



Ticket to the future

3 Stops to Sustainable Mobility



Introduction

Since the middle of the last century, innovations such as the mass motorisation, the public transport, travel by air and telecommunications have revolutionised the concept of mobility. Mobility can no longer be defined uniquely by transport. Today, there is a wide choice of individual, collective, physical or virtual mobility options. Making these choices is both complex and confusing and the differences in local, national and global conditions compound this.

Current mobility patterns are unsustainable

It is also clear that current patterns of provision and consumption of mobility are not sustainable. It is a paradox of our supremely functional modern world that amenities supposed to connect us together, in fact, more often separate us.

This is particularly visible in urban situations, as cities all over the world suffer from high levels of traffic related congestion, pollution and the degradation of communities and social dysfunction.



Mobility is a fundamental necessity of 21st century living and brings access to jobs, markets, education, health care and other primary services and leisure. However, no one mode can satisfy all the urban transport needs either today or in the future. Therefore a balance must be struck between collective and individual transport, taking into account economic, environmental and societal issues in order for any level of sustainable development to be achieved.

Modern society and transport have yet to find a modus vivendi

Adequately addressing the highly complex challenges of sustainable mobility depends on the co-ordination of all stakeholders, as well as, integrating environmental, societal and economic concerns in core decision-making supported by an enabling policy framework.

In the following pages you will see unfolding the convincing arguments in favour of sustainable mobility, its social and economic advantages, and strong environmental performance, showing how public transport¹ is a real ally to delivering sustainable solutions to cities everywhere.

Wolfgang Meyer
UITP President

Hans Rat
UITP Secretary General

March 2003

¹ The term public transport has been used throughout this brochure to mean high occupancy collective passenger transport, available to all members of society and provided by metros, light and heavy rail, all types of buses and ferries.

Ticket to the future

3 Stops to Sustainable Mobility

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The three pillars of sustainable development, covering social, economic and environmental aspects, are all deeply embedded in the provision of public or collective passenger transport. UITP recognised this in the Toronto Protocol² signed and endorsed by 4000 transport professionals at the UITP World Congress in Toronto in 1999 and the Declaration for Cities on the Move (the Melbourne Communiqué) signed in Melbourne by the Asia Pacific Division in 2000.

To build on these initiatives, UITP created a Working Group in May 2002 dedicated to Sustainable Development. One of their activities has been the production of this brochure. The brochure, launched at the 55th UITP World Congress in Madrid in May 2003, identifies the challenges and pathways for the future in terms of achieving sustainable mobility and describes what is already being done in the transport sector. This is complemented by a charter on sustainable development, signed by UITP members, which defines the concrete actions contributing to sustainable development that members pledge to achieve between UITP's two next world congresses (Madrid, May 2003 and Rome, June 2005).³

This brochure focuses almost exclusively on urban and regional passenger transport, as this is critical in shaping future sustainability, and already poses the greatest mobility challenge for planners and politicians alike all over the world.

It sets out as 3 'stops' the challenges cities and regions face, the possible solutions and the contribution of public transport in meeting these mobility needs in a sustainable manner. The first section, and first stop, outlines the social aspect and the important role mobility plays in everyone's quality of life. It describes the challenges the world faces to provide sustainable mobility for all in respect to the estimated increases in urban population.

The environment and health of the planet is the second pillar of sustainable development. The second 'stop' in this brochure discusses the impact that energy use and other non-renewable resources, such as land use, has on the ecological balance and the effect this has within the world-wide context of global warming.

The third and last stop 'Economic Value' is certainly by no means the least important. In fact, economical viability is vital to the success of the other two 'stops' of this brochure. The cost of mobility to the community is of crucial concern and this chapter looks at how transport costs can be kept down, the economic challenges faced because of congestion and the beneficial impact of sustainable mobility on local economies as they provide local employment and community cohesion.



The brochure also establishes actions required by all stakeholders to achieve this goal. The recommendations found in the brochure come from the combined international experience of the working group and the consensus of UITP's world-wide membership. The recommendations apply to all transport actors and political decision-makers and they demonstrate that every change, even small ones, help build more sustainable transport networks, bringing the benefits of mobility to all rather than just a few.

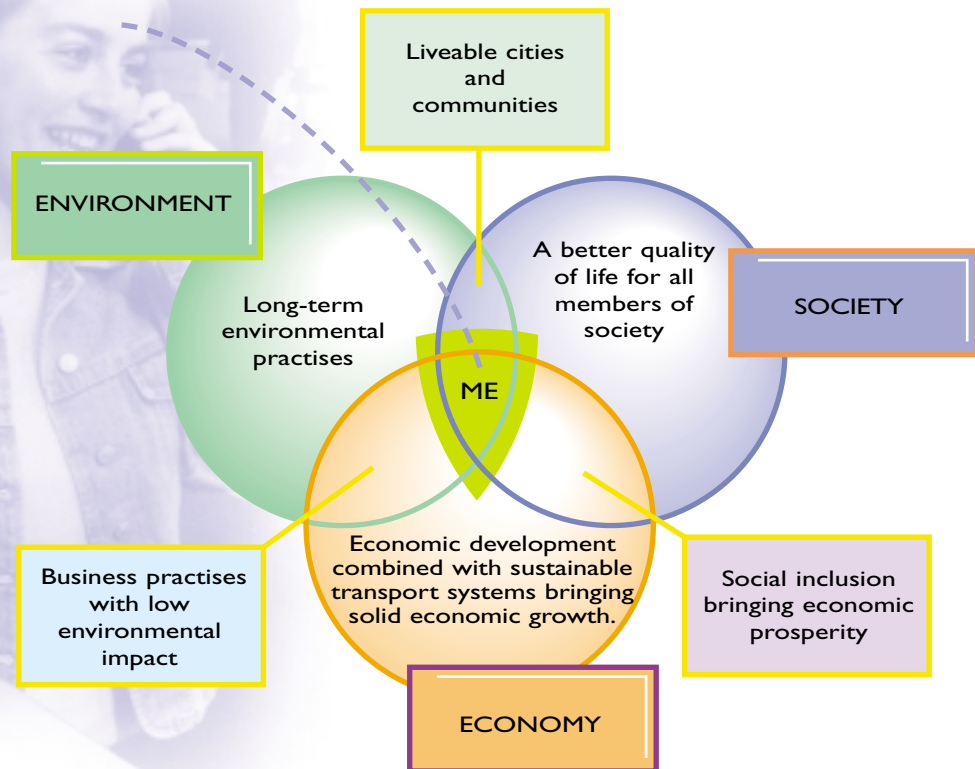
² Full text available from the UITP web site www.uitp.com.

³ Other language versions, an executive summary and further information is available from the UITP web site (www.uitp.com).

Ticket to the future

3 Stops to Sustainable Mobility

The Concept of Sustainable Mobility



Source: Ralph Hall, *Introducing the Concept of Sustainable Transport to the U.S. DOT through the Reauthorization of TEA-21*

A world where sustainable transportation fits in

Sustainability has three components: society, the environment, and the economy that are all inter linked.

Society is the organisation of complex human interactions and today we depend quite strongly on them. Thus the sustainability of societies is a necessary condition for meeting human needs. Societal factors are a major component of any legacy to future generations and are therefore important for sustainability. They also determine the present quality of life, of which accessibility is a significant factor.

The Environment refers to respect for human surroundings and other life forms and limiting their activity to the least irreversible damage to the environment.

The Economy describes the resources available and how these resources are organised to meet human needs and goals. Economic factors have a strong influence on the environment and society in general.

The Transportation of people must be affordable, available and sustainable in its impact on the environment and society. It also helps to achieve sustainability in other aspects of human endeavour.

Based on a definition from the Canadian Centre for Sustainable Transportation

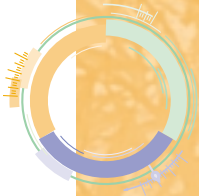
Sustainable Mobility - A cornerstone of sustainable development

Sustainable transportation is an aspect of global sustainability, which involves meeting present needs without reducing the ability of future generations to meet theirs.

A sustainable transportation system is one that:

- allows the basic access needs of individuals and societies to goods, jobs, education, leisure and information to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- limits its emissions and waste to within the planet's ability to absorb them, minimises consumption of non-renewable resources, the use of land and the production of noise, and reuses and recycles its components whenever possible.



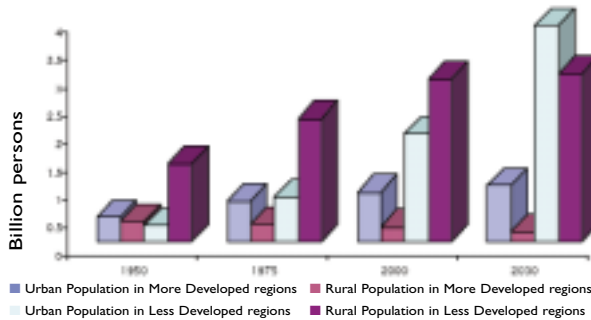


Stop one - Social Equity

Cities, Transport and Sustainability

More People – More Demand

Population Growth and World Population Distribution



Source: United Nations Population Division

Urban populations will increase by 27% in the next 30 years and by 2030 the number of megacities will increase to 23, with 18 of them in the developing world. (The United Nations defines a megacity as one with a population in excess of 10 million.)



Can cities support increased travel demand?

In 1950, the total population of the world was 2.5 billion. By 2000 it had grown to 6.0 billion and it is estimated to be around 8 billion people by 2030. The majority of this growth will take place in urban areas of the developing world, already home to nearly 80% of the world's present population, and where high rates of congestion, road accidents and noise and air pollution affect the daily quality of life of many citizens. The 400 million additional urban dwellers expected in Africa and over twice as many in Asia by 2030 will put enormous pressure on the urban infrastructure of developing countries.

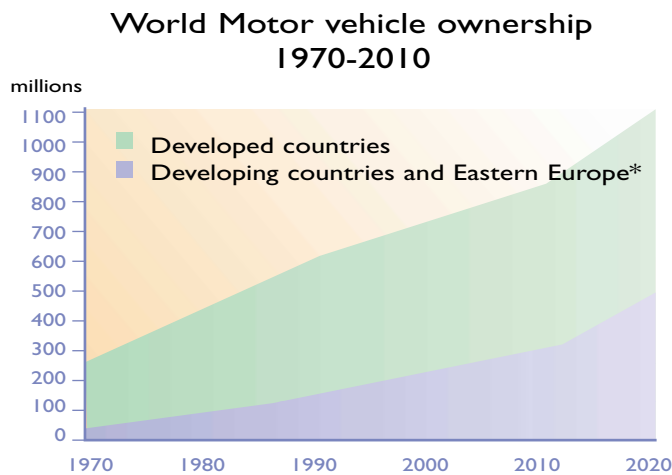
As demonstrated today by the high levels of congestion in most urban areas, whether in rich industrialised or the developing nations, it is blatantly clear that unrestricted individual car transport is not able to satisfy the demand for mobility in cities.



More and Faster

People travel longer distances and more frequently than they did 50 years ago. However, the time people spend making a trip remains roughly the same. In short, people are demanding more mobility, faster.

