Urban Transport Sustainability: Asian Trends, Problems and Policy Practices

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The paper describes the possible direction of Asian EST, starting with an overview of recent trends and problems in transport systems within Asia, policy practices are also introduced. It was found that although the current situation and trend of transport in the Asian region presents a diverse picture stemming from geographical differences and levels of economic development, most Asian countries share similar concerns about transport-related problems, namely severe congestion, air and noise pollution,. Common patterns can be identified behind these problems, which include: a)large increases in traffic demand, resulting from rapid economic growth, urbanization, and motorisation, b)poor control of vehicle emissions and the absence of effective inspection and maintenance systems, c)lack of adequate and appropriate infrastructures, and d)poor coordination of transport and land-use policies. In the current situation, insufficient understanding of environmental deterioration mechanisms delay the implementation of necessary policy measures in many Asian countries. Each

country should find the best way to achieve EST as fast as possible by learning from others' experiences. Existing good examples within the region, such as intermediate public transport systems and electric road pricing, can provide a strong foundation for this purpose.

Key words: Transport systems in Asia, environmental challenges, policy practices, Asian EST

1. Introduction

Achieving environmentally sustainable transport is a major challenge faced by countries around the world, in particular, Asian countries which have to cope with transport-related environmental problems stemming from the rapid economic growth. Asian countries have developed diverse and unique transport systems to cope with increasing travel demands for over a century. However, the rapid growth rate in motorised road transport has partly offset the advantages of these transport systems. This rapid motorisation, together with poor land-use planning condenses urban space and accelerates suburbanization thus leading to the development of an inefficient urban structure. A vicious circle of motorisation and suburbanisation has caused serious transport-related environmental problems, including traffic congestion, inefficient energy use, as well as, air, water and noise pollution.

In many Asian countries, public transport depends heavily on roads. Urban and inter-city rail transit systems are yet to be developed or need much greater system expansion and improvement. Economic conditions require the use of low-quality fuels and poorly maintained low-quality, and often older vehicles, leading to high levels of pollution and inefficient fuel use. Asia is expected to achieve significant economic growth during the 21st century. This growth will not be sustainable unless issues of transport-related air pollution and use of fossil fuels are addressed. There is a need to establish clear environmental goals and timetables that are appropriate to local circumstances, and to identify ways of meeting these goals while ensuring social and economic development.

Recognizing this need, the OECD (Organisation for Economic Cooperation and Development) organized an international conference on Environmentally Sustainable Transport (EST) for the Asian region which was held in Nagoya, Japan, from 23-25 March 2003. It should be noted that although the conference was a sequel to the OECD's EST project, the term "EST" was used in a broader sense here than the original one[1]. As the idea of EST is still vague among most Asian countries in the first place, a main emphasis was given to encouraging them to take a first step towards EST that is conceptualization of Asian EST rather than to applying the OECD's EST concept/approach to the region as it is. In the light of this, the purpose of this conference was to discuss how to transport people and goods in the Asian region in an environmentally sustainable manner, taking into account regional trends and priorities. At the same time; however, the EST case studies for Japan which

[1]As for the OECD's EST project, refer to the conjunctive paper: Peter Wiederkehr, et al, "Environmentally Sustainable Transport: Concept, Goal, and Strategy −The OECD's EST Project" elsewhere in this volume.

explored the feasibility of EST in Japan, applying the same EST criteria used in other existing EST case studies, were conducted and presented at the conference[2].
This paper aims to describe the possible direction of Asian EST, starting with an overview of recent trends and problems in transport systems in this area, and introduces some policy practices contributing to the alleviation of these problems.

