

Why worry about urban transport?

Maybe you are not convinced that urban transport needs fixing? Let's take a look at some of the negative impacts of urban transport policies gone wrong.

Links with many other issues

Or maybe you are thinking that transport issues are not your main concern. In this section we explore links between transport and various other issues and perspectives. Transport is relevant to organisations and activists with various concerns, including housing, poverty, consumer, disability, women's issues, the aged, children, health, safety, the local environment, the global environment, urban heritage, health/safety, good governance, or economic efficiency.

Social Equity

- Do low-income earners have the same transport options as those with higher incomes?*
- Do women have the same transportation needs as men?*
- What transport problems do children face?*
- Can people with disabilities move about the city?*

Poor access can prevent people from securing their most basic needs and rights: the right to enough food, adequate shelter, good health, a basic education, etc. In many cities, the vast majority of the population face some kind of transport disadvantage.

People who are economically, physically, and socially disadvantaged are harmed by a transport policy that focuses solely on economic efficiency and by an automobile-focused transport system that does not meet their travel needs. They tend to suffer a disproportionate share of external costs, since they can afford less protection against traffic impacts.

Transport problems of the poor

Poor mobility is not only an effect, but also a cause of poverty.

People living in poverty make fewer trips covering shorter distances but take more time to do so than higher-income people (UNDP, 1998). Time and money spent travelling cannot be spent on income-generating activities, so poor mobility is not only an effect, but also a cause of poverty.

Barter, Paul A. (1999) "Transport and Urban Poverty in Asia: A Brief Introduction to the Key Issues", Regional Development Dialogue, Vol. 20, No. 1, Spring 1999.

The poor can spend long hours and a high proportion of their income meeting basic mobility needs. Reducing this mobility burden is critical to lifting the poor out of poverty. In developing countries more than half the trips made by the poor are made by walking, and the balance are by public transport or some form of non-motorised transport like a bicycle. For instance, in Jakarta in 1985, walking accounted for almost 60% of all trips taken by the lower-income half of the population.

For low-income people in many Asian cities even public transport fares are unaffordable or are a very great burden.

In Jakarta in 1990, 14% of households could afford only 20 bus tickets or less per month, and 40 percent could afford only 53 (Source: consultants' study). Many poor households in Asia are already rationing their use of public transport, reducing their ability to earn income or break free from poverty.



"Transport strategies and programs can be designed to provide the poor with better physical access to employment, education, and health services. For the urban poor, adequate public transport, including the services of the informal sector and non-motorized transport, is essential" (World Bank, 1996 p. 72)

Improvement to non-motorised transport is one of the most effective ways to help the poor. For the very poor, making the walking environment safer and more convenient will dramatically improve their ability to move around the city.

Improving the cycling environment and making bikes more affordable can have even more dramatic impacts on poverty reduction given the longer distances which can be covered on bicycle compared to foot and the freight and passenger transport features of bicycles. A significant barrier is the up-front cost of a bicycle. Tariff reforms and micro-credit schemes can play a role in overcoming this problem, as they are beginning to in Bangladesh.

In many low-income settlements a lack of basic services is one reason for the transport burden on the poor. In these cases, non-transport solutions can help. Providing piped water, sanitation and electricity for instance, will immediately reduce the transport burden on the poor in such settlements.

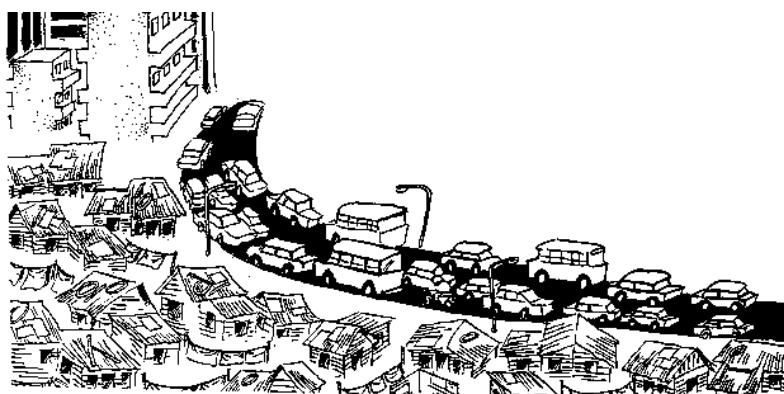
Physical Displacement

One example of a community which successfully organised against eviction is Lyari Nada in Karachi. About 30,000 houses were to be affected by the proposed Lyari Expressway. A Karachi NGO, the Urban Resource Centre, assisted the community to successfully fight the plan.

Transport infrastructure projects frequently require the acquisition of land and the removal and resettlement of residents. The need to acquire land is often greatest for large roads and their interchanges, which require huge amounts of space in already built-up areas.

Transport appears to account for a significant proportion of the estimated 200,000 to 300,000 families suffering forced eviction in Asia each year. The force used in these evictions is sometimes brutal. Frequently, insufficient compensation is offered nor suitable alternative accommodation provided. Often there is no consultation or negotiation with the affected community.

The UN has called forced evictions "a gross violation of human rights." The urban poor, who often lack secure tenure to the land or homes they occupy, are most vulnerable to such evictions. Rights-of-way are more likely to be routed through low-income settlements because the land there is 'cheap'.



Sabariah Jais



☒ [Asian Coalition for Housing Rights \(ACHR\)](#) is an Asia-wide network which lobbies against unjust evictions.

People who have been removed often end up on the city's fringe. The shift to the outskirts means their transport time and costs sky-rocket and access to income-earning opportunities is reduced. Social networks are broken as communities disperse.

Access to affordable transport is important to the livelihoods of the urban poor. A survey by the NGO, SPARC, of pavement dwellers in central Bombay showed that 80% walked to work. Their choice came down to: "They were willing to live in congested dwellings without safety or security just so they could walk to work".

CREATIVELY FIGHTING TRANSPORT-RELATED FORCED EVICTIONS IN MANILA.

When local government didn't respond to protests over large-scale forced evictions in Manila an association of poor people's organisations, called DAMPA, called on the Japanese Government to investigate violations of the rights of people displaced by Japanese-funded public projects, including a highway flyover, an aqueduct, a railway extension, and an airport expansion. The Philippines and Japan are both signatories to international treaties which prohibit funding of projects which violate the rights of displaced residents. In March 1996, a Japanese fact-finding team, including church, academic and NGO representatives, made a much-publicised visit to Manila. They found that: people were evicted without prior consultation or notice; in relocation sites, people were left without basic services, water, electricity, schools and hospitals; people lost jobs in the relocation process; people were taken to relocation sites without choice of where to go, resulting in community disorganisation; implementing agencies reneged on promises of compensation, support services. The mission's findings came out in all the local newspapers, along with its recommendations to OECF: affected people, especially the poor, must be included in planning relocation programmes, and some of the project budgets should be allocated for relocation of displaced residents. The OECF promised to cancel funding for projects involving involuntary resettlement, and to investigate complaints of affected residents and rights violations. [Source: Asian Coalition for Housing Rights, 73 Soi Sonthiwattana 4, Ladprao 110, Ladprao Rd, Bangkok 10310, Thailand. Fax: 662 539 9950, E-mail: achrsec@email.ksc.net].