It is clear that this growth in travel demand cannot be supported by existing transport infrastructure, and building more roads has already proved, time and again, not to be the answer. In rapidly developing countries, ad-hoc urban planning and urban sprawl combined with increasingly congested roads has already brought alarming consequences. People have to commute for longer and high levels of congestion makes surface public transport services less reliable and less attractive. If they have the choice, more people then travel by car, which is more expensive and as slow but provides more comfort.



* Note : Eastern Europe includes the former Eastern Europe block countries except East Germany

Source: Asif Faiz and Surhid P. Gautam, "Motorization, urbanization and air pollution", discussion paper (The World Bank, Washington, D.C., September 1994), p.8; US Dept. of Energy

This further marginalises the poor, and the less able as not everyone has this choice. It also makes all transport less safe, as increased traffic increases the risk of accidents for everybody. This has a strong impact on the mobility of women and the young and ageing populations, who rely heavily on public transport for their mobility needs.

Equitable transport for all

Improving local transport brings immediate benefits to those who need it most. Richer affluent people do not usually live in heavily trafficked streets. It is the less well advantaged that have to struggle daily with degraded environments, high levels of local pollution and high accident rates.

A fast public transport network supports growth in travel demand. Today, networks with the highest speeds and frequency also have the highest modal share.



The original pundits of the information age have suggested at various times over the last twenty or so years that new ways of working will revolutionize our daily commute to work. In theory teleworking or telecommuting reduces the need to travel to work every day. But the swift and widespread integration of information technology has not replaced the basic human need for contact.

Efficiency and respect for all

The most efficient modes of transport that are able to carry large quantities of people can already satisfy high demand and, unless they are already running at full capacity, can cope best with increases in travel demand. For high demand, metro and suburban rail compare with no other mode in terms of capacity, carrying over 50,000 passengers on one line/hour. Light rail systems of all lengths are also extremely efficient; for example in Manila, the Philippines, one 15 km line carries 400,000 passengers per day and a 30 km line in Istanbul, Turkey, transports 300,000 people per day. Rapid, high capacity and trolley bus systems on dedicated road space can also provide an effective solution for up to 200,000 passengers per day/per direction if infrastructure investment funds for rail are scarce as has been demonstrated in Latin America.



Present patterns of consumption of mobility are not sustainable. This does not need to be the case as the wide choice of innovative systems available today means that countries in either the developing and developed world can put efficient networks in place that are appropriate to their budgets and requirements.



Experience shows that by giving buses dedicated road space the amount of passengers carried can increase by between 40 and 200% in peak hours!

Better use of existing infrastructure also brings benefits

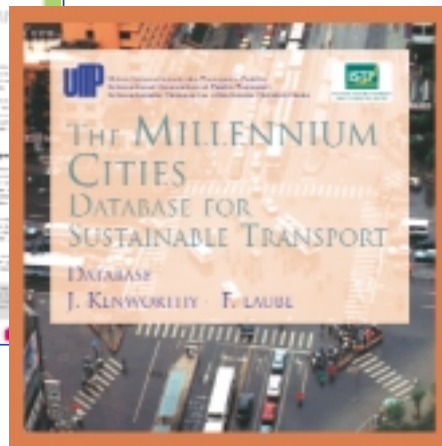
A car-dominated infrastructure with noisy urban freeways or busy highways near residential areas is not conducive to social interaction and isolates communities. Well-designed public transport infrastructure, on the other hand, not only takes up much less urban space but also helps bring communities together.

Paris has 120 km of bus corridors accessible to cyclists and a further 40 km have been widened and are fully separated from other traffic. A charter of 'good conduct' has been negotiated between the RATP bus drivers and cyclist organisations to ensure equitable and fair use.



UITP Recommendations

- Plan systems to achieve the best combination of modes and service offers for all members of society. An integrated approach will bring about a change in consumption patterns.
- Facilitate and reform the decision-making processes at international, national, regional and local levels to enable appropriate cross agency and department to advocate coherent and integrated policies, which are in place long enough to make a measurable impact.
- Implement innovative technologies to make public transport more attractive and integrated with other modes. UITP recommends the use of current technologies such as smart cards, GPS, 'real-time', and clear customer-friendly information about public transport services.



International examples

Rapid Bus Systems

In Latin America, a number of large cities such as Bogotá, Quito and Porto Alegre have successful rapid bus systems. For example in 2000, Bogotá opened the first two lines of a bus-based high capacity transit system called Transmilenio. Today, even with only three lines open, it carries 700 000 passengers per day, with 42 000 per hour in peak times.

Bogotá officials have invested in urban renewal with a strong focus on the transport system:

- Transmilenio (31 km of exclusive bus lanes)
- Limiting car access during peak-hours – the citizens voted to make the entire urban area car-free except for taxis during the morning and evening peak hours from 2015.
- Bicycle paths (200 km programmed to link the entire city) and sidewalks to promote non- motorized modes
- Green spaces and public spaces to revitalize the urban land use.



Faced with the unsustainable increase in private vehicles on its roads, Bangalore Metropolitan Transport Corporation (BMTCL), India, a government-owned bus company serving some 6 million people, will introduce a Mass Rapid Transit System based on high-capacity buses and exclusive bus lanes. This cost-effective project, now in pilot phase, won the 2002 UITP Asia Pacific Award for 'Affordable Public Transport'.

Source: UITP Mobi+

Finding solutions without building new infrastructure - Surabaya, Indonesia

Rapid economic growth and a demand for transport has made all the agencies involved in transport and urban planning in Surabaya, North East Java, the second largest city in Indonesia (population 2.5 million) and typical of numerous cities in the region, seriously rethink ways of providing mobility. Recent initiatives by the city to develop an improved integrated transport system without building more infrastructure focuses on a major new north/south bus route and raising the public's awareness for the need for a sustainable urban transport system through targeted campaigns. Further measures include cleaner fuels, support for non-motorized transport, and traffic management to restrict the use of private vehicles.

Source: *Urban Transport Environment and Equity*, Eduardo A. Vasconcellos

Rail helps reshape urban land use into dense, more sustainable patterns

In Perth, Western Australia, patronage of a new 30km urban rail line linking the northern suburbs to the city, previously a bus-only corridor, increased by 40% in the first year and to 56% a few years later. 25% of the increase in the first year came from car drivers who changed their habits to use it to travel to work.

Impact of the Currambine Line on rail performance indicators 1991-1996

Indicator	1991	1996	% change
Rail vehicle km per capita	4.8	10.0	108%
Average rail speed	34	50	47%
Rail passenger km per capita	97.3	275.4	183%
Rail boardings per capita	7.0	22.5	221%

Source: Kenworthy J., Laube F; *Urban transport patterns in a global sample of cities & their linkages to transport infrastructure, land-use, economics & environment*.

In addition, a reduction in car trips has been achieved through targeted marketing techniques combined with a bus stop enhancement programme and increased distribution of public transport timetables. Without any new infrastructure, 15% of all car trips were identified as being, in principle, changeable to other modes.

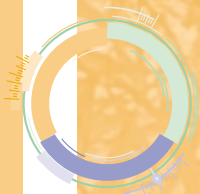
Source: *World Transport Policy and Practise* 7 (4): 61-66 (James B & Brog W)

Madrid - the creation of new metropolitan regions stimulates integrated urban transport

The organisation of transport is made all the more complex by fragmented responsibilities and budgets. Structures need to be adapted as cities grow and urban sprawl links them with surrounding towns, blurring boundaries and creating a greater need for integrated transport solutions. In 1986 Madrid created a 'Consortio de Transportes de Madrid' (CTM) bringing together all the agencies responsible for urban transport, urban planning and public works of 178 municipalities under one roof and giving it the responsibility for strategic and tactical organisation of urban transport.

CTM reflects diversity in its decision-making processes with workers unions, operators and customer associations as full members of the board. It depends on a politically elected body, the Comunidad de Madrid, for funding and has demonstrated the success of this model by investing in integrating the transport network and concentrating on developing rail. It has effectively doubled the length of the metro line since 1995 by adding 111 km of metro line, 72 new metro stations, plus a further 20km of regional rail with 3 new stations and 12 new interchanges to facilitate changes between modes. This rate of construction brings dramatically lowers costs to only 32mio_ per km, far lower than for most other cities. Since the regional transport consortium was established in Madrid 16 years ago, passenger trips have increased over 63% (1986 – 2001) and the use of the system continues to increase steadily.





Health and Safety

Accidents bring a high cost to society

Safe travel is a major concern to consumers of all ages and social classes. There is a generally accepted misperception that travel by car is still relatively safe, particularly in developed countries, yet traffic accidents are a major cause of death in both developed and developing countries. It is an indisputable fact that the majority of all transport accidents are caused by car traffic and according to a WHO report (published in 1999 and based on 1998 data) there are 1.17 million deaths and more than 10 million injured due to traffic accidents world-wide.



This is a growing problem for the developing world. The World Bank shows a 350% increase in traffic fatalities over a period of only 20 years in Subsaharan Africa, and figures today show there are 66 fatalities per 10,000 vehicles in Tanzania and slightly less (60) in Kenya. These statistics need to be compared to those in Europe to fully appreciate the extent of the problem. In the United Kingdom there are 1.4 fatalities per 10,000 vehicles.

In towns where there are well-developed public transport systems, the number of deaths by traffic accidents are half as many as in towns where almost all journeys are made by car.

This doesn't mean it is any safer to travel in the developed world. Road accidents are still the primary source of death in the 15-30 year age group in the European Union, and account for as much as 40% of all accidental deaths in some countries. Obviously, many more are seriously maimed or injured, burdening society with high health care costs. Pedestrians, young and old, and cyclists are at the greatest risk.

Safety – a concern for all

The direct relation between the numbers of people killed or maimed on the roads and the number of journeys made by car in a community demonstrates the need for promoting good quality public transport. Astoundingly, more than 50% of all car trips made in Europe are for a distance of less than 5 km and 30% are for under 3 km, making the risk of having an accident especially high. Many of these trips could be replaced by other, more sustainable modes.

	Fatal accidents per million inhabitants
USA	130
Western Europe	70
Affluent Asian Cities	60

Source: UITP/ISTP Millennium Cities Database

Paying equal respect to road safety rules, the most dangerous cities are the ones where most trips are made by car, such as in the car-dominated US with 13 deaths per 100 000 people (MCDB et Kenworthy & Laube, et al 1999 International Sourcebook of Automobile Dependence in Cities 1960-1990). On average it is 5-10 times safer to travel by public transport (based on per passenger x km transported). In Europe it is some 20-25 times safer to travel by rail than road, making public transport and rail significantly safer than the private car.

Motor vehicle accidents kill 3 000 Canadians every year and are the most common cause of accidental death for people under 35, costing the health care system \$CAD 10 million annually. On the other hand, public transport in Canada is estimated to be 20 times safer trip for trip.

