal caring roles became more difficult, resulting in increased applications for support services (for example, home care) (*ibid*).

Older people and people with disabilities are more likely to have low incomes and to be reliant on public transport. The price of public transport is, therefore, critical to their mobility. The Inquiry considered that a high quality, affordable public transport system integrated with other forms of transport is crucial to the reduction of inequalities in health (*ibid*).