Women and transport

☒ [Institute for Transportation and Development Policy \(ITDP\)](#) and the [International Forum for Rural Transport and Development \(IFRTD\)](#) - both organisations have done investigations into gender and transport.

Gender issues in the transport field have been severely neglected.

The transport planning profession is male-dominated with a generally low awareness of problems faced by women. It is surprising and perhaps shocking that women have rarely been considered a distinct 'transportation user group' with distinct travel needs and preferences.

Women, by and large are the primary care givers in families, caring for children, ageing parents and family members with disabilities. Therefore, when we speak about a transportation system that does not serve the needs of children, the frail or the disabled, women will be disproportionately disadvantaged by it.

Women's Multiple Roles

The different tasks that women perform and their weaker access to and control of resources add up to a very different set of transport demands and patterns, on average, compared with men.

Women also, in general, do most of the household and community maintenance. These activities can range from carting water and buying food to "social and community maintenance" activities—visiting sick relatives, assisting neighbours, belonging to community organisations, etc. These responsibilities generally also fall on women who do paid work outside the home or head households without the support of a spouse.

A large proportion of the trips made by women are in categories conventionally and wrongly regarded as "not essential" since they are not associated with formal paid work.

Most transportation planning today focuses on the peak hour commute associated with formal sector paid employment. Usually, though not always, these flows of labour are dominated by men.

Women, on the other hand, tend to travel outside of peak periods. Their travel is often focused on meeting household needs. In poorer





International Forum for Rural Transport and Development (IFRTD)

urban households and in rural areas household travel burdens may include trips to collect water and fuel or to remove solid waste. Other mobility needs may centre on getting to work, bringing children to schools, visiting health facilities, shopping for basic household needs, and transporting goods. "Trip chaining" (joining many trips into one) means women are often handling luggage and children at the same time.

In Brazil, recent studies showed that employed women had longer trips, changed modes of transport more often than men, and spent 60 minutes getting to work versus 45 minutes for men. Furthermore, on average, women had to take 2 buses while men only had to take one (Mainstreaming Gender in Transportation Projects: A toolkit. World Bank. April 1997. p.5).

Gender and poverty – disadvantage compounded

📖 World Bank (April 1997) Mainstreaming Gender in Transportation Projects: A toolkit.

Rarely is any poverty analysis done in transport planning. Even more rarely is there any systematic gender inclusion procedures for transport - from training of professionals, to participation of users, to the design and planning of systems, services, and equipment.

The poorer a woman is, the less able she is to 'buy' help, the more complex her travel and transport schedule. For instance, she can not pay to have a bus pick up her child, she cannot afford piped water, and she cannot hire a pedicab to transport goods from the market.

🌐 GENDER AND TRANSPORT web-site maintained by Jeff Turner, University of Manchester: <http://www.art.man.ac.uk/transres>

In 1995, women were estimated to account for 70% of those living in poverty worldwide. Therefore, transport systems and services that do not meet the needs of the poor are disproportionately affecting women and their dependants.

"The lower the income of a household the more probable it is that women will experience greater transport deprivation as compared to men. Transport deprivation may take the form of women's use of inferior modes of transport as compared to men; it may take the form of women's journeys having multiple purposes and thus generating greater anxiety in the travel context; it may take the form of customary or legal constraint on women's right to travel or to use a particular transport mode" (Grieco and Turner 1997).

These factors combine to make low-income women significantly less mobile than men in the same socio-economic group. This in turn has very negative implications for women's ability to break out of poverty and increase the well-being of both themselves and their families.

Social Norms Affecting Women's Access to Transport

Significant social barriers exist to women's mobility. In some societies there are norms that discourage or even prevent women from riding bicycles or motorbikes or driving cars. Even where such taboos do not exist, it is commonplace that when a vehicle is available to a family, it is a man who has greatest access to it. Efforts to increase the mobility of women sometimes face stiff resistance to those who feel threatened or offended by such empowerment.



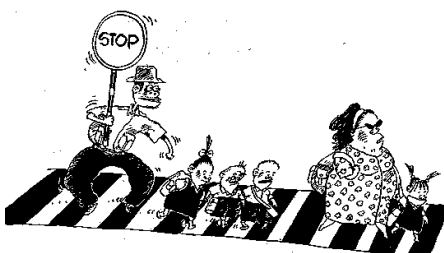
Sexual harassment

Sexual harassment, and the fear of it, can further inhibit women's mobility. Overcrowded buses and trains, isolated bus stops, poorly lit footpaths, and pedestrian bridges or underpasses can be places of anxiety or fear for women.

To address sexual harassment public transport, some cities have tried to segregate men and women. Bombay and Mexico City have certain train cars reserved for women during the peak-hour commute period when over-crowding is particularly severe. Dhaka has experimented with buses with 6 front seats reserved for women. Problems have developed, because once reserved seats are filled, women are often refused entry. Calls for women-only buses have been heard but such a bus service will tend to be infrequent and women will have lengthy waits.

Children's Mobility

▣ Hillman, H., Adams, J. and Whitelegg, J. (1990). "One False Move: A Study of Children's Independent Mobility". London: Policy Studies Institute.



Source: Cabai in "Ideas for Action - Making Urban Areas Child-Friendly".

▣ Tranter, P. J. (1993). "Children's Mobility in Canberra: Confinement or Independence?" (Monograph Series No. 7). Department of Geography and Oceanography, University College, Australian Defence Force Academy.

It is a paradox that as cities and towns motorise, children's independent mobility declines. Adults remember fondly when they used to walk or ride bicycles to school. They remember playing in the street and being quite safe. Children make up a large proportion of the population in most low-income and middle-income countries.

Today's children face a very different reality in many traffic-saturated urban centres. The freedom to travel, explore and play independently outside the home is restricted. The street has become a dangerous environment for children. Aggressive drivers, fast-moving traffic, unsafe pedestrian environments, pollution, and noise, make getting around not only difficult for children but extremely dangerous.

Children are becoming more and more dependent on adults, usually parents, to help them move around, even to get to school. Some parents already burdened by other responsibilities, do not have the time or the financial resources to take on the burden (or paying someone else to) of transporting their children.

For poor urban children the situation is aggravated. Often, low-income settlements are situated on marginal land in areas exposed to pollution, noise and traffic danger. Many low-income children work to contribute to their family's earnings. Children working as street vendors face high direct exposure to risk.

The cost of transporting child to and from school is often a burden for low-income households. Therefore, if access to school is difficult children may stop attending. As girls shoulder a disproportionate share of household work they are left with less time for other activities such as travelling to school or finishing homework. When school is too far and there is no affordable transportation, the girl child will often be the first to forgo her education.

Child Poverty

Access and mobility for the frail and people with disabilities

✉ [Access Exchange International](#) is an international voluntary organisation that promotes accessible transportation for people with disabilities.

📄 "Mobility for All: Accessible Transportation Around the World", an excellent introduction to this issue, with an international perspective, by Access Exchange International
<http://www.independentliving.org/mobility/index.html>

✉ [Social Development Division, UN-ESCAP](#), Bangkok. Contact: Ms SAN Yuenwah.