2. Recent Trend in Transport Systems

2.1 General trend

Growing Asian cities have experienced rapid economic development and urbanisation since the latter half of last century. This development has resulted in a significant increase in the mobility of people and goods that are highly automobile-dependent. Figure 1, shows recent trends of motorisation in concurrence with income growth in some selected cities. Most major cities, except Hong Kong and Singapore, have exhibited a high rate of increase in car ownership. Capital cities in Korea and the ASEAN (Association of Southeast Asian Nations) countries have shown the highest increase over the last two decades.
Due to the higher rate of increase in car ownership than in road supply, as shown in Figure 2, the present carrying capacity of the road network cannot cope with a further increase in traffic demand. In the case of Seoul, car ownership per thousand people has increased more than 10 times, from 15.6 in 1980 to 181.6 in 2000, resulting in a drastic decrease in road length per passenger car. Tokyo and Nagoya show similar trends with data showing a level of 5 km/passenger car. This trend has caused a deterioration of road network conditions, which in turn has brought about the reduction in the average travel time along major corridors within big cities.

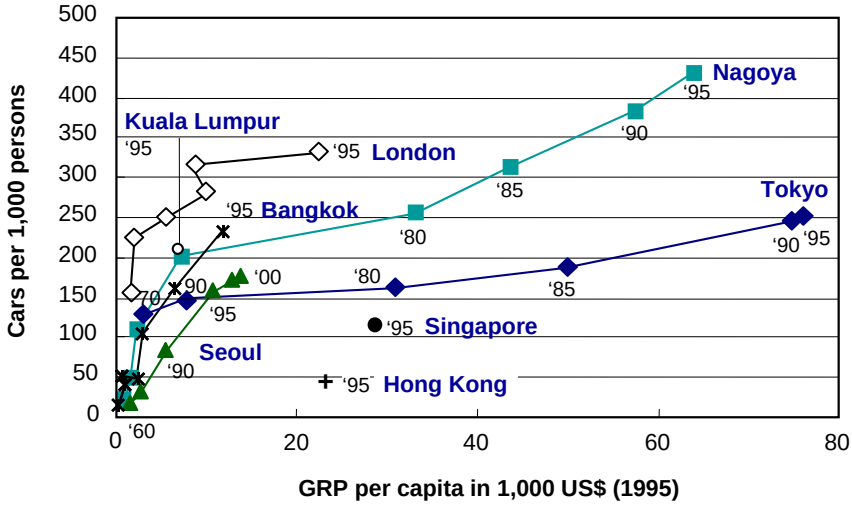


Figure 1. Recent trends of motorisation in selected Asian cities

[2]As for the case studies for Japan, refer to the conjunctive paper: Moriguchi and Kato, "EST Case Studies and Perspectives in Japan" elsewhere in this volume.