Source: CUTA Public Transit and our quality of life; issue paper 3; Oct 2002



Car traffic affects individual life styles, the life of a community and paradoxically the ability to travel. Children lose the ability to play safely near their homes and are either kept indoors or escorted everywhere in cars, leading to social isolation, low levels of physical activity and ultimately develop unhealthy travel habits. For example, walking to public transport stops is a 'gentle' exercise, good for all ages and sectors of the population, helping attain the minimum recommended levels of activity per day as given by WHO.

Transport, health and quality of life

Present traffic conditions, either in Europe or the rest of the world, are not conducive to taking public transport, walking or cycling for daily mobility needs. Introducing legislation to ensure that sufficiently wide sidewalks and pavements are built and maintained in all new developments, and public transport stops are positioned at the most convenient and safest situations and not the opposite, would help change this.

Quality environments that encourage walking, cycling and the use of public transport help social and cultural interaction. This creates vibrant healthy communities and encourages social responsibility through increased human contact.

Specific attention should be given to the special needs of children and older people. Safety and local air quality around schools and establishments of further education degenerates if access is only by private car. Clear signs, passenger information and attractive street architecture all add value to urban life and the perception of safety.

Public transport brings mobility independence for all ages and sectors of society. Safe transport environments influence habits and children should learn from an early age how to meet their mobility needs independently of a car by walking, cycling and using public transport. Older people often depend heavily on a well functioning and safe transport system to maintain their autonomy and independence. Both of these groups are some of the most vulnerable to traffic accidents either as pedestrians or cyclists.

There is a direct link between transport policy and the health of the general population. Policy makers, health, transport and environmental professionals and the general public need to become more aware of the added value of integrating health considerations into decisions related to mobility, paying particular attention to the most vulnerable groups.



UITP Recommendations

- Integrate all modes of transport to create safer transport environments and attain maximum interoperability.
- Promote the most efficient transport modes in order to diminish health costs to the community due to accidents and lack of physical exercise
- Encourage future desirable mobility habits in young people.
- Create better environments for walking and cycling to complement public transport and reduce short distance travel by private vehicles in urban areas.
- Increase awareness via the media and other public campaigns that rail and bus transport is considerably safer than travel by private car:



International examples

York, UK - Safer Today

The city of York has developed a transport strategy that places vulnerable road users at the top of a road hierarchy and has implemented traffic restraint measures by reducing vehicle speeds.

Changes in road user casualties in York and the United Kingdom from 1981-1985 to 1990-1994 (%)

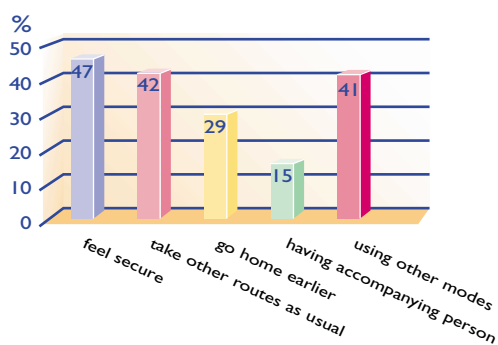
Casualties	York (% change)	United Kingdom (% change)
All casualties	- 40	- 1.5
Pedestrians	- 36	- 15
Cyclists	29.5	- 12
Powered two wheelers	- 65	- 54
Car passengers	- 16	+ 16
Car drivers	+2.5	+ 41.5

Cycle use in York increased from 16% of all trips to 19% between 1991 and 2000 and walking from 14% to 16%, with a decline in car use from 55% to 53% over the same period.

Research on mobility of women – more complex and a greater feeling of insecurity

In Switzerland, research on female mobility in the city of Bern was conducted to focus on their needs. One of the findings was that female mobility needs are complex and their journeys are usually multi-stop trips. Women also have a higher subjective feeling of insecurity especially at night. As many as 41% of female passengers change to another mode for night trips, and 29% just go home earlier. Regionalverkehr BernSolothurn (RBS) started a project to improve the subjective and objective feeling of security. As women are often frequent users of public transport but are also changing to the car at a higher rate than men (known by the number of car registrations in female names) it is very important that their special requirements are taken into consideration.

How do women change their travel behaviour at night?

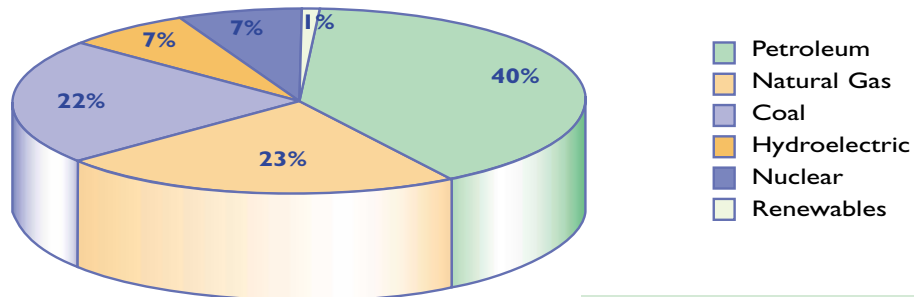




Stop two - Environmental Balance

Energy and Resources

World Consumption of Energy (152.20 Quad. BTU)
Share of Primary Energy



Source: Transport Energy Data Book: Edition 21, ORNL, 2001

The World Consumption of Energy is mainly based on fossil sources. 95% of all transport relies on petroleum.

Transport and Energy Consumption

Transport is the largest consumer of energy and still relies heavily on non-renewable fossil fuels. According to a study by the International Energy Agency, IEA, the transportation sector will overtake industry as the largest energy user by 2020, and energy used for transportation is projected to increase at an annual rate of 2.1 percent, the biggest growth of all end-use sectors. By this date the world will be consuming two thirds more energy than today and most of this growth in demand will come from the developing world.

Energy Use by Urban Mode (MJ/Passenger-km)

Mode	Vehicles Production	Fuel	Total
Two wheeler	0.5	0.3	0.8
Light Rail	0.7	1.4	2.1
Bus	0.7	2.1	2.8
Heavy Rail	0.9	1.9	2.8
Car, Petrol	1.4	3.0	4.4
Car, Diesel	1.4	3.3	4.7

Source: Energy Conservation and Emission Reduction Strategies, TDM Encyclopedia, www.vtpi.org/tdm/tdm59.htm

Energy use by bus or rail is 3-5 times more efficient than cars or aviation per person x km based on full loads. One litre of fuel can carry 1 passenger 48 km by metro, 39.5 km by bus but on average only 18.6 km by private car.

Metros are the most energy efficient of all modes, closely followed by light rail. Their advantages and efficiency will become even more attractive and sustainable as more electricity is produced from renewable energies.

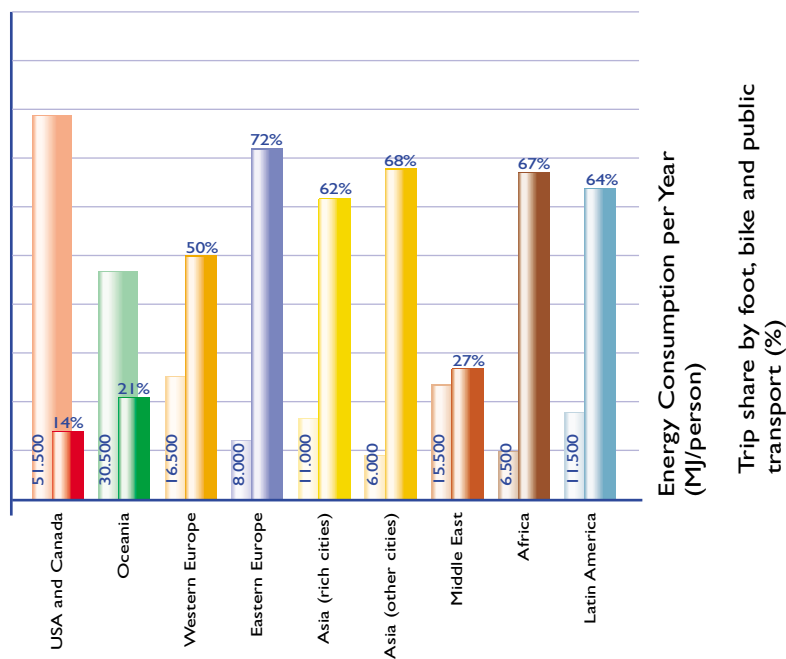
In France, at constant rates of traffic, each 1% rise in rail passengers converted from the road represents a saving of around 37,000 tonnes of oil equivalent, and a saving of 60,000 tonnes if this 1% is taken away from air transport.

Source: SNCF *The environment - a strategic asset for the rail industry: the SNCF approach*

Steady growth in carbon-based energy use will drive up the climate disrupting emissions of carbon dioxide. This makes public transport in urban areas more attractive, as it offers far better energy efficiency than personal transport. The higher the modal share of public transport, the better the efficiency achieved.

It should not be forgotten that road transport still provides the backbone of many systems. Less polluting low sulphur diesel is now widely used in most developed countries, and many older bus fleets have been fitted with particulate filters but the phase out of leaded fuel and the introduction of cleaner less polluting fuel needs to be accelerated in developing countries.

Density, modal choice and energy consumption per year for passenger transport



Source: UITP/ISTP Millennium Cities Database

New sources of energy

In the long-term, even with better technologies, the continuing growth in travel demand cannot be supported by the current energy supplies and the need for energy saving technologies, better energy management and more use of renewables is evident.

Importing fuel is expensive and uses up large amounts of valuable foreign exchange, a real concern for developing countries. Some developing countries can spend between 25-35% of their export earnings on importing energy, influencing negatively their trade balance (e.g. Kenya).

Countries, such as Brazil, have taken steps to address this. The use of ethanol, produced from sugar cane, now has widespread use there both as a fuel or to replace some of the more polluting additives in gasoline and

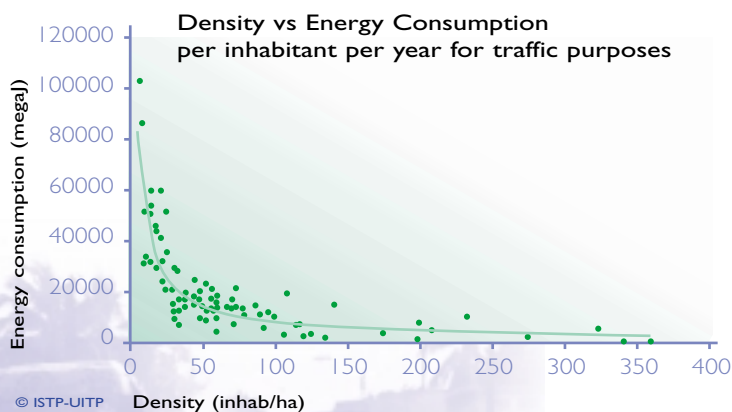
diesel. Not only does this reduce Brazil's reliance on fossil fuels but it also has a direct result on air quality, which has considerably improved in cities like Sao Paulo. However, the production of the sugar cane also needs to be made more equitable for all.