People with disabilities and frail aged people need transport to get to work, school, recreation, medical services, etc. Public transport and urban street environments needs to become more accessible to blind people, those who are partially sighted, people with mobility and cognitive impairments, people who are deaf, deafened or hard-of-hearing. For people with disabilities (as for all of us), maintaining autonomy and self-sufficiency is crucial for self-respect, for livelihoods, and the ability to earn income.

In many countries in Asia and elsewhere significant percentages of the population have some kind of disability or frailty. Certain countries have particularly high numbers, perhaps as a result of wars or previous epidemics (of polio for example). In all countries many aged people face mobility problems, and make up a increasing proportion of the population. With improved health and development, they will become an even more important group who transportation planners will have to take into account.

"In Sri Lanka, public transport is unimaginable for the disabled... There is not a single bus or train in Sri Lanka that could accommodate a wheel chair.... It is generally estimated that over 50,000 disabled persons are in need of special transport facilities to attend schools and other educational institutions, proceed to places of employment, visit clinics, hospitals, places of religious worship and also for other personal visits... Problems being faced by the disabled are numerous, to begin with, due to transport and mobility problems the young disabled are denied basic education. Parents do sometimes take their child to school the first four years of primary school, but when the child grows big and becomes heavy to carry, that becomes the end of the child's education, hence the great number of illiterate disabled persons in the country." (T. Jayasingzhe, "Mobility Denied for Disabled in Sri Lanka", p.371-373)

Health and Safety



Traffic kills

✉ Transport Research & Injury Prevention Programme (TRI PP), Indian Institute of Technology, New Delhi, India

An urban transport system dominated by cars and motorbikes is bad for our health. We all recognise that the pollution coming from their tailpipes is choking us.

But dependence on cars and motorbikes for transport also translates into more road deaths, increased noise throughout the city, sedentary lifestyles and psychological stress related to increased "road rage". Many of these impacts tend to fall most heavily on those who use cars and motorcycles the least: women, children, the elderly and the urban poor.

Motorised traffic is dangerous, especially to vulnerable road users, such as pedestrians.

Traffic accidents cause at least 500,000 deaths every year. Traffic accidents "already cost the South almost as much as all the aid they receive". By 2020, traffic accidents are expected to become the third largest cause of disability and premature death after clinical depression and heart disease and way ahead of war or HIV which gain more attention. [Astrid Noklebye Heiberg, president of the International Federation of Red Cross and Red Crescent Societies, 1998].



Road deaths per vehicle kilometre is a misleading measure - deaths per 100,000 people is a fairer indicator

Variations in road death rates between different cities

MYTH: "Cars are safer than bikes".

FACT: Maybe car-occupants tend to be safer than cyclists per kilometre travelled but car dominated cities are NOT safer than cities with very high bicycle use.



SPEED KILLS - although car drivers may feel quite safe inside their high-technology machines, high speeds dramatically increase the risks for pedestrians and other vulnerable road users.

The best measure of the total impact of road deaths in a society is the number of deaths per capita (usually expressed as the number of road deaths per 100,000 people). Unfortunately, road safety is often compared using numbers of deaths per kilometre of vehicle travel. This is misleading. Deaths per 100,000 people depend on a combination of both the deaths per vehicle kilometre and the total amount of vehicle travel.

Cities with good transport balance tend to have lower rates of transport deaths per 100,000 people than those that are highly dependent on private transport. For example, Hong Kong and Singapore, where public transport is dominant, are safe cities. Amsterdam, Copenhagen and Tokyo with very high bicycle use are safe - which contradicts the argument that is often heard, that we should not promote bicycles because they are not safe. And American cities have high rates of road deaths per 100,000 people despite high standards of transport engineering and enforcement. The sheer volume of driving in US cities leads to very high levels of deaths.

Low-income countries tend to have very high rates of deaths per vehicle kilometre (many times the rates in high-income cities). But they nevertheless have low rates of road deaths (about 6 deaths per 100,000 people) because such countries tend to have so few vehicles per person.

Middle-income countries, such as Malaysia, Thailand, Taiwan and Korea, have high rates of death per vehicle kilometre (although not as high as in low-income countries) but they can also have significant levels of vehicle use overall. These two factors combine to give such countries (and their cities) the highest rates of road deaths per 100,000 people, of over 20 deaths per 100,000 persons per year, higher than either low-income or high-income countries (Kenworthy, Laube, Newman and Barter, 1997).

The urban poor are especially vulnerable to traffic danger. In low-income cities, vulnerable road users (pedestrians, bicyclists and motorcyclists) comprise a high proportion of road fatalities and the poor are disproportionately represented in these vulnerable road user groups. Car occupants are a tiny proportion of road deaths in low-income cities.

The probability of death for pedestrians struck by a vehicle at different speeds:

At 65 km/hr, 85% die,

at 50 km/hr, 45% die,

at a "traffic calmed" speed of 30 km/hr only 5% die.

[Rajesh Patel, Geetam Tiwari and Dinesh Mohan (1994). Introduction to Traffic Calming", WHO Collab. Centre for Research and Training in Safety Technology, IIT, New Delhi].



Air pollution and health

Urban transport is a major contributor to air pollution in cities and towns. Many of the pollutants have severe health impacts.

The World Health Organisation On Air Pollution

Air pollution can adversely affect human health, not only by direct inhalation, but also indirectly by other exposure routes, such as drinking water contamination, food contamination and skin transfer.

Most of the traditional air pollutants directly affect the respiratory and cardiovascular systems...

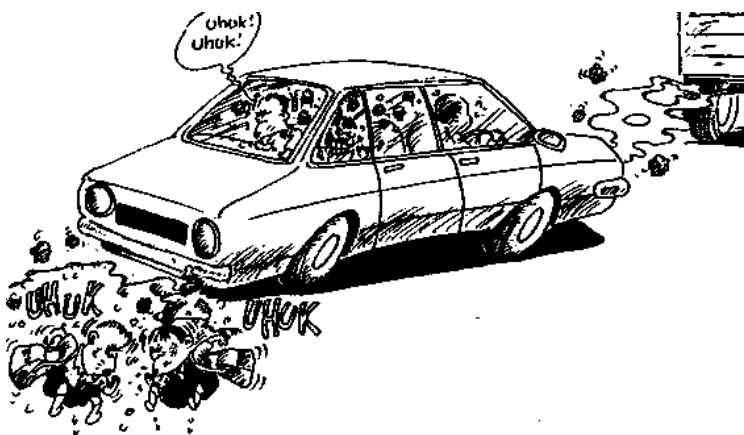
The direct human health effects of air pollution vary according to both the intensity and the duration of exposure and also with the health status of the population exposed. Certain sectors of the population may be at greater risk, for example, the young and the elderly, those already suffering from respiratory and cardiopulmonary disease, hyper-responders and people exercising.

At the present time, assessment of air quality for public health purposes consists essentially of examining ambient air quality against established guidelines. The WHO has recommended air quality guidelines for a wide range of pollutants; these guidelines indicate the level and exposure time at which no adverse effects on human health are expected to occur. Many countries set their own national air quality standards which are primarily designed to protect human health and are legally enforced. (UNEP/WHO 1992, p.11)

"The ability to breathe fresh air should be a guaranteed basic right." Friends of the Earth, 1997, in "Unlocking the Gridlock: the key to a new transport policy". FoE discussion paper.