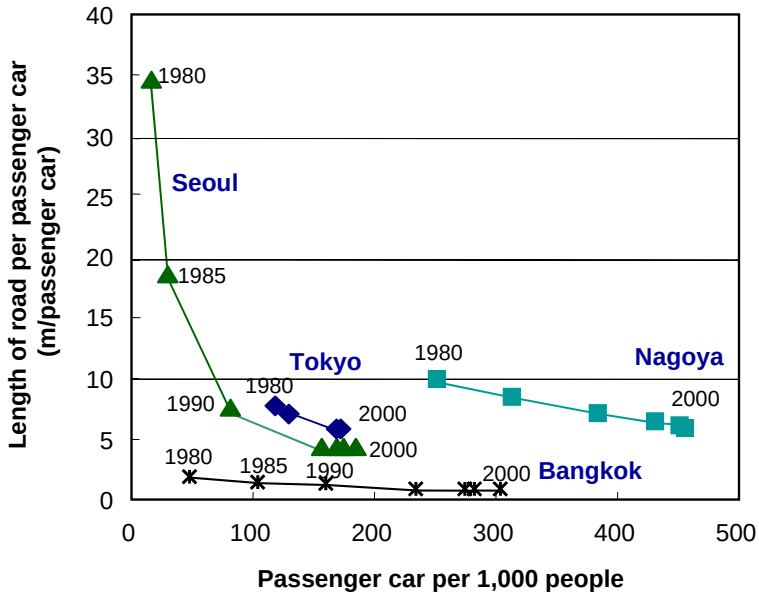


Figure 2. Car ownership v.s. road supply in selected Asian cities

Automobile dependency is the cumulative effect of transport and land use patterns that result in high levels of automobile use and limited transport alternatives. It has a variety of economic, social, and environmental impacts, including higher car ownership, higher cost of transport infrastructure, lack of roadway and railway supply, a modal shift to the automobile, more congestion, mass energy consumption, increased traffic accidents and pollution as shown in Figure 3 (Hayashi et al. 1993, 95, 98). The figure outlines the mechanism behind these links. Economic development brings about income increases and urbanisation. Income increases give rise to car ownership and road transport demand, reinforced by the lack of alternative transport modes such as railways. At the same time, the more suburbanisation proceeds, the longer trip-length becomes. As a result, car dependence increases and so does road demand. Increase in road transport demand, together with a lack of road supply and public transport causes severe congestion. The increase in per capita transport energy in Figure 4 seems to be induced by extended trips in spread built-up areas as well as by road congestion.

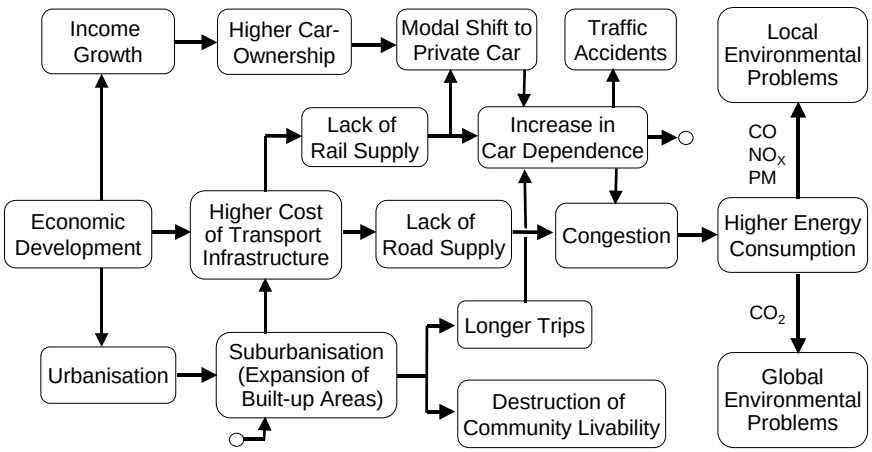


Figure 3. Causalities of deterioration in transport-related environment

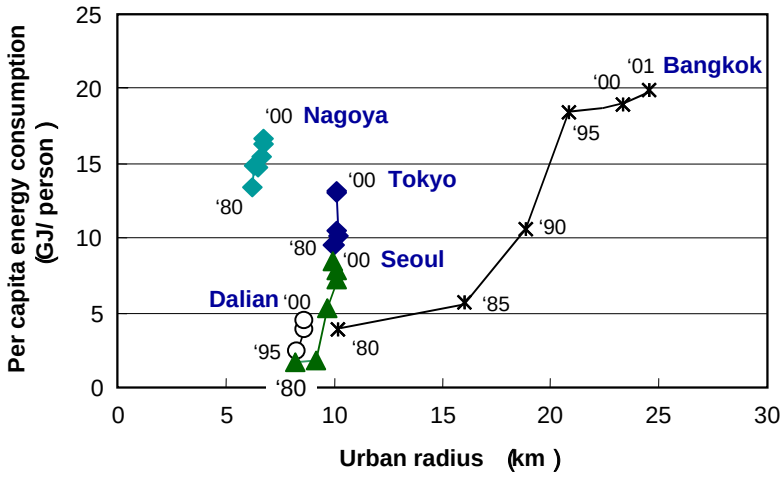


Figure4. Urban expansion and its effect on transport energy consumption

2.2 Characteristics of the Asian transport systems

Currently, numerous Asian models are known, particularly those concerning passenger transport. Among them, well-known examples are the dense urban and interurban railway networks of Japan, Korea and Singapore's advanced systems of demand management, including road pricing. In some Asian countries, public transport systems can provide seamless, almost door-to-door service for large numbers of residents. In other countries, a variety of non-motorised and economical transport systems provide essential service.