New energy resources are also being developed and tested, such as hydrogen, in public transport vehicles today. Hybrid buses can provide a good alternative to diesel and have the proven reliability required by operators to ensure good levels of service. Electric and 'midi' (short wheel-base) buses also demonstrate advantages in specific situations and the constant ongoing trials with other new energies will bring them mainstream and more alternatives will become available.

Urban space – a limited non-renewable resource

Even if all cars were emission free they would still take up excessive amounts of urban space to transport the large quantities of people needing to travel to or around cities. It is an indisputable fact that trains, light rail, ferries and buses, when travelling at capacity, transport large quantities of people and use a minimum of urban space.

Compact urban developments which use urban space economically are also the most energy efficient

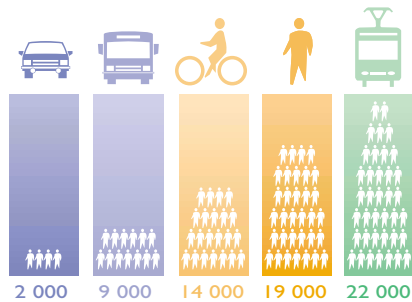


Urban space should be considered as a limited resource. Each mode of transport uses space for moving and parking over a given period of time but the most space consuming mode is the private car, which spends 90% (or 22 hours per day) of its life stationary. Hence enormous quantities of valuable urban space are used uneconomically only for parking. On the other hand, a bus only parks during refuelling, servicing or at the end of its daily circuit.

Integrating land use and mobility planning

Land-use and mobility are intertwined and the location of employment in respect to residential areas induces travel demand. Transport also helps develop areas and the indirect benefits of this increased access around stations, public transport lines and stops can be quite substantial.

Number of people crossing a 3-5 m wide space in an urban environment during a 1 hour period



Private cars are by far less efficient than the other modes of transport in town without taking into account the space they take up for parking

Source: Botma & Pependrecht, Traffic operation of bicycle traffic, TU Delft, 1991

An average daily journey from home to work by car consumes 90 times more space than the same journey made by metro and 20 times more if it was made by bus or tram.

The space required by a person depends on the mode of transport, its speed and the time the vehicle remains parked. The table below compares different modes in the context of moving and parking.

Space (km x m²) required for peak hour 10 km two way working trip (9 hour day)

Mode	Parking	Moving in traffic	Total
Bus carrying 50 people	< 0.5	3	3
Two wheeler	12	8	21
Car carrying on average 1.25 people	72	18	90

Source: UITP/ISTP Millennium Cities Database

As urbanisation increases so does pressure on urban space. This will have dramatic consequences in developing countries, where today relatively small amounts of space are occupied by their road networks – compare 11% in Bangkok to 30% in Los Angeles. The outlook is pretty unattractive if urban land is not carefully allocated.



UITP Recommendations

- Use energy more efficiently with new technologies.
- Develop more sustainable, less polluting modes such as energy efficient rail. Improve road operators' performance through staff training to achieve the most efficient and environmentally friendly driving standards.
- When choosing and developing public transport, planning authorities should encourage dense, mixed-use developments and zoning around the network. Retail and employment activities should be developed around stations.
- Promote dissuasive policies to restrict car use in inner cities and optimise the use of all available space, especially urban space used for parking.



- Provide an incentive to change mobility habits by building well-sited Park + Ride facilities combined with fast, frequent and comfortable public transport services.
- Limit the number of parking spaces per m² of new offices or commercial premises; the better the public transport service, the tougher the standards.

International examples

Montreal: Bio Buses – an alternative to fossil fuels

Biodiesel is a product derived from methanol and either vegetable oils or animal fats. From March 2002 to March 2003, the STM (Société de Transport de Montréal) demonstration project will consume an estimated 500,000 litres of biodiesel mixed at 5% and 20% respectively of biodiesel to conventional diesel.

Biodiesel:

- Reduces GHG and Emissions
- Does not need a new technology (current diesel technology is enough)

Source: UITP Mobi+ CNG Fuel cell bus.pdf

Ethanol buses in Sweden

The town of Umeå (pop.100 000) in northern Sweden decided to introduce ethanol buses in 1994, with a view to completely changing over the fleet from diesel to ethanol. 7 new buses were purchased and 4 existing buses were retrofitted with ethanol engines, making it the highest percentage of ethanol buses in any bus fleet. The fuel efficiency of ethanol is higher than diesel but on average 75% more is needed as it has a lower energy content.

- The extra costs in more expensive vehicles and maintenance, and the higher fuel costs of ethanol over diesel make them around 5% more expensive overall.
- Benefits include a 30% increase in ridership and easily meeting national emission standards. Ethanol also works extremely well, better than diesel, in low temperatures. There are no major infrastructure costs as ethanol is used in much the same way as diesel.



Source: SLTF Swedish PublicTransport Association

Public Transport and energy savings – how the USA could significantly reduce energy imports if 1 in 10 Americans used Public Transport more

Percentage of the US population using public transport on a regular basis	Savings on oil imports
Current levels 1-2%	1 months of imports
7%	6 months of imports
10%	12 months of imports

Source: APTA, the American Public Transportation Association

In short if one in ten Americans used public transport on a regular basis it would reduce US oil imports by 40%. This would also reduce carbon dioxide emissions by more than 25% of the limits set by the Kyoto agreement, without introducing any other measures.

Delhi, India reduces reliance on one type of energy

A network of electric trolley and CNG buses will soon be introduced to complement the existing metro and diesel bus system. Part of the reasoning behind this action is to reduce reliance on one type of fuel mode, and avoid transit ‘shutdown’ and gridlock in the city due to fluctuations in fuel price and availability.



Paris - a top quality bus fleet with clean technology

RATP, the operator covering all modes in Paris, has been developing a strategy to have a full bus fleet using clean technologies by the end of 2003 - namely CNG, LPG, diesel-water emulsion, bio-fuels blends, electrical buses and, for the largest part, exhaust after-treatment (particulate filters). In the coming months, a fuel cell vehicle using hydrogen and producing zero local emission will be tested. Rigorous testing was carried out and validated by 'ADEME' (the French agency for the Environment and Energy Use). The best results in environmental terms were achieved using diesel blended with 30% of diester (from colza seeds) in combination with particulate filters. This gave the optimal balance in terms of emissions and lowest costs.

The updated version of the UITP Bus Committee Report on clean fuels and technologies will be available by end of 2003

Urban Land Use Planning and Policy in Portland, Oregon USA makes public transport the preferred option

In the early 1970's, Oregon State implemented a comprehensive plan to develop the Portland Metropolitan Area. The plan included:

- Control of development areas, in order to control urban sprawl
- Control of the real estate through stringent zoning
- Development of green areas
- Construction of a transit system to support the need for mobility

As a result, Portland built a LRT system to serve its metropolitan area, and started with a high frequency service so its citizens found it an attractive alternative to their cars from the beginning. It now enjoys an increasing ridership, which is the opposite trend in most US cities of a similar size. Today, 75% of Portland’s population are car owners but the majority choose to make certain trips by public transit.

Car sharing, Car pooling and Mobility Management use new technologies, save urban space and help increase public transport use

Optimisation of existing resources is an important aim for all public transport companies and the new technologies in electronics and information technology systems are useful in finding effective solutions. The main benefits are: more transport efficiency, an increased flexibility of the transport network, better passenger safety and environmental respect.

UITP is a partner in the MOSES EU funded Car Sharing project. It cites that:

- One car shared vehicle replaces between 5-10 individually owned cars, and as it is used more frequently does not use up the same space for parking (22 hours stationary out of every 24 hours);
- An average reduction by 50% of the emissions per passenger/kilometre;
- Fleet is usually more modern and therefore state-of-the-art low emission, or is electric, and is well maintained;
- Vehicle use is adapted to needs – a large car is only used when required.

Venice and Bologna, Italy have both introduced car sharing/pooling schemes. The fleets are automatically managed via AVM and mobile phone systems GSM (data). Since 1996, combined measures, including car sharing have increased public transport use by 30%.

The main difference between car pooling and car sharing systems is that the carpooling services are more localised and flexible. Moreover, a citizen can share his own car or van, offering a different path day by day.

They introduced the schemes to:

- Decrease the ownership of second and third cars;
- Eliminate older, more polluting vehicles;
- Reduce cars continually parked using urban space, as the ratio between the number of vehicles driven in the city and the number of privately owned garages and other parking spaces is very poor;
- Residents of the historic centre waive their right to keep vehicles inside municipally owned parking facilities if they do not use their vehicle more than 4 times a month;
- Create an alternative system to taxis for periods of scarce availability (between 5:00 am and 7:00 am).

The Mayor of the City of Venice has given car-sharing users special dispensation to:

- a) Drive through or stop in "Limited Traffic Areas";
- b) Use preferential lanes and/or reserved lanes within the municipal territory;
- c) Park free of charge in the pay parking spaces (so-called "blue stripes") and in the parking facilities operated by A.S.M. S.p.A.;
- d) Car sharer vehicles are able to circulate freely, regardless of whether their license plate number is odd or even in respect to the so-called "alternate license plate" days.

Source: ASSTRA

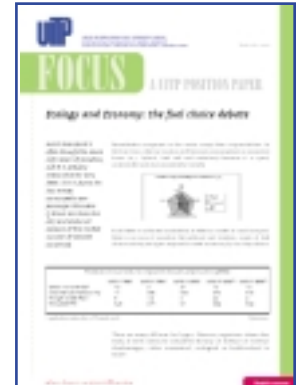
Strasbourg: Limiting access for cars to downtown areas has made better use of urban space

Since trams were reintroduced in 1994 in Strasbourg, France, many areas of the city have been pedestrianised, and now cover a zone of more than 3 hectares. Place Kléber, which used to handle a through traffic of 50,000 vehicles / day, today joins together two pedestrian areas. Pedestrians, cyclists and the tram coexist peacefully, which is enjoyed by all the citizens of Strasbourg and is frequently used for temporary exhibitions, markets and shows.

Measures aimed at increasing the quality of life for all include:

- 30 km/h speed limit in the historic city centre and in surrounding areas, increasing safety;
- Parking restrictions and limiting automobile traffic in residential areas, freeing space for other more social or useful activities;
- Devices to prevent illegal parking on pavements, ensuring harmony and ease of movement for all;
- Enhancing facilities for pedestrians and along the tramlines areas with plants, art installations and cultural activities.