We are NOT safe from air pollution inside air-conditioned vehicles!

Environmental Transport Association Trust (ETA), <http://www.eta.co.uk/>



Source: Cabai in "Ideas for Action - Making Urban Areas Child-Friendly".

The Environmental Transport Association Trust (ETA) of United Kingdom has completed a study which concludes that air pollution inside cars can be up to five times greater than background concentrations. Pedestrians and cyclists are usually exposed to lower concentrations of pollutants because they tend to be at the side of the road rather than in the middle. Car users are, in effect, travelling in a tunnel of pollutants. Factors that increase levels of pollutants in cars include low wind speeds, slow moving traffic, vehicle age and faulty exhaust systems. A similar study in Australia found benzene levels in cars up to 11 times greater than ambient levels. For older cars without catalytic converters, exposure was up to 27 times greater during urban commuting trips. This suggests that the pollution levels in cars relate to a combination of emissions from the cars own exhaust emissions and those from other vehicles on the road. [Source: Air Quality Issues, Vol. 3, Issue 3, January 1998. Atmospheric Research and Information Centre, Email: aric@mmu.ac.uk, <http://www.doc.mmu.ac.uk/aric/arichome.html>]



Health Effect of Vehicle Emissions

Substance	Source	Health Effect
Carbon Dioxide (CO ₂)	Fossil fuel combustion	Secondary effects associated with global warming; potential of increased disease
Nitrogen Oxides (NO _x)	Fossil fuels; old/faulty catalytic converters	Increased susceptibility to viral infections, lung irritant causing bronchitis and pneumonia, premature mortality
Volatile organic compounds (eg benzene)	Incomplete combustion; fuel vapours	Drowsiness, eye irritation, cancer-causing, neurotoxic effects
Smog (ground level ozone)	Reaction of NO _x and hydrocarbons	Temporary breathing difficulty, long term lung damage, reduced immunity, increased hospitalisations
Lead	Petrol additive	Inhibits neural development, causes brain damage, particularly in the young.
Particulate matter (PM _{2.5} and PM ₁₀)	Fossil fuel combustion, particularly diesel	Cardiovascular disease, respiratory disease, particularly in the young and elderly
Sulfur Oxides (SO _x)	Operation and leaking of car air conditioners	Helps form acidic aerosol sulfates which penetrate deep into lungs and cause damage
Carbon Monoxide (CO)	Fossil fuel combustion	Hampers ability of blood to carry oxygen, exacerbates heart disease, drowsiness, compromises brain function and foetal development

Air pollution is severe in many Asian cities and towns

Many Asian cities face air pollution problems that are among the most severe in the world. This is due to an unfortunate combination of low-quality fuels, poorly maintained engines, low standards for vehicle emissions, high urban densities, and in some cases, topography and climatic conditions that reduce dispersal of pollutants.

Air pollution and children

Children are particularly vulnerable to illness and disease caused by motorised vehicle emissions and the chemical and particulate content of these emissions.

WARNING! *The World Bank has warned that as many as 18 million children may face permanent brain damage due to excessive lead in the body.*

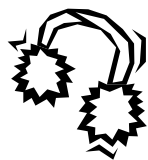
Respiratory disease is common among children in polluted urban environments where motorised vehicles are the principal source of 'poisoned' air. Because children's lungs are still developing, they breathe faster and inhale more toxins and suspended particulate matter than adults do. Like their lungs, children's bodies and brains are still developing. Exposure to dioxins and toxic metals from the exhaust fumes of cars is extremely detrimental to children's physical and mental health.

Lead is particularly concerning and a continuing problem in Asia where leaded fuels continue to be used in a number of countries. Children are more vulnerable to lead emissions than adults because they can absorb as much as 50 per cent of ingested lead compared to 8-10 per cent in the adult population. Long-term exposure to lead hampers development of children's brains. It is associated with behavioural and learning disabilities, hearing impairment, reduced attention span, and drops in IQ levels.



Noise


According to the WHO Draft Charter on Transport, Environment and Health:




- ! **Transport, and in particular road traffic, is the main cause of human exposure to ambient noise.**
- ! *About 65% of the European population is estimated to be exposed to noise levels leading to serious annoyance, speech interference and sleep disturbance (55-65 dBLAeq over 24 hours).*
- ! *Children chronically exposed to loud noise (e.g. in the proximity of airports) 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.*

Dangers of a sedentary lifestyle

Pedestrian-friendly and bicycle-friendly cities make it easier for people to remain physically active as an incidental part of their day.

 British Medical Association (BMA) (1992) "Cycling towards health and safety" (Oxford University Press, Oxford, New York)

Some health authorities are reluctant to promote cycling (and even walking) because of traffic danger. However, a study commissioned by the British Medical Association (BMA) found that the benefits of bicycle riding in terms of reduced danger of disease from being more physically active far outweighed the added risk from accidents.

 Roberts, I., Owen, H. Lumb, P. and MacDougall, C. (1995) "Pedalling Health - health benefits of a modal transport shift". ISBN: 0 7308 0741 X (Contact: Bicycle Institute of South Australia - BISA) <http://www.science.adelaide.edu.au/slate/demos/cyhealth.pdf>

The growth in the use of private vehicles is leading many people in towns to increasingly live a lifestyle with very little physical activity. Such a sedentary lifestyle - one with little walking, cycling or any other exertion - takes a great long-term toll on health. Conversely, exercise bestows many health benefits, including a general feeling of well-being and helping to prevent depression. Failure to get enough exercise is linked with coronary heart disease, stroke, obesity and maturity-onset diabetes. All of these diseases are rising rapidly in middle-income Asian countries and among the wealthy of low-income countries.

The health benefits of regular physical activity can be summarized as:

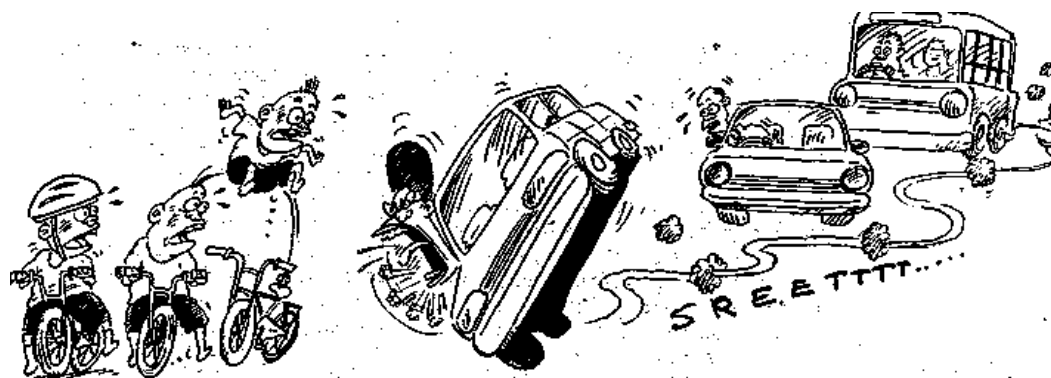
- ! **50% reduction** in the risk of developing coronary heart diseases (i.e. a similar effect to not smoking);
- ! **50% reduction** in the risk of developing adult diabetes;
- ! **50% reduction** in the risk of becoming obese;
- ! **30% reduction** in the risk of developing hypertension;
- ! **10/8 mm Hg decline** in blood pressure in hypertensive subjects (ie a similar effect to that obtained from antihypertensive drugs).
- ! *Other effects include reduced osteoporosis, relief of symptoms of depression and anxiety, and the prevention of falls in the elderly. (WHO)*

The dangers of a sedentary lifestyle are starting with our children. For example, the walk to school is under threat from lifestyle changes, rise in car ownership and the increasing fear of traffic danger, molestation and abduction. Increasingly, if they can afford to, parents drive their children to school to protect them from danger, but they are actually increasing the risks of obesity and dependency.