Public transport has been developed in close connection with urban development for a relatively long time, since the early twentieth century. In Bangkok, Metro Manila, and Singapore, horse drawn tramways and streetcars were introduced earlier than in OECD countries. In Tokyo, railway construction had already begun in the late nineteenth century. These transport systems were formed, having competitive and complementary relationships with earlier modes of transport such as horse drawn carriages and rickshaws. They played a specific role in urban expansion and the formation of cities.

When motor vehicles were imported around the middle of the twentieth century, buses and taxis began operating. Although the transport systems continued to be developed and enhanced, traffic became congested in central areas and consequently the streetcars declined. Thereafter, motor vehicle-based public transport systems were developed along with the progress of motorisation in the second half of the twentieth century. However, public transport has not been able to bridge the gaps between demand and supply. In each city, these systems continue to be developed according to the city's own particular characteristics.

Asian transport systems have the following features in common: a) high reliance on road public transport, b) well-developed public transport systems to provide almost door-to-door service, c) mixed transport by diverse transport modes.

a) High reliance on road public transport

Public transport services in Asian metropolises are more dependent on buses and intermediate public transport modes than on rail transit. Intermediate public transport (IPT)[3]

[3] Intermediate public transport is sometimes referred as paratransit

represents the full spectrum of transport modes, both motorised and non-motorised, that fall between the private car and the conventional bus. This can be regarded as the first characteristic of transport in Asia. Figure 5 shows the per capita passenger-km of public transport in some selected cities of both Asian and OECD countries (UITP 2001). Most Asian cities, except Tokyo, show a much higher share of bus service in the total demand for public transport service than other cities. Even in Seoul which has developed a dense subway network, the share of bus services remains higher than half.

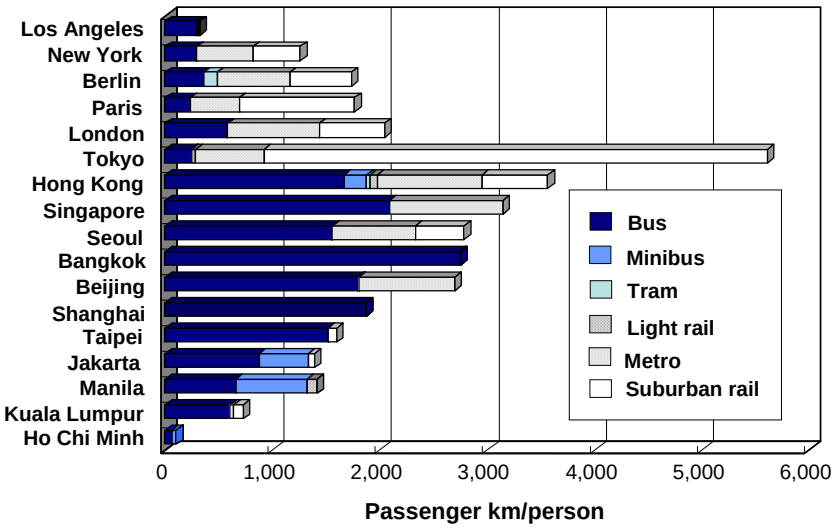


Figure 5. Per capita passenger-km of public transport in some selected cities

b) Well-developed public transport systems to provide almost door-to-door service

In many cities, a hierarchy of public transport systems has been developed to meet a growing demand and preference for door-to-door service. An important role is played by intermediate public transport that is suitable to unplanned urban structures and insufficient transport infrastructures. In general, more diversity is seen in Asian cities than in European and North American cities, primarily with regards to small and medium-volume ride-sharing public transport, including taxis and motorcycle taxis. Table 1 presents the categorisation of typical transport modes in Asia.

c) Mixed traffic by diverse transport modes

The third characteristic of transport in Asia is the mixture of diverse modes of transport. For instance, in Bangkok, the streets are shared by a variety of transport modes that differ in travel behavior, including buses, minibuses, taxis, tuk-tuks, songtaews and motorcycle taxis. While the category of road-based ride-sharing transport is limited to buses in OECD countries, in Asia there is a great deal of small and medium-volume ride-sharing transport. This exists in a rich variety of forms, including trucks that have been converted into songtaews and jeeps that have been converted into jeepneys. In Bangkok, songtaews which are a type of pickup truck fitted with two long bench seats, tuk-tuks which are motorised three-wheelers, and motorcycle taxis account for 14% of public transport. In Manila, jeepneys and tricycles account also for a significant share in public transport.