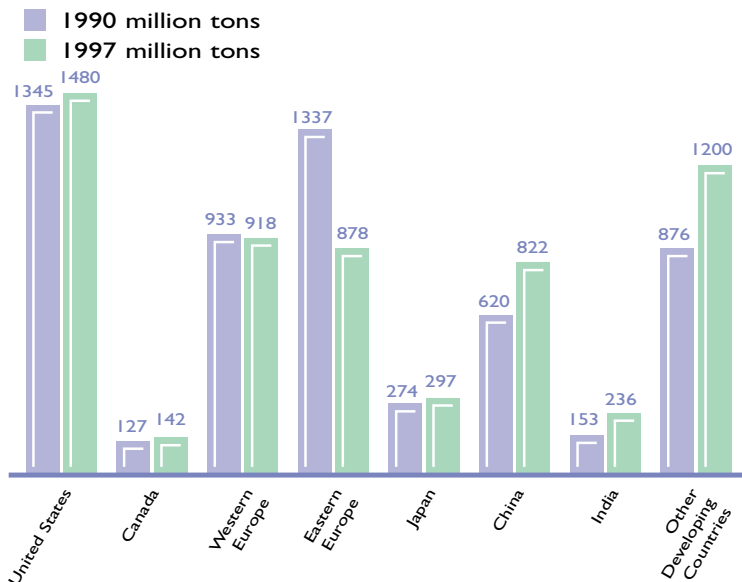
Source: www.transportstrasbourg.org





Global Warming

World Carbon Emissions, 1990 and 1997



Source: Carbon Monoxide and Dioxide Emissions
 U.S. Department Of Energy, Energy Information Administration, Washington, DC, March 2000

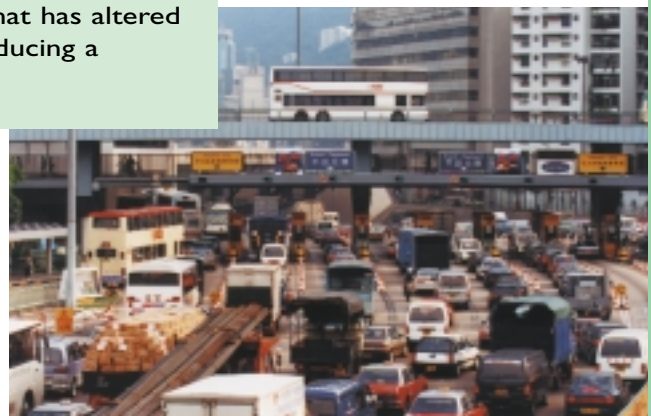
More motorised transport and an increase in private travel demand will deepen the Greenhouse Effect, jeopardising any efforts to limit permanent Climate Change.

Transport- a major source of Greenhouse Gases

The negative impacts of air pollution on human and environmental health are now at the forefront of the political, social and environmental debate. The health of the planet, as well as the health of individuals, is at risk. The effect of Greenhouse Gases (GHG - CO₂, methane and water vapour) on our climate is indisputable.

Climate change is a global problem and requires every sector to play a role. Total emissions in volume are predicted to reach 70% above today's level by 2030 and the lions share of this will come from developing countries. It is estimated that emissions from China alone will be up by 3.6 billion tonnes by then.

The Greenhouse Effect is the phenomena attributed directly or indirectly to human activity that has altered the composition of the atmosphere, producing a change in the world's climate



The transport sector is already a major contributor to GHG, either directly or indirectly, and transport is responsible for approximately a quarter of all GHG in the European Union (equivalent to 823 million tons of carbon). In both developed and developing countries, the transport sector's share of GHG is growing. This trend is alarming. For example, the amount of GHG emissions from the transport sector in Asia, which is 10% of the total in 1990, is projected to grow by 65% by 2010 in India.

Source: TERI, The Energy and Resource Institute (www.teriin.org/urban/air.htm)

In Canada, passenger travel by automobile was responsible for about 42% of transport sector emissions (11% of the national GHG) whereas passenger travel by public transit buses, school buses and intercity buses was responsible for about 1.1% of transport sector emissions (0.3% of the national GHG). Transit Efficiency: urban passenger travel by cars emitted 215g of GHG per passenger-km whereas urban passenger travel by public transit emitted 77g of GHG per passenger-km

Source: Promoting Better Health Through Public Transit, CUTA



Private automobiles account for around half of all CO₂ emissions and are the major source of CO₂ in urban areas. These countries also often suffer from higher emissions due to the continued use of leaded petrol and older more polluting engines, which are often less regulated or maintained.

Over the past fifty years, the number of cars in the world has increased from 50 million to around 450 million. The predicted explosive growth in private car ownership in developing countries will bring alarming consequences despite significant progress in engine technology (see Figure on page 6 – World Motor Vehicle Ownership). In Europe this figure grows by approximately 3 million new cars per year.

Source: Fédération Internationale de l'Automobile 1999.

Lower Emissions from Public Transport

All carbon emissions from public transport are considerably lower per passenger transported, but the sector still recognises its share of possible damage to the environment.

The myth of empty buses

Despite popular belief, research in Sao Paulo shows that a standard 45 seat diesel bus with only two passengers emits less carbon monoxide, carbon dioxide and less hydrocarbons per person than a private car with an occupancy of 1.5 passengers. But not everyone will or can travel by public transport all the time so a balance needs to be created through integrated planning, incentives, regulation and a reduction in car-use.

Source: Urban Transport Environment and Equity, Eduardo A. Vasconcellos

New engine technology is certainly a promising way to improve public transport efficiency. Electric and hybrid vehicles, the use of hydrogen and other new fuels reduce emissions but the wide spread use of clean diesel is already improving emission levels of public transport vehicles. Current technologies already offer a significant reduction in emissions, and future technologies will help the switch to non-polluting sources.

It should be remembered that in developed countries, in particular, the additional threat of the 'rebound effect' means any gains in environmental performance through improved technology are offset by increased pressure of demand, population growth, and higher standards of living. So despite efforts made in reducing individual vehicle emissions and other measures, the results risk being no better than a 'business as usual' scenario.

The over arching need in achieving reduced emissions globally will be a modal shift from private transport to public transport.

UITP Recommendations

- Increase efforts by the supply industry to produce more efficient, lighter road and rail vehicles. Operators and authorities must buy them in high enough quantities to bring them mainstream, and lower prices and maintenance through economies of scale.
- Implement better 'Environmental Management' and pursue improvements in engine and fuel technology to lower significantly public transport's impact on Global Warming and ensure it acts as efficiently as possible.
- Governments should agree fiscal advantages and incentives to reward procurement of environmentally clean technologies.
- Strictly enforce controls, and regular maintenance to reduce environmental impact. An emphasis should be placed on scrapping or retrofitting old polluting vehicles and replacing them with efficient newer ones.

International examples

Public Transport programme for Sweden

The Swedish Public Transport Association (SLTF) has an environmental programme for Public Transport in Sweden including:

- The reduction of emissions of greenhouse gases by 30% from the year 2000 to 2020 and by a further 10% by 2006.
- The reduction of emissions of greenhouse gases by increasing of the Public Transport market share.

It includes principles and guidelines for environmental management systems for Public Transport authorities, an analysis of the most significant environmental impact, environmental objectives and activities to achieve the objectives.

Public Transport itself must reduce the CO₂-emissions by using alternative fuels and reduce total fuel consumption. The composition of vehicle fleets is based on total amount of emissions and tenders evaluated accordingly.

The environmental program has been used by several Swedish Public Transport authorities and resulted in cost effective programs and measurably reduced environmental impact.

Source: Environmental policy for public transport requirements, SLTF, the Swedish Public Transport Association.



Cologne, Germany, one of the first public transport companies to be awarded the EMAS certification

KVB (Kölner Verkehrs-Betriebe AG), the public transport company of the city of Cologne is one of the first municipal transport companies to have implemented the European Eco-Management and Audit Scheme (EMAS), a management tool for companies and other organisations to evaluate, report and improve their environmental performance. The company has not only reduced its environmental impact considerably and established an environmental management system, but also proven to be innovative in raising public awareness of environmental issues and networking with other environmental transport activities. For example, they have negotiated attractive rates and special conditions with car sharing organisations for all their season ticket holders. Their efforts amongst others include an 80% reduction in the use of fresh water and measures to stop waste oil and lubricants to pollute the soil. Their latest scoop is the "EMAS train"; a tram which displays prominently the new EMAS logo in large format and provides more information on EMAS to passengers inside. This tram was launched on public transport day of the first European Mobility week in September 2002. It will enable interested passengers to know more about the environmental management system used by KVB and sets an excellent example on how to inform transport users and citizens in general about the sustainable principles of KVB.



Source: KVB press release

Developing public transport sustainably in Hong Kong

Environmental Management Systems

MTR the mass transit company responsible for building and operating railways in Hong Kong, has initiated a corporate-wide ISO 14001 certified Environmental Management System (EMS) to enable each of its six divisions to monitor and react to the environmental impacts associated with its activities, so that they can be managed and minimised at all times.

Managing Contractors/Suppliers

MTR has initiated a programme to enhance environmental awareness in the construction industry and with suppliers/contractors throughout the project lifecycle.

Source: MTR Corporation Sustainability Report 2002





Urban Air Pollution

Urban air pollution affects everyone

Urban air pollution is a major cause of the serious deterioration in the quality of life, and it has detrimental effects on health, with the elderly and young children being the most vulnerable members of the population. According to WHO, every year more people die from diseases provoked by traffic-related air pollution than are killed in car accidents.

Carbon Monoxide (CO), produced from the incomplete combustion of organic materials, Sulphur Dioxide (SO₂) and particulate matter produced by diesel-powered vehicles and coal fuelled power plants are primary pollutants and key contributors to ground-level ozone and smog. High particulate levels, in particular near the ground, have negative health effects and aggravate cardiac and respiratory diseases, irritation, lung inflammation, as well as reducing the oxygen-carrying capabilities of the body, ultimately contributing to early death.

In developed countries, air quality has improved substantially thanks to better technologies (catalytic converters, low emission engines, particulate filters) and cleaner fuel. However the saturation of the roads with traffic, combined with unfavourable atmospheric conditions, threaten these improvements.



Low urban air quality is a real problem in developing economies

Mexico City – twice the recommended level

WHO estimates that Mexico City's concentration of suspended particulates is on average 179 mg/m³, nearly twice the recommended level of 90 mg/m³. The exhaust fumes of the 3 million cars in the city are mainly responsible for this low air quality.

Tehran – no emission control for cars

In Tehran, a quarter of the car fleet is without any emission control and is over 20 years old. In December 2001, the level of pollution was so high that authorities had to shut down schools and to close city centre to cars, advising everyone to stay indoors.

Source: IEA

Delhi – traffic pollution a real health hazard

The levels of SPM (suspended particulate matter) in Delhi's air exceeds the permitted levels by over 100% and the RPM (respirable particulate matter) levels exceeds standards at most monitoring stations. Vehicular pollution has grown from 64% to 72% in the last decade and petroleum and diesel consumption by 400% and 300% respectively. In New Delhi, pollution from the automobile has increased 8 times over the past 20 years and surveys show that the incidence of respiratory diseases from air pollution is 12 times the national rate.

Source: TERI, The Energy and Resource Institute (www.teriin.org/urban/air.htm)



A lack of standards and their enforcement means many vehicles in both the public and private fleets in developing countries are highly polluting and, despite low motorisation levels, the air quality in many developing cities is deteriorating fast. The World Bank puts the cost of this at 2.7% of GDP for Dakar, 1.6% in Ouagadougou and 2% in Abidjan – crippling high figures for emerging economies.

GDP is Gross Domestic Product

Public Transport - a cleaner alternative

The zero-emission car is still a long way off and private cars are the main cause of local urban air pollution related to transport. Occupancy rates for cars are in decline, bringing more and more cars onto the roads resulting in higher emissions, despite cleaner engine technology. Conversely, and without any new technology, public transport already produces lower emissions per passenger.