Road rage

The phenomenon of road rage has made headlines in many countries recently. Heavy motorised traffic is extremely stressful and creates intense frustrations among drivers, passengers, pedestrians and cyclists alike. Traffic noise further adds to the problem. The toll on mental health and the sense of community and on work-place productivity in our cities and towns is difficult to measure but it must be high.



Source: Cabai in "Ideas for Action - Making Urban Areas Child-Friendly"

It is a popular prejudice that people change when they get behind the wheel. Whether they change or just display characteristics usually submerged in the normative niceties of social intercourse, the behaviour of drivers displays an anarchic, aggressive and anti-social tendency which would earn them ostracism (if not a thick ear) when on foot. It seems likely that some of these tendencies are encouraged by a degree of sensory and social isolation which gives the illusion of separation from a social context, such that the usual obligations and empathies of everyday life are suspended.

Imagine a pedestrian behaving like many drivers:

- *Manoeuvring close behind another pedestrian and maintaining the same speed meanwhile flashing a flashlight at them.*
- *After being overtaken by another pedestrian, speeding up and then immediately pulling up in front of her.*
- *On rainy days splashing water over people standing at the kerbside.*
- *If about to be passed by another pedestrian, speeding up, whereupon the other will also speed up and so on, until both are proceeding along the footpath at breakneck speed, endangering other pedestrians.*
- *Walking along the street making obscene gestures, swearing at other pedestrians merely for being there and criticising the way they walk.*

If these behaviours were indulged in by pedestrians they would be regarded as evidence of severe mental disorder! A car appears to engender a feeling of privacy, even though it is in the public domain, and a feeling of urgency, even though none exists. (By Sonia Hunt, FOE UK)

Quality of life and community

An over-emphasis on private motor vehicles is a major factor in a general decline of urban quality of life and sense of community.

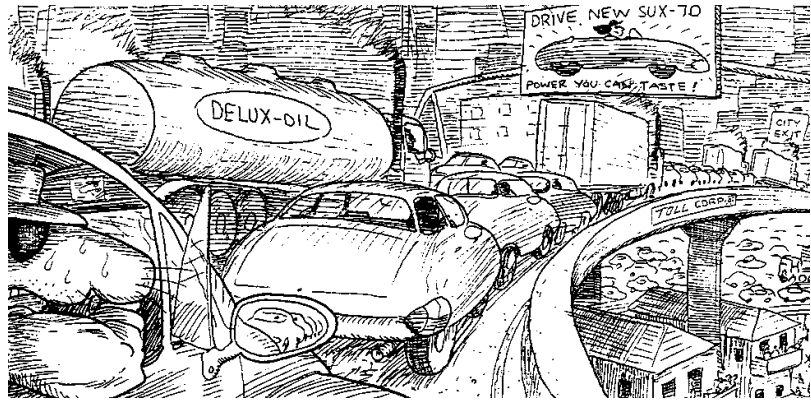
Severance of communities

Road projects frequently sever communities, making schools, shops, and services inaccessible to households on the "wrong" side of the barrier. Where insufficient allowance is made for crossing of the new roadway, severe dislocation results.

Community ties of mutual aid and support are an important cushion for the poor against their vulnerability to unforeseen mishaps, such as illness or accident. But new transport infrastructure can destroy long-established communities or create barriers within them.



The poor, who control little private space in the city, are also particularly dependent on the “commons”, including public spaces, such as streets, alleys, paths, parks and squares. Traffic and cars (both moving and parked) usurp an enormous amount of urban public space, thus adding to the already highly inequitable distribution of space (both private and public) in most cities.



From "Roads of Doom" Les Robinson and Comrade Zhukov (LinkUp)

Space invasion

It has been estimated that in car-oriented cities, between 30% and 50% of all urban land is devoted to cars and car-related land-uses.

One single occupant car requires 75 times the amount of urban space as a pedestrian, 20 times that of a cyclist, and 13-40 times that of rail transit (Whitelegg 1993).

Whitelegg, J. (1993). *Transport for a Sustainable Future: The Case for Europe*. London: Belhaven Press.

Private vehicles, especially cars, are the most space-consuming of all of the urban modes of transport. Roads, parking lots, on-street parking, expressways, toll plazas, road interchanges and bridges take up vast amounts of urban space. As cities become more automobile dependent, and road speeds increase, the amount of space taken up for motor infrastructure increases dramatically.

In Asian cities, including Manila, Jakarta, Delhi and others, most road space is occupied by private cars and motorcycles, while the great majority of passengers are still moved by buses and jitneys, which take much less than half of the road space.

In China Walter Hook (1994, p.11) observed:

"...in Beijing roughly 56% of the road space was being consumed by private vehicles, company cars and taxis, although these moved less than 10% of the passengers. More than 90% of the motorised passenger traffic was moved by the bus fleet, while consuming only 25% of the road space. Meanwhile, the bicycle lane was not in gridlock, but continued to move at 6-8 km/hr, and moved more than 900 more people per lane hour than the current mixed motor vehicle lanes."

Space saving is one of the biggest benefits that has come to cities that have improved their balance of transport priorities. When less space is devoted to roads and parking then public spaces can be opened up for greenery and community life.

In fact, when traffic is made to move slowly it becomes possible for pedestrians to mingle with traffic and for children to play in the streets again. "Traffic calming" slows down traffic so that streets can become **shared** spaces that are not just for motor vehicles.



Destruction of built heritage

The rapid increase in private motor vehicles wreaks havoc and destruction on the fragile fabric of historic urban areas. Heritage buildings, old trees and public spaces are "sacrificed" for new roads, road-widening and car parking space.

Modern commercial buildings and housing, with "proper" car-access and car-parking are often perceived as good developments, whereas traditional vernacular buildings that front directly onto streets are perceived as obsolete. The viability of traditional buildings, such as shop-houses (both as residences and businesses), is impaired due to incessant traffic congestion, pollution and lack of pedestrian amenities.

Phuket Built Heritage Threatened by Road Widening

✉ [AWPNUC - Asia & West Pacific Network for Urban Conservation](#)

An example of these problems is Phuket old town in southern Thailand which has significant vernacular built heritage with a concentration of 80 to 100 year-old shop-houses in a Chinese style blended with Portuguese influences. The character of the district is threatened by the 1990 designation of the area as a 'high density commercial zone' where narrow roads are to be widened. New buildings are required to be set back behind the current building line, in order to reserve land for future wider streets. This is creating an ugly bump-and-dent street facade. Heritage advocates object that the road widening proposal is impractical. Since 1994, local people, NGOs and consultants have been successfully lobbying the municipal government to enact a conservation program for the area.