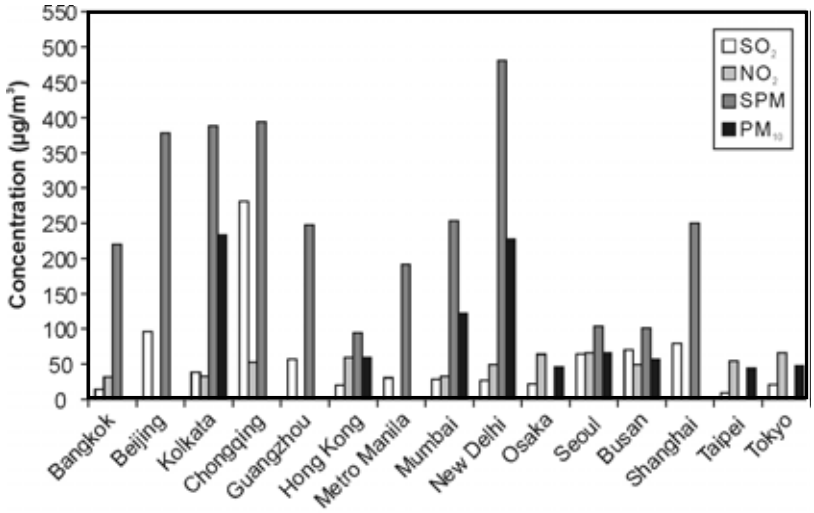
Table 1. A variety of transport modes in Asia

Categories			Transport Modes	
Infra-structure	**Volume**	**Public/ Private**	**Asian Cities**	**Ref. Paris**
Rail	Mass Transit	Public	Subway , LRT	Subway, LRT
Road			Airconditioned Bus Non-airconditioned Bus	Bus
	Middle-Size Transit	Inter-mediate Public (IPT)	Mini Bus, Remodeled Bus Songtaew, Jeepney	-
	Individual Transport		Taxi Tuk-tuk, Tricycle Bike Taxi	Taxi
			Non-motorised Mode (Rickshaw , Carriage)	-
		Private	Passenger Car	Passenger Car
			Motorcycle	Motorcycle
			Bicycle	Bicycle

3. Environmental Challenges of Transport Systems in Asia

3.1 Current problems

In many Asian cities, it is observed that air quality has deteriorated, due to urbanisation and motorisation; in particular, concentration levels of SPM are high as shown in Figure 6. One of major causes of transport-related environmental problems in Asia is the severe traffic congestion, resulting from increasing travel demands and a lack of appropriate transport



Source:
AMIS database (1990-1999), WHO

Figure 6. Average annual pollution concentrations by city

infrastructure. Infrastructure supply hardly catches up with the demand because of a shortage in road networks, delay in the introduction of mass transit systems, low maintenance levels of public transport, and distressed investing capability of government. Therefore, there is a need