Travel by public transport produces on average 95% less carbon monoxide, 90% less volatile organic compounds and approximately 45% less carbon dioxide and nitrogen oxide per passenger kilometre than travel by private vehicles. Greater use of public transport, therefore, would considerably reduce hazardous pollution in precisely those areas where it now presents the greatest risks.

Climate change issues are closely tied to energy concerns, since most of the energy used is carbon-based, so reducing CO₂ emissions relies heavily on the diminution of energy demand.

Emissions by Public Transport and by replacement use of private vehicles metric tons 1999 US

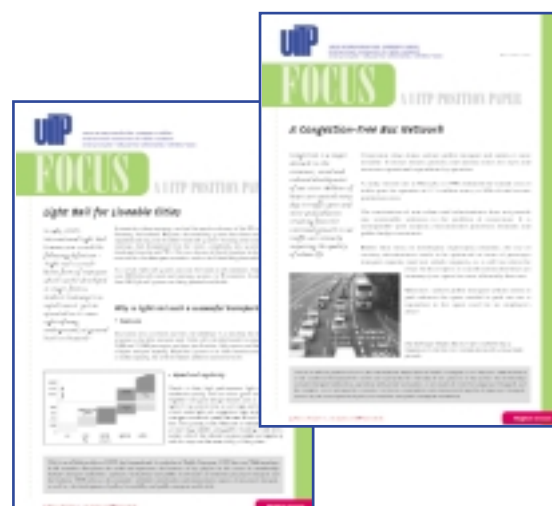
Mode of travel	VOC*	CO	Nox	CO ₂
Public transport	6,319	38,079	29,838	9,120,489
Private vehicle	76,748	783,006	57,002	16,526,345
Environmental savings	70,431	744,927	27,164	7,405,856

* Volatile organic compounds

Source: APTA report *Conserving energy and preserving the environment: the role of public transport*
Shapiro R., Hassett K.A., Arnold F.S. July 2002

UITP Recommendations

- Promote the use of low or zero polluting modes (on a local level) such as light rail, metros and electric vehicles to provide high occupancy mobility in inner cities. Dedicated rights of way and restricted access for private transport will improve safety and air quality for all.
- Operators and the industry should adopt the best possible practices in their own activities in promoting cleaner technologies and practises for public transport fleets.
- Low sulphur (or desulphurised) diesel and lead free fuel should be marketed and distributed in all countries, but especially in developing countries, with the same conditions as diesel and leaded fuel have today. Authorities should allocate tax rebates and other incentives on desulphurised fuel and stimulate widespread distribution.



International examples

The World Health Organization and the Consequences of Air Pollution

The World Health Organization (WHO) estimates that about 700,000 deaths annually could be prevented in developing countries if three major atmospheric pollutants - carbon monoxide, suspended particulate matter, and lead - were brought down to safer levels. The direct health cost of urban air pollution in developing countries was estimated in 1995 at nearly US\$100 billion a year.

In European cities around 80 000 adult deaths a year are estimated to be related to long-term exposure to traffic-related air pollution. Both short and long-term WHO air quality guideline values for ozone, NO₂ and particulate matter levels are frequently and considerably exceeded in the European region.

Source: Charter on Transport, Environment and Health, WHO

Shanghai – investing for the future and combating present congestion and pollution

Shanghai, with several times the income of Delhi today, has less than half the number of private vehicles but congestion is a major problem due to the large number of bicycles, pedestrians, cars, buses and highly polluting motorised two wheelers, all fighting for the same road space. Public transport trips average 10.5 million trips daily with over 7 million being made by bus. With the ambitious goal of keeping the time needed to cross the city to an average of 60 minutes, developing rail has been a priority as it is the most economic way to move large quantities of people. 65km of metro line already averages a million passengers a day and an extra 200km of rail will be completed by 2005, linking areas of the city in a 'hub and spoke' (Cross and Ring) network.

UITP Metropolitan Railways Conference Shanghai 2002



Regenerating technology decreases public transport's emissions - EURIII

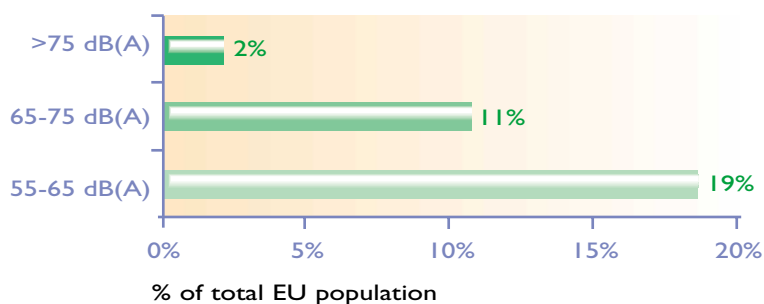
Diesel oxidation catalysts (DOCs) have already been retrofitted to many buses in Europe and the US, and starting in 2000 the Hong Kong Government began a programme to bring all its 12,000 diesel buses in line with the stringent EURIII emission standard. It has undertaken to fit particulate filters and catalytic converters as the most practical way to reduce emissions from older diesel buses



Noise

More than just a nuisance

Estimated percentage of population exposed to different road traffic noise levels (EU 15)



Source: European Environmental Agency, *Are we moving in the right direction? Indicators on transport and environment integration in the EU, Term 2000.*

WHO norms for noise exposure
>40 dB LAeq: Influence well being
>50 dB LAeq: Moderate annoyance
>55 dB LAeq: Serious annoyance
>65 dB LAeq: Can be detrimental to health

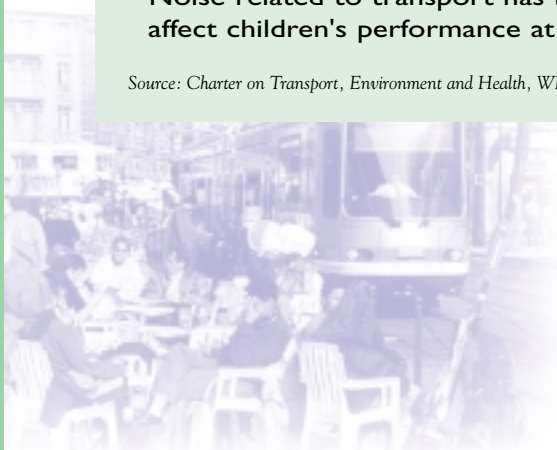
Noise is a type of 'pollutant' in cities today and transport is the main cause of human exposure to ambient noise. 30% of Europeans are exposed to road noise, with nearly 20% of the population in Europe exposed to seriously high levels of noise.

Children at most risk

Road, aviation and rail are major sources of noise annoyance and the effects of extended exposure can lead to socio-psychological effects (depression, disabilities...). Public Transport also generates noise, particularly surface services, but less than the constant passing of cars. Operators can also introduce measures to decrease these impacts through new technology and improved practises.

- Noise can interfere with sleep patterns and mental activities such as memory and the ability to deal with complex analytical problems. Children chronically exposed to loud noise show impaired acquisition of reading skills, attention and problem-solving ability.
- Noise related to transport has been shown to negatively affect children's performance at school.

Source: *Charter on Transport, Environment and Health, WHO*



The success of initiatives such as the 'In town without my car', when areas of the city are made 'car free', show considerable reductions in noise levels. In general a difference of up to 17dB is usual, based on measurements taken at the same time of day, without cars but allowing bicycles and public transport access. This was the case along the Archbishop Makarios III avenue, one of the main thoroughfares of Nicosia, Cyprus, during a car free day in 2002. In Ealing, a suburb of London, the noise level was over 10 decibels lower than when all the traffic is present. This difference corresponds to a doubling of loudness of noise levels.



Home zones and restricting speed and access, as well as, parking in residential and commercial areas help to reduce noise and rebuild communities. This does not reduce the commercial benefit for shops as can be seen in the UITP Focus paper on Parking. Pedestrianising areas in towns and cities also gives these spaces back to the citizens creating quieter more convivial areas allowing better social interaction and contact.

UITP Recommendations

- Reduce noise through regular maintenance of the public transport fleets, new quieter technologies, noise absorbing materials and restraining intense car use in densely populated urban areas.
- Continue research in noise reduction to make both road and rail public transport more attractive.
- Restrict car use at peak times and all deliveries in city centres to reduce noise levels. Lower noise levels in home zones and pedestrian areas through speed and access restrictions, improving the quality of life for all citizens.

International examples

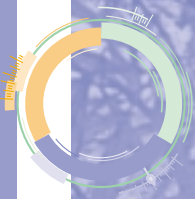
Noise Control

RATP, the public transport operator in Paris, France

Has introduced a noise management plan for all modes, but to address noise made by the metro in particular. Measures include:

- Research into noise and vibration levels over whole rail network;
- Reduction of noise at source;
- Maximising the use of electric brakes and other noise reducing braking technology;
- Dampening of noise made by metro wheels (squeal), especially on corners;
- Insulation and other vibration reducing measures on specific track sections near sensitive areas;
- Reduction of all industrial noise through better environmental management of power supply, maintenance buildings, workshops, exhaust fans etc.;
- Research and improvements on the different levels of noise inside buses;
- Participation in European research programmes.

Source: RATP Brochure, *Rapport écologie urbaine et développement durable*

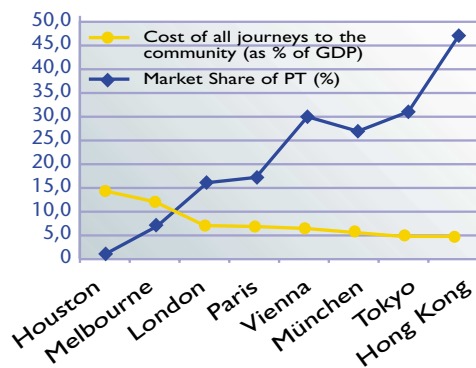


Stop three - Economic value

The cost of transport to the community

Density and the cost of transport to the community

Cost of Journeys to the Community ↔
Market Share of Public Transport



Cost of all motorised trips
Source: UITP/ISTP Millennium Cities Database and Wiener Linien

Poor infrastructure and traffic congestion not only has a high environmental impact but also reduces the economic viability of a country, while increasing the overall cost of transport. Unpleasant living conditions in cities drive people to live outside city centres, creating sprawling green suburbs. Linking these suburbs with employment and services is more expensive than for dense and compact communities.

In developed countries, in cities with average or high density where more than half the journeys are made by public transport, by bicycle or on foot, the cost to the community of urban journeys accounts for 5-7% of GDP. This figure rises to 15% of GDP in sprawling cities where the automobile is king. Cities in developing countries where density is low and level of car ownership is high with respect to income per inhabitant, find the cost of journeys can exceed 25% of GDP.

If cities of similar populations and wealth, such as Singapore and Houston, are compared research reveals that Singapore, which is ten times more dense and has ten times less cars, spends 10 billion US\$ less per year than Houston to transport its inhabitants (i.e. \$US 3,000 per inhabitant). It also offers them better accessibility!