Crime

There are several connections between transport policy and crime

Transport issues overlap with urban safety and crime prevention in several ways. Heavy traffic on a street can cause it to become desolate and devoid of pedestrians or of informal surveillance, increasing the risk and fear of crime. Inappropriate pedestrian facilities, such as desolate pedestrian tunnels or overhead bridges, can become havens for attackers.

Poor street lighting effects low-income areas more than higher income areas and contributes to poor road safety as well as curtailing the after-dark movements of many people (especially women) for fear of crime.

📖 Wekerle and Whitzman (1995) "Safe Cities: Guidelines for Planning, Design and Management", Van Nostrand Reinhold.

Conversely, an over-obsession with security against crime can create an urban environment full of fences and walls which hinder pedestrians.


📖 Social Research Associates (1999) *Personal Security Issues in Pedestrian Journeys*, UK Department of the Environment, Transport and the Regions (London) <http://www.mobility-unit.detr.gov.uk/psi>

Crime and fear of crime can also be a barrier to people using city-friendly modes of transport. Bicycle theft is a barrier to cycling by the poor who fear the loss of what is to them a very valuable asset. Crime and harassment on public transport vehicles and while waiting for public transport is a problem in many cities, especially for women even to the extent of preventing them from using buses in some cases.



Economy and low cost

Automobile dependency is extremely expensive

 Newman, P. and Kenworthy, J. (1999) Sustainability and Cities: Overcoming Automobile Dependence (Island Press, Washington, D.C.).

Low-cost ≠ second class

Urban rail systems are not usually affordable in low-income cities but a low-cost strategy of restraining private vehicles and promoting public transport can set a city on a path which leads eventually to rail systems, when the city can afford it.

Urban transport infrastructure, operating costs and external costs can be a large drain on economies, especially low-income economies. And an over-emphasis on private vehicles and large roads is the most expensive of all transport strategies - for both the government and the private household. Both become locked into owning and operating an enormous stock of infrastructure and equipment (roads by the government and vehicles by private individuals). For countries which depend on imported oil, this cost can become a significant drain on the trade balance.

A recent comparative study suggests that car-dominated American and Australian cities spend a much higher proportion of their wealth on transport than cities with more balanced transport systems in Europe and the richer parts of Asia.

A low-cost approach to urban transport is highly compatible with social equity, economic efficiency, an emphasis on ecological sustainability and with the creation of highly livable and attractive cities. **A low-cost, pro-poor approach is not a second class transport approach.**

In fact, the real failure is the city which spends all of its scarce investment resources on a few mega-projects but which never meets the transport needs of the majority of the people.

A number of cities that are now wealthy and have also retained successful public transport had earlier adopted a low-cost strategy during the early stages of motorisation. Seoul, Hong Kong, Singapore, Amsterdam, and Copenhagen are all cities in which the ownership of private cars was restrained for decades. Investment in public transport and road infrastructure were also kept at modest levels until incomes per capita had risen to high levels (Barter, 1999).

The successful low-cost strategy of Curitiba in Brazil with its "surface metro" using busways is also now world famous.

The Informal Transport Sector as an Economic Force: Rickshaws in Bangladesh

There are more than 4 million hand-pulled or cycle rickshaws in the world, mostly in Asia and Latin America. The number is growing, and in several countries, the rickshaw plays an important economic role. In Bangladesh it accounts for more than 50 percent of Dhaka's vehicles, 70 percent of its passengers, and 43 percent of its total passenger mileage. More than 1.25 million people are employed in this business, and 5 million poor people depend directly on rickshaws for their subsistence, more than depend on the hand-loom textile industry or the whole of the modern industrial sector.

Two factors limit how much the poor can benefit from the rickshaw. First, despite attempts (as in Jaipur and Nagpur) to ban the ownership of multiple rickshaws and to provide cheaper finance for owner-operators (as in the Dominican Republic), most operators rent their vehicles from owners who derive high rates of return on ownership. Second, restrictive licensing has often been used to encourage the replacement of rickshaw as by motorised modes. In poor countries this has failed to limit the number of rickshaws but has fostered systematic corruption, transferring income from operators to the police. It has also worked to the advantage of larger rickshaw owners, who are frequently better able to deal with the police.

Source: Gallagher 1992



Ecological Sustainability



GTZ Nepal

<http://www.irrdb.org/>

International Rubber Research and Development Board for statistics about rubber and its application to the automotive industry.

Some Ecological Costs of One Car

Extracting raw materials

26.5 tonnes of waste

922 million cubic metres of polluted air

Transporting raw materials

12 litres of crude oil in ocean

425 million cubic metres of polluted air

Most of us are aware of the most obvious implications of motor vehicle use. Burning fossil fuels results in the emission of noxious fumes that pollute our cities. Also associated with fossil fuel use, there has been much talk about 'global warming' – something we can neither readily see, smell or feel. Its implications are serious nonetheless.

We also need to consider the range of less well-known, but equally important, impacts.

For example, the many polluting and environmentally damaging processes before the motor-vehicles get to the "showroom." Besides air pollution, there are many other environmental stresses that are associated with the use of motor vehicles. These include: loss of wildlife and wildlife habitat; water quality deterioration and flow disruption; and impacts borne by the demand for fossil fuel exploration, extraction and refining. We also need to consider impacts related to the disposal of toxic motor vehicle parts such as batteries and tyres, and the disposal of motor vehicles themselves.

It is only by recognising the multitude of impacts related to the entire life cycle of motor vehicles that we can hope to find effective ways to deal with them.

Before the car hits the road

If everyone bought a car and never used it, we would still have massive environmental impacts. Creating motor vehicles from raw materials and energy inputs results in an array of environmental consequences. Each automobile contains between 1000 and 2000 kilograms of materials including: iron, aluminium, a variety of steels, plastics, rubber, glass, copper and zinc, among others

The mining, processing and refining of ore resources necessary for automobile production generates substantial environmental stresses. These stresses include:

- degradation of landscapes and loss of ecologically productive land due to mining; fragmentation of wildlife habitat;
- pollution resulting from material extraction and processing;
- improperly decommissioned mines leave a legacy of environmental toxins; and
- energy consumption and pollution in transporting materials for manufacture.

Up to 70% of global natural rubber production goes into producing tyres, while up to an additional 10% goes into producing other non-tyre automotive parts. Over the last century, vast tracts of rainforest throughout Malaysia, Indonesia, Thailand, Vietnam, Sri Lanka and other countries in Asia have been cleared to make way for rubber plantations (Malaysia, Thailand and Indonesia account for 73% of global natural rubber production). Tyre manufacture then requires further energy-intensive industrial processes and release of environmental toxins.



Producing the car

1.5 tonnes of waste
74 million cubic metres of polluted air

Driving the car

18.4 kilos of abrasive waste
1,016 million cubic metres of polluted air

Disposing of the car

102 million cubic metres of polluted air

The OECD estimates that one quarter of the energy consumption in the life cycle of the average car occurs before it even hits the road (OECD 1995).

intensive industrial processes and release of environmental toxins.