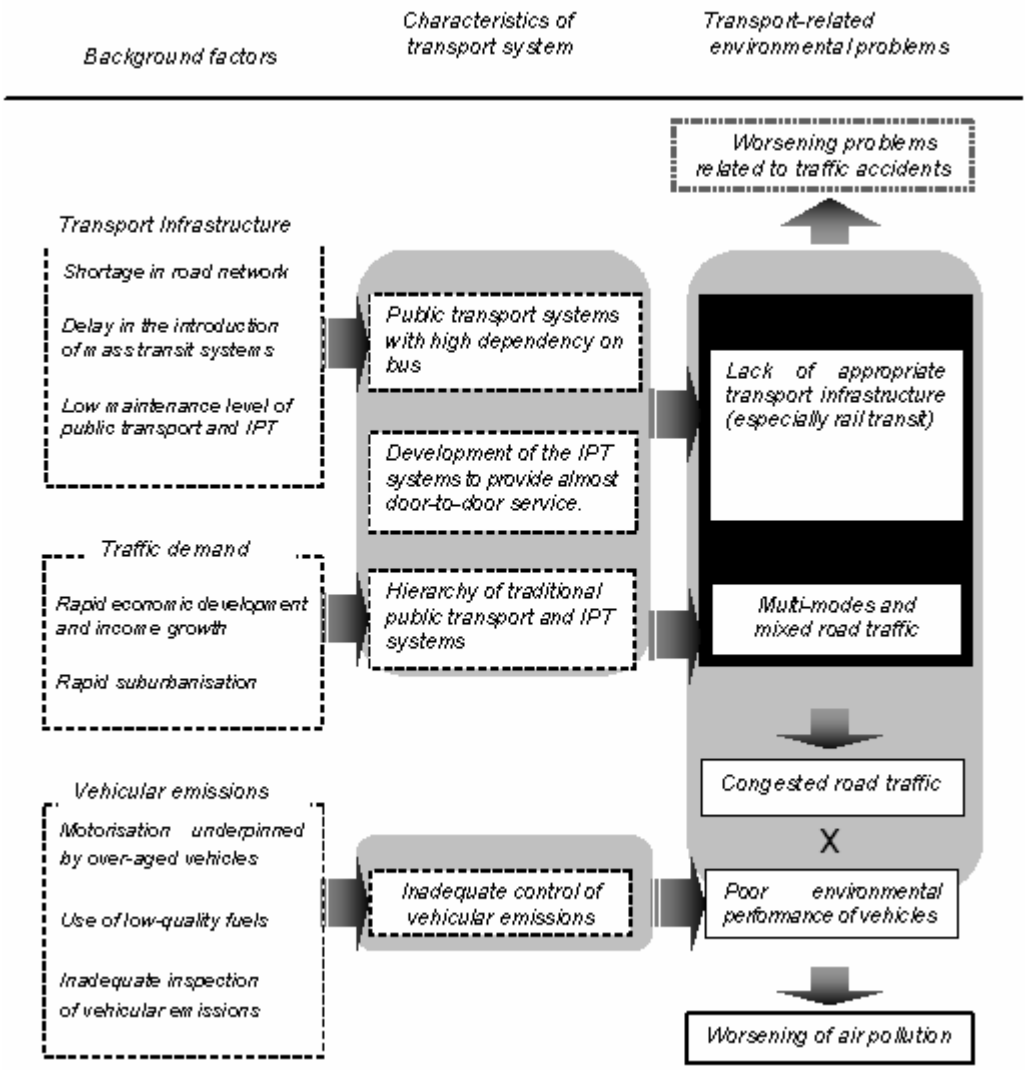


Figure 7. Mechanism of transport-related environmental problems in the Asian region

for an integrated strategy, which includes not only emission standards, fuel standards, effective inspection and maintenance systems, but also transport planning and management.

Figure 7 overviews the mechanism of current transport-related environmental problems in connection with background factors and characteristics of transport systems in the region. In the figure, the characteristics such as a) high dependency on bus and b) development of the intermediate public transport (IPT) systems to provide almost door-to-door service, are regarded as influential factors to environmental problems through bringing heavier traffic. The mixed road traffic which is caused by a traditional hierarchy of public transport and IPT systems would induce more congestion if not properly managed.

Air pollution has been aggravated by inadequate control of vehicle emissions. This situation is also related to a high proportion of over-aged vehicles, low-quality fuels, and institutional

inadequacy of maintenance systems. In Asian countries, motorisation is strongly pushed by the use of over-aged vehicles and of motorcycles with particularly low environmental performance. With regard to fuel quality, and as a general trend, the demand for diesel fuel is greater than for gasoline,. The sulfur content of light fuel oil is much higher than in OECD countries, and this is thought to have an adverse effect on emissions. Also, leaded gasoline is still being used in some countries, including Pakistan, Vietnam, India, Indonesia, and the Philippines (see Figure 8, Minato 2001). However, major countries like India and China have recently decided to introduce unleaded gasoline, and gradually phase out leaded gasoline. Each country has been adopting emissions regulations, improved fuels, vehicle inspection programs and other environmental policy measures somewhat later than the OECD countries. It is also important that a serious problem recently stems from imported motor vehicles, which do not comply with emission standards in respective countries.