The true costs of transport

All transport activities give rise to internal and external costs. Internal costs are those met directly by users such as purchase, fares, taxes, fuel, energy and maintenance. External costs are more difficult to measure. They represent costs paid by others and are required in order for the transportation mode to function and include road infrastructure, parking lots and traffic management. They also include indirect costs to the community as a whole such as congestion, air pollution, noise, accidents, the destruction and the visual scarring of communities, as well as the demolition of historic buildings and sites and uneconomic urban sprawl.

External costs differ in relevance according to local characteristics. Quantifying and prioritising them is sometimes difficult and debatable. However assessing the cost of congestion, accidents and the use of space are widely accepted. Public transport, due to its collective nature, excellent safety record and efficient use of space, wins on every count.



Higher costs for families

More expensive transport has an impact on family budgets. The proportion of a family budget allocated to all journeys is typically between 10-20%. It is often difficult to estimate the full cost of a car. Comparative studies in Europe show that the annual cost of a car is 6-9,000€ per year based on an average annual mileage of 15,000km for a petrol model and 25,000km for a diesel model. In real terms this means between 500 and 660€ per month.

Source: Energie-Cités website

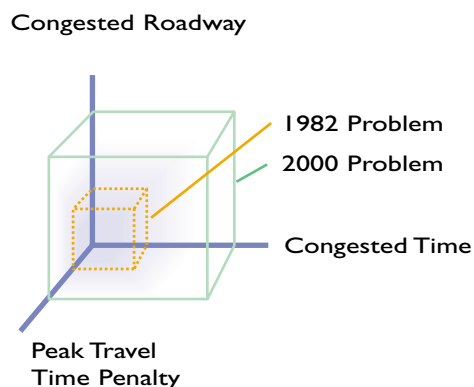
High levels of public transport use in Montreal in Canada means families spend 24% less on transportation each year than families elsewhere in Quebec – an annual saving of CAN \$ 1,250.

Source: CUTA Fact sheets

Congestion – an unnecessary expense for communities

Furthermore congestion is growing in all urban areas and has a measurable impact on an economy. This problem is not confined to peak times or specific areas but is now widespread in both developed and developing cities, and threatens economic growth and viability.

Conceptual view of the Expanding Box of Congestion Problems



Source: Texas Transportation Institute

Congestion is a three dimensional problem. It now affects more of the time spent travelling and occurs on more roadway, resulting in greater time penalties. This graphic shows the results of research in 75 US urban areas for the years between 1985 and 2000. Congestion affected more roads in total increasing from 34% to 58%. Peak period congestion increased from 33% to 66% and travel takes longer (increasing from 14% to 39%). The problem is not simply that it takes more time to get around than it did, but that congestion exists on roads and at times that it did not a few years ago. Individuals and businesses therefore need to plan for more time to accomplish trips, there is less certainty involved in travel plans and it is more difficult for agencies to handle vehicle crashes, breakdowns and unusual weather conditions causing further significant increases in travel time and greater uncertainty. This obviously has an impact on the reliability of all transport, including road based public transport. Fewer vehicles carrying more people would relieve this problem.

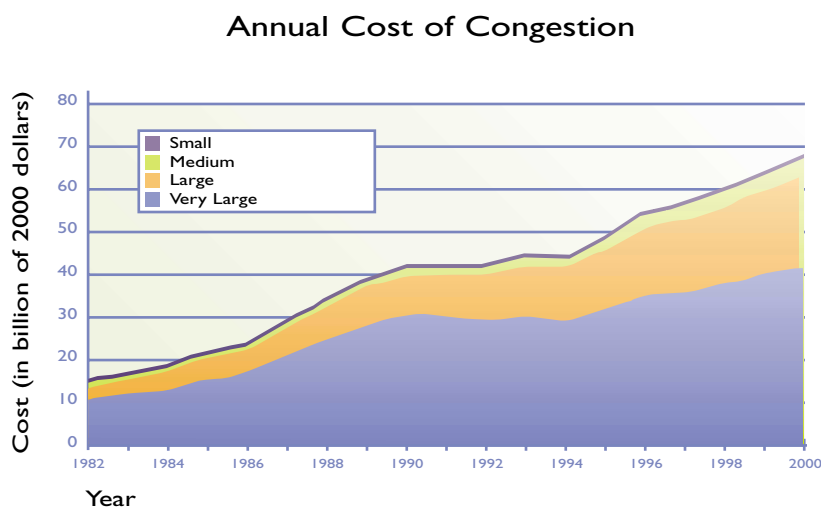
Source: Texas Transportation Institute

In cites in developed counties, where density is only 20 inhabitants/ha instead of 60 (two thirds lower), the total cost of journeys to the community increases by 50%. Energy consumption and greenhouse gas discharges from passenger transport are multiplied by 3 and access time to urban activities for captive users of public transport is increased by 50-100% making them less economically viable.

Source: UITP MCDB/ISTP

A recent OECD Study (Urban Travel and Sustainable Development OECD-CEMT Paris, 1995) estimated that congestion costs amounted to 2% of GDP, which implies that the cost of congestion in the European Union comes to about €120 billion. This is four times what is spent on passenger public transport across the EU.

Source: European Council of Ministers of Transport, CEMT



Source: Texas Transportation Institute

The 2002 Urban Mobility Report by the US based Texas Transportation Institute, which studied 75 urban areas in the US between 1982 and 2000, found that the total cost for congestion was some \$68 billion, the average annual cost for the year 2000 was \$900 million, and, cities with large populations suffered most (62% of the total congestion cost).

Public transport creates jobs

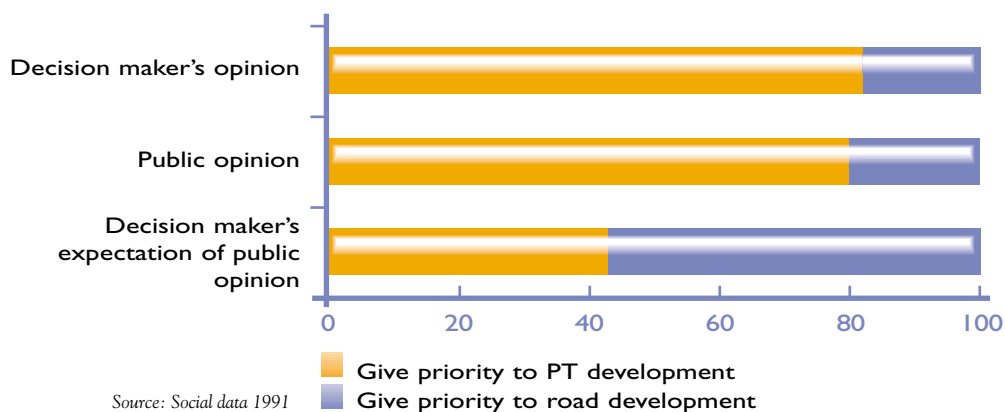
In addition to reducing costs caused by congestion, public transport creates jobs and supports local economies. According to a study by APTA (The American Public Transportation Association) for every \$10 million invested in capital projects for public transport, more than 300 jobs are created with a \$30 million gain in business. In Europe, public transport creates 2-3 times more employment opportunities per passenger kilometre than private transport.

Source: INRETS April 96 l'emploi et energie mobilisé dans les transports de voyageurs

In many cities, collective transport services are some of the biggest local employers. For instance in Paris, RATP alone is responsible for some 30,000 jobs.

Investment in public transport can be expensive but the benefits are much greater and help towards achieving long-term sustainability. Decision-makers often draw the conclusion that growing traffic volumes and car ownership reflect peoples' desire to drive. This is certainly misguided as can be seen in Vienna, a city that can boast one of the highest modal splits in favour of public transport in Europe combined with a high level of car ownership.

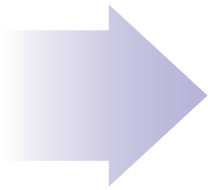
Attitudes of European decision-makers and citizens towards developing public transport and road infrastructure



Equitable charging and regulation are paramount in developing the sector in all countries. More specifically in less developed countries, paratransit or informal transport often creates anarchic transport conditions. There are now well over a million paratransit vehicles in service. They have usually developed to fill a gap in the market between individual and public transport and can provide a premium service. More often than not, unfortunately, they are a major source of congestion and environmental nuisance, undermining formal public transport. Sensitive regulation and stricter monitoring in safety and emission controls allows them to play a valuable niche role alongside conventional public transport.

Cities without a sustainable transport system will not be able to compete economically. These cities will also be less attractive for living and working.

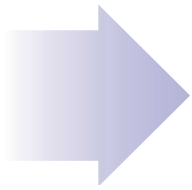




UITP Recommendations

- Develop policies in respect to sustainable mobility for the optimal use of economic resources centred on: intelligent land use planning, the restriction of private car use and the promotion of public transport.
- Develop high-density urban areas with robust public transport systems, combined with restrictions on vehicle use to keep costs low. Maintain consistency between land-use planning and transport policies to curb urban sprawl.
- Take courageous and sometimes unpopular political decisions to achieve “zero growth in traffic”.
- Earmark the proceeds from parking and road tolls, as well as contributions from other economic actors who have benefited from the accessibility provided by public transport networks (e.g. property developers, employers etc.) for further developing public transport.
- Set fares at a level which allows a service to be provided that is good enough to persuade motorists to use public transport.
- Structure and regulate paratransit and informal transport in less developed cities to facilitate access to safe, affordable transport for all in an equitable fashion, especially the low income and most vulnerable members of society.





International examples

Zurich – wealth and public transport goes together

Zurich, the financial centre of Switzerland, has a highly developed and integrated public transport network. The concentration of jobs in financial districts here as in Wall Street, the City of London and Frankfurt calls for high capacity, attractive transport systems.

In the 1970's, growing pollution and congestion led the city to reaffirm its determination to develop and maintain a competitive network. Since then, the city has adopted the following measures and is internationally known for efficient, cost effective transport:

- Full priority given to the tramway network
- Limited investments in road capacity
- Reduced number of parking places in downtown areas
- Imposed several traffic calming scheme in residential neighbourhoods
- Successfully introduced the concept of 'zurimobil' offering an integrated choice of transport, including car sharing, to its citizens.

Zurich spends a relatively high percentage of GDP (9-10%) on transport but this is due to the attractive service it provides.

Source: Three messages from Zurich concerning the new transport policy, Ernst Joos, May 2000

New Zealand – increased patronage through incentives

Output-based funding rewarding regional councils has helped increase public transport patronage with incentives from central government funds. This has helped stimulate a change in mode with percentage changes of as high as 180% in regional towns to a more modest but still significant growth in all the major cities (e.g. 6% in Wellington, 17% in Auckland). Wellington enjoys one of the highest patronage of public transport per capita outside Asia partly due to its control of downtown road space via restricting and charging for parking in the capital.