The production of plastics used for auto body mouldings and interiors requires the exploration and extraction of oil and the processing of oil by-products.

Of course, most of the energy and material resources used for motor vehicle production are non-renewable. While it is possible to recycle some parts of the disposed vehicles, it is not technologically possible to recycle them in their entirety. Currently in the United States, approximately 71% of an automobile's gross vehicle weight is recycled.

Roads themselves also have a number of direct environmental impacts. For example, toxins from bitumen pavement leach into soils and ground water contaminating them. Roads and parking lots also interrupt natural water flows, infiltration and drainage patterns, thus contributing to flooding problems.

Green space and habitat loss



A danger with over-emphasising private vehicles is that it tends to encourage the city to spread out rapidly at low densities. This is problematic because many cities are located on, or adjacent to, fertile agricultural land and/or valuable natural areas.

In some cases, streams, rivers and wetlands that serve vital ecological functions are paved over because of poor environmental regulation. Even paving lands within the vicinity of river banks can alter water-flow regimes and ecosystem balance. The loss of wetlands to urbanisation means more flooding, poor ground water quality and loss of wildlife.

The expanding city also means fewer green spaces and public spaces for humans. Because pressure is intense to increase road capacity in congested Asian cities, urban parks and public spaces are lost.

Water pollution

One of the least recognised impacts of motor vehicle use is water pollution. Motor vehicles and their supporting services release heavy metals and other contaminants into water tables, rivers and oceans in a variety of ways.

“Urban run-off” is one of the most common ways these transport related pollutants reach our waters. All vehicles spill petrol, give off body rust, release particles from tyres and brakes, and leak oil, brake fluid and lubricants. All these contain an array of environmental nasties (lead, petroleum, zinc, cyanide, nickel, cadmium, and so on). Some airborne pollution also reincarnates as water pollution when rain brings it back to earth.

✉ Water Watch Asia network

Roads also give off particles as they wear, and the asphalt leaches toxins throughout its life. Petrol stations leak petrol into soils and ground water as their underground tanks age. The amount of petrochemical products that find their way into our waterways is enormous. On a global basis, nearly 2.9 million barrels of crude oil are spilled directly into the seas every year. This is equivalent to 10 oil spills similar to the disastrous *Exxon Valdez* spill off the Alaska coast in 1989.



Demand for Fossil Fuels

Transport accounts for a large share of the world's consumption of oil. Although fuel efficiency of motor vehicles has generally improved over the years, these gains have not reduced the impact of fossil fuel consumption. Most gains from increased fuel efficiency have been erased by strong growth in the number of vehicles on the roads worldwide, and in the number of vehicle kilometres they are driven.

Finding and Transporting Oil

Most of the world's motorcycles, cars and trucks require gasoline or diesel fuel to run. This, of course, requires the exploration and extraction of oil and transport to a refinery where it is turned into gasoline and diesel. This must be stored and delivered to gas station, where individual customers 'fill up' and then burn fuel in order to run their vehicles.

<http://www.epa.gov/oilspill/index.htm>
US Environmental Protection Agency oil spill site.

<http://www.iclei.org/efacts/oilspill.htm>
For extensive discussion on the ecological impact of oil spills.

Each of these stages has distinct environmental consequences. The most well-known, because of its obvious and massive devastation, is the infamous 'oil spill'. The clean-up process for oil spills is not entirely "clean". Often chemical dispersants used to break up oil spills create problems of their own.

Although the *Exxon Valdez* is considered a massive spill and caused major devastation, it was actually quite small relative to many other spills (see below). Not all oil spills come from tankers. In fact, about 90% of spills, by volume, comes from non-tanker sources.

One way to prevent oil spills from happening is simply to reduce our demand for oil. Less oil demand means less oil transport and less risk of those catastrophic events that are an inevitability.

Selected oil spills between 1967 and 1994

Rank	Year	Oil spill incident	Barrels of Oil	Litres of Oil
1	1991	Kuwait, 1991 Gulf War	5,714,400	908,496,000
2	1979	Exploratory well Ixtoc1; Gulf of Mexico	3,333,400	529,956,000
3*	1992	Oil well; Uzbekistan	2,095,280	333,115,200
4	1983	Oil well; Iran, Persian Gulf, Nowruz Field	1,904,800	302,832,000
5	1983	Tanker Castillo de Bellver; South Africa, Table Bay	1,869,085	297,153,900
6	1978	Tanker Amoco Cadiz; France; off Portsall, Brittany	1,635,747	260,056,980
7	1988	Tanker Odyssey; Canada, North Atlantic Ocean	1,026,211	163,150,740
8	1979	Tanker Atlantic Empress; off Trinidad and Tobago	1,016,687	161,636,580
34*	1978	Storage tanks; Japan, Sendai (offshore Miyagi prefecture)	421,437	67,001,580
47*	1978	Tanker Tadotsu; Indonesia, Straits of Malacca	314,292	49,967,280
53	1989	Tanker Exxon Valdez; USA, Prince William Sound, Alaska	261,910	41,639,400
55*	1994	Tanker Thanassis A.; Hong Kong, South China Sea	259,529	41,260,860

Source: Adapted from Cutter, 1999



Air pollution

Burning petrol or diesel to run motorised vehicle results in a variety of "emissions" that affect environments at the local, regional and global environments.

Environmental Effects of Vehicle Emissions

Substance	Source	Environmental Effect
Carbon Dioxide (CO ₂)	Fossil fuel combustion	Global warming: shifting climate patterns, rising seas, extreme weather, agricultural and ecosystem disruption.
Nitrous Oxides (N ₂ O)	Fossil fuels; old and faulty catalytic converters	Global warming: 270 times the warming potential of CO ₂ , though released in smaller quantities.
Nitrogen Oxides (NO _x)	Fossil fuels; old and faulty catalytic converters	Acid rain, ground level ozone constituent, suppressed of plant growth, degradation of buildings.
Volatile organic compounds	Incomplete combustion and fuel vapours	Contributes to global warming through formation of ground level ozone.
Smog (ground level ozone)	Reaction of NO _x and hydrocarbons	Damages plants and crops, reduces structural integrity of materials, contributes to global warming.
Lead	Petrol additive	Enters food chain through soil and water. Extremely toxic. Inhibits neural development, particularly in children.
Particulate matter (PM _{2.5} and PM ₁₀)	Fossil fuel combustion, particularly diesel	Haze, changed precipitation patterns.
Chlorofluorocarbons (CFCs)	Operation and leaking of car air conditioners	Depletion of ozone layer, increases ultraviolet radiation, inhibits photosynthesis, contributes to global warming
Carbon Monoxide (CO)	Fossil fuel combustion	May contribute to global warming at 2.2 times the warming potential of CO ₂ through atmospheric reactions

Global Warming

<http://www.ipcc.ch/>

The IPCC was established in 1988 by the World Meteorological Organisation (WMO) and UNEP to assess the available scientific, technical, and socio-economic information in the field of climate change.

<http://www.climate-network.org/>

A network of NGOs active on climate-related issues.