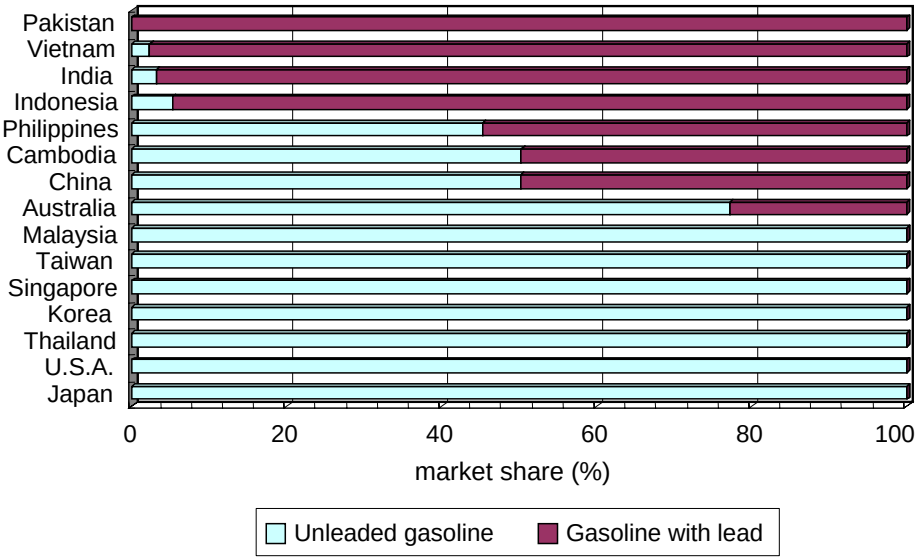


Figure 8. Share of leaded fuel in APEC member economies

3.2 Problems in the near future

We cannot be optimistic regarding the environmental sustainability in the Asian region, in light of projected trends, such as further population concentration, rising incomes and increasing motorisation. The characteristics of transport systems in Asia, as described in 2.2, also give rise to concerns about the future. For example, the fact that mass transit is bus-dependent suggests that future growth in demand could lead directly to an increasing demand of road-based transport, causing further congestion. The high level of demand for door-to-door service, mainly supported by intermediate public transport could cause a switch to private cars. There is a further concern that the switch to private vehicles will be promoted by increasing use of poorly maintained vehicles that brings high environmental pressure.

At the same time, wide differences among countries should be highlighted. For example, while people in Japan and Singapore have very high levels of access to passenger and goods transport mainly due to well-developed public transport systems, 40% of India's rural

villages, where 70% of its population lives, are not connected by all-weather roads to market centers or main road networks. Asia's growing share of world transport and its associated social costs require that Asia play a significant role in any mitigation strategy; however, this does not mean that the developing countries in Asia must be expected to bear an "equal or proportionate" share of the mitigation burden. Strategies in Asia need to draw on the experience of other parts of Asia or other regions outside Asia, reflecting local or regional priorities, such as access, conventional transport-related pollution, noise, congestion, and so on.

4. Policy Practices towards EST in Asia

4.1 Transport policies

To cope with the shortage in transport infrastructure, mass transit systems such as the LRT, MRT and subways have been constructed in Bangkok, Kuala Lumpur, and Manila. In these cases, easy transfer between new rail transit and existing public transport systems are key factors to promote the use of new infrastructures. Successful practices in less developed countries comprise a regeneration of bus industries and a provision of high-quality vehicles to attract more passengers, as experienced in Hanoi.

In order to discourage automobile dependency (both ownership and use), some Asian cities have started to adopt TDM measures. Singapore introduced a bidding system for vehicle purchasing rights (certificate of entitlement, COE) and electronic road pricing (ERP). Seoul introduced a congestion pricing at Namsan Tunnels