Source: ANZ Bus and Coach Association

Rich industrialised countries with high car ownership does not automatically mean low public transport patronage

Vienna, Austria, has one of the highest car ownership levels but public transport still enjoys a high market share. Patronage has risen by 10% over four years and 32% of all trips are now made by public transport, with 38% made by car or motorised two wheelers and the remaining 30% by non-motorised modes. This has been made possible through an integrated approach such as a common ticket for all modes in the metropolitan area, well planned interchanges, expanding light rail, metro and suburban rail services and personalised marketing to new residential areas.



Car ownership in Freiburg, Germany, rose from 113 per 1000 people in 1960 to 422 per 1000 in 1990. Despite this car use has remained almost constant but total trips have risen by 30%, with an increase of 53% in public transport patronage and 96% in bicycle trips between 1976 and 1991.

Real estate values have increased substantially along Brisbane bus line



Property values along Brisbane's south-east bus line have risen as much as 20%, as buyers take advantage of traffic free travel to the city. Around 375,000 private vehicle trips were converted to public transport along the bus line. The 15.6km line with an operating speed of 80km/hr, and opened in 2001, is part of a planned 75km long route.

Earmarking funds for transport

London, UK – the introduction of congestion charging.

A flat fee of £5.00 (8€) is charged for all vehicles using the road space (either moving or parking) in the small CBD area of the city of London from mid-February 2003. The scheme has cost £200 mio (~€300 mio) to set up but the estimated net benefit is £130mio, and at least

£100 mio has been earmarked for funding transport and traffic improvements over the whole city. These include a 40% increase in bus services and the introduction of 200 new buses, new routes with a 24 hr service on some of them. Initial results show this measure has reduced traffic by 20% and traffic delays by 30%. Support for the scheme has been strongest from the business community, who are losing £2 mio in lost revenue and £4 mio in lost time per week due to the present levels of congestion.

Source: TfL, Transport for London

Singapore - Electronic Road Pricing Scheme

- Population: 3.6 million

- Total Vehicles 700 000

- Introduced payment for entering the Central Business District (CBD) in 1998

Different tolls for the different roads used are automatically debited via a smart card and device. Restrictions apply from 7.30 am to 7.00pm and from 7.30 am until 9.30 pm on the outer expressway

Benefits:

- Reduction of nearly 25,000 cars during peak times and an increase in traffic speed.

- Total reduction of traffic in zone during charging period of 13%.

- Increased passenger use, meaning less solo drivers.

- Shift of vehicles from peak to non-peak periods.





Conclusions

A responsibility for all

Sustainable development and sustainable mobility are no longer isolated topics for theoretical or ideological discussions but are crucial issues, which have an impact on the everyone's daily quality of life. As can be seen over the last decade, traffic congestion, air pollution from transportation and greenhouse gas emissions have spiralled out of control, but it is too late to worry about whether cars are good or bad, the 'auto-genie' is out of the bottle and here to stay!

The challenge is to develop transport alternatives that take into account all modes, integrating the advantages of cars, while mitigating the disadvantages. There is no doubt that this is a complex task for politicians, transport organising authorities and operators in both developing and developed countries as well as for the supply industry.



The time for action is now

Creating a better future requires acting now for a more equitable present, and governments and businesses in all sectors need to be committed to programmes that will improve the current trends and patterns. Without a fundamental shift in our present habits of consumption and production, economic progress will be stifled and environmental degradation will continue, affecting all citizens. There will be greater social exclusion for the poor and less able, diminishing the advantages of a diverse urban culture.

Real sustainability is only possible if every level of society participates in the process and starts to make changes in their own mobility expectations and patterns. In other words, all the

various players, including consumers, need to change practises and put policies into place that will lead to a sustainable future for all.

Sustaining a quality of life

Sustainable mobility is not the goal in itself. The goal is sustaining quality of life through the equitable appropriation of space and resources and the corresponding access to social and economic life for all. The integration of economic and financial instruments into environment and transport policies is a step in the right direction, but it is also the duty of all mobility actors to promote more sustainable practises.

The three steps to sustainable mobility as outlined in this brochure show that it is achievable even today. Public transport performs well in all three steps demonstrating that it is not only part of an environmental solution, but it is also a dynamic social and economic actor in the sustainable future of cities.

There is an opening now for the public transport sector as a whole to take the lead. However a co-ordinated and sustained approach involving all stakeholders and supported by political commitment is needed for long-term sustainable development to occur.



Sustainable Mobility

Only Three Stops Away

Examples of UITP members' commitment to Sustainable Development

MTR Hong Kong

MTR, a listed railway operating company in Hong Kong, have identified compelling business reasons for taking environmental and social responsibilities seriously:

- Improving productivity by engaging staff and encouraging them to implement best practises
- Attracting socially responsible investors and investment funds and other investors who value good corporate governance and transparency.
- Long –term benefits from reducing environmental impact and improving safety of customers

They have been recently invited to join the FTSE4Good, the sustainable index of the Financial Times and the DJSI, the Dow Jones Sustainable Index.

MTR Corporation Sustainability Reports are independently audited and are available from their web site.

Further information and the report can be downloaded from www.mtr.com



Italy - combined measures for success

Since 1998, ASSTRA, the association grouping all Italian public transport operators, has been promoting policies and initiatives favouring sustainable mobility. This includes calling all members to:

- Increase the standards of quality of local public transport to make it more attractive;
- Progressively equip and improve vehicle fleets so they have a lower environmental impact;
- Promote the introduction of alternative fuels;
- Promote intermodality by complementing public transport with car sharing, car-pooling and collective taxis;
- Promote cultural change in mobility behaviour

ASSTRA has signed several agreements with government institutions, such as the Italian Environment ministry, NGOs and other organisations active in environmental and civic issues to commit to actions to reduce congestion and pollution, improve energy efficiency and promote public transport.

Specific actions include:

- Training professional Mobility and Energy Managers to manage mobility relations with companies with more the 300 employees.
- Joint communication campaigns linking public transport to the environment and sustainability with the World Wildlife Fund (WWF);
- A project entitled "Guidelines for the Integrated Implementation of a System of Quality and Environmental Management within Mass-Transit Enterprises" in collaboration with ENEA (Ente Nazionale Energia Ambiente);
- A technical commission was established in May of 2002, consisting of representatives of the member enterprises, to draw up the "Guidelines for a Plan of Acoustical Monitoring of Systems of Local Public Transportation" to reduce noise pollution.
- Measurement campaigns of electromagnetic emissions in urban mass transit have been carried out by the local public transportation enterprises of the cities of Milan, Naples, Rome and Turin, combined represents local public transportation by road, by rail and in subways

Environmental Management in Paris

RATP, in Paris, France has put in place an environmental management system for its network covering all areas of maintenance. It was awarded ISO 14001 certification for its metro line 8 in 2001, the first metro line in Europe to be given certification covering all activities.

By the end of 2002, further certificates were awarded to a bus depot and maintenance workshop. Its 50 maintenance sites are under constant scrutiny on the treatment of waste and water. Since 2001, environmental specifications in respect to life cycle and energy efficiency have been introduced for all rail and road procurement.

Sustainable Development and urban ecology have been strategic objectives since 1998 cited in RATP's strategic plan, and a dedicated unit reporting to the Board has been created. In 1999 it signed a Charter on Sustainable Development for Public Companies, with seven other public bodies. This charter has 5 main themes: Competence Development, Personnel Involvement, Technology Expertise, Research and Regional Support. It has also installed 7 agencies covering the Ile de France region where it operates, creating strong local partnerships and supporting community actions.



Connex – committed to sustainable development

Connex, one of Europe's leading private passenger transport operators with a fleet of around 25,000 road and rail vehicles in 22 countries in Europe, Middle East, Australia, and North and South America has made Sustainable Development a strategic objective. They already have a 10 point charter on Sustainable Development and an Environment Committee. Regular reporting takes place on passenger kilometres offered, fuel consumption, percentage of clean fuels used, polluting emissions and waste recycling. These indicators provide employees as well as external stakeholders accurate information. Tracking them over time reveals their progress in environmental protection and shows where they stand in relation to other divisions in the holding.

Source: Connex Environmental Report 2001

People make the difference

Alcan, and its UITP member Alcan Transport, supports sustainable development and has incorporated it into its business principles. In its published Corporate Sustainability Report 2002, it states that Sustainability includes:

- Improving Alcan's performance - increasing social and economic benefits and reducing the environmental impacts of its activities over the short and long term, and becoming a more profitable and competitive organisation;
- Strengthening relationships and partnerships – recognising and working with their employees, stakeholders and shareholders to address their needs and the needs of the company;
- Demonstrating integrity and commitment – maintaining and valuing the high standards they have today as a company in all its day-to-day operations.

Alcan's set of values guides its growth:

- Integrity – operating in integrity in all business dealings, and adhering to a sound code of moral and ethical conduct.
- Accountability – striving to be openly accountable and willing to align decision-making power with all levels of the organisation. Alcan employees should honour their commitments and accept responsibility for their actions and behaviour.
- Trust and transparency – Trust is the core of ethical business and trust must exist that Alcan and others will do as they say.
- Teamwork – leveraging the ability of employees, suppliers, contractors and customers and using cooperative teamwork to help solve problems and implement projects more effectively.

Source: Alcan Corporate Sustainability Report and web site www.alcan.com



UITP - the international association of public transport, representing all mobility actors world-wide has 2500 members in 80 countries; The General Secretariat is in Brussels and they have regional offices in Rome, Moscow, Canberra and Hong Kong. An office in Sao Paulo will be opened shortly.

UITP Mobi+ is the Association's electronic documentation centre with internet access available to all UITP members. It contains the World Congress papers, all other UITP conference papers, articles from Public Transport International, UITP bi-monthly magazine, virtual links and other documentation.

UITP/ISTP Millennium Cities Database can be bought from the UITP Publications department (contact Dorian Angotzi doriano.angotzi@uitp.com). Over 200 indicators have been collected from 100 cities world-wide including data on the population, the economy and urban structure, the number of road vehicles, public transport networks, individual mobility, modal choice and the cost of transport.

The following abbreviations have been used:

- APTA: The American Association of Public Transportation
(<http://www.apta.com>)
- ASSTRA: The Italian National Public Transport Association representing all urban networks and 70% of regional networks.
- CUTA: The Canadian Urban Transit Association
(<http://www.cutaaactu.ca>)
- SLTF: The Swedish Public Transport Association
- SNCF: Société National des Chemin de fer, the French National rail network
(http://www.sncf.com/co/mieux_nous/environnement.htm)
- WHO: The World Health Organisation
(<http://www.who.int/en/>)

UITP and its members are taking up the challenge of sustainable development seriously and their commitment to the UITP Charter on Sustainable Development, launched in May 2003, tracks this commitment. A full list of members actively supporting this initiative can be found on the UITP web site.


UITP thanks the members of the Sustainable Development Working Group who have all contributed to this work as well as the many others whose invaluable help was also much appreciated:

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The following UITP staff:

Heather Allen, Issue Management
Mohamed Mezghani, Director of Programmes & Studies
Petra Mollet, Director of Corporate Development
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UITP, International Association of Public Transport
rue Sainte Marie 6 • B-1080 Brussels • Belgium
Tel +32 2 673 61 00 • Fax +32 2 660 10 72