There is now a widespread consensus that burning of fossil fuels is adversely affecting the global climate in serious ways. There are naturally occurring gases in the Earth's atmosphere that act like a 'greenhouse' which trap some of the sun's heat, preventing it from leaving, and allows plants and animals to thrive.

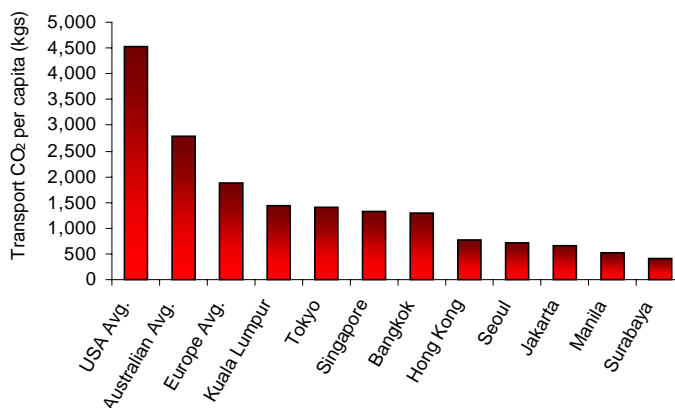
Over the last century, this *natural greenhouse effect* has been *enhanced* by the burning of fossil fuels and increased emissions of other greenhouse gases related to human activity. This *enhanced greenhouse effect* is what is responsible for *global warming*. In 1990, the world's leading climate scientist concluded, through the United Nations' Inter-governmental Panel on Climate Change (IPCC), that human activity is indeed leading to a notable warming of the planet. This has the potential to unleash extreme weather events, widespread ecosystem disruption, increased disease and crop damage. These effects could be particularly acute in Asia.

Cynical Corporate Lobbying Against Climate Change Agreement

US energy and other corporations conducted a public campaign in the US against the global warming treaty prior to the Kyoto conference, arguing against developing countries being let off the hook. Oil giant, Exxon, was prominent among the corporations opposing US commitments to reduce emissions unless developing countries also made commitments. However, the Wall St. Journal reported in October that Exxon, the world's biggest oil company, had also urged developing countries to reject the global warming treaty, because environmental controls would hinder their development. Speaking at the 15th World Petroleum Congress in Beijing, Exxon chairman Lee Raymond urged developing countries to use more, not less fossil fuels, and said nature was to blame for most global warming. [Source: Tri-State Transportation Campaign: 281 Park Ave. South, 2nd Floor, New York, NY 10010, USA; Tel. +1 212 - 777 8181; fax: +1 212 - 777 8157; E-mail: tstc@tstc.org; URL: http://www.tstc.org/].

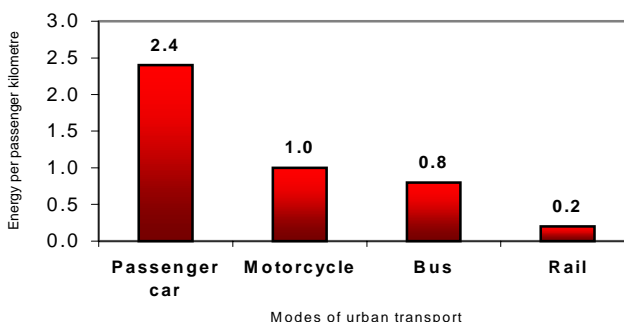


Transport CO₂ Emissions per person in Asian Cities, 1990



Source: data from Kenworthy and Laube et al 1999. USA is average of 10 cities, Australia is average of 5 cities, Europe is average of 11 cities.

Energy use by different transport modes in Asian cities, 1990 (Megajoules per person-kilometre)



Source: data from Kenworthy and Laube at al., 1999

<http://www.cseindia.org>

The Centre for Science and Environment (CSE) focuses on a variety of environmental issues in India including climate change, air pollution and water pollution with a special focus on their equity dimensions. The site features extensive information, links, a library of publications and online ordering.

Motor vehicles emit a range of gases which contribute to global warming. Emissions from motor vehicles produce about 20% of the incremental carbon dioxide in the atmosphere arising from human activity and 33% of chlorofluorocarbons (CFCs). Transport also results in emissions of methane and nitrous oxides (which have 21 and 290 times the global warming potential of CO₂). Other transport emission such as nitrogen oxides, hydrocarbons and carbon monoxide also contribute to global warming indirectly by catalysing or inhibiting other atmospheric reactions.

Questions over International Environmental Justice and Equity

Developing countries in Asia and elsewhere currently emit a relatively low level of CO₂ compared with rich countries. The average person in China and other developing countries emits a tiny fraction of the emissions of people in the U.S.

Asian developing countries' emissions are rising very rapidly. Nevertheless, for the foreseeable future their per capita emissions will continue to be substantially smaller than the USA and other OECD



countries. The USA and other OECD countries must clearly reduce their share of emissions in absolute terms.

HOWEVER, while there are compelling equity reasons to allow some CO₂ emissions increase in developing countries, there are not compelling reasons to allow transport emissions to increase unabated. It would appear to be foolhardy to orient our transport towards planet-warming private motorisation, particularly when low-emission, low-impact and more equitable alternatives for transport exist.

Vehicle disposal

Car dumps can be sources of considerable local pollution. Surveys in the Flanders region in Belgium have found high concentrations of lead, cadmium, and zinc.



There is currently no way to recycle material from old tyres to manufacture new tyres in the same way plastics, glass or metals can be.

When vehicles and vehicle parts reach the end of their useful life, the vehicles must be disposed of. While a certain proportion of the materials can be recycled, the disposal of the remaining parts nevertheless causes various problems. The impacts associated with vehicle and parts disposal include space consumed for dumps, toxic leachate from automobile parts and residual fluids and impacts due to accidents. Vehicle and vehicle component disposal release environmental pollutants into the soil, water and air. Leachate from metals, batteries and plastics elevate concentrations of lead, zinc, cadmium and other heavy metals and toxins.

The disposal of tyres also results in toxic leachate entering the soil and water and potentially toxic emissions from tyre fires, posing a threat to human and ecosystem health. Tyre stockpile fires emit a large amount of semi-volatile organic compounds as well as zinc and lead that are hazardous to human health and contaminate the food chain.

Hagersville, Canada 1990: **One of the World's Largest Tyre Fires**

"On 12 February 1990, at approximately 0100h, a fire began in an outdoor storage area containing 14 million used tyres. Arson was the suspected cause. The fire burned for 17 days, eventually consuming 12.6 million tyres. Since this was the first tyre fire of this magnitude in Canada, emergency response teams resorted to trial and error in their efforts to combat it, developing techniques that have been employed against subsequent incidents of this type.

Tyre fires represent significant environmental problems due to the hazardous combustion products emitted into the air and ground, including benzene, toluene, xylene and oils. The environmental consequences of the Hagersville fire were severe, with considerable surface and ground water contamination. Between 12,000 and 50,000 litres of oil were believed to have reached the water table."

Environment Canada, OECD International Exchange of Accident Case Histories Involving Hazardous Substances, 1990. pp. 1-2. From: <http://hoshi.cic.sfu.ca/miacc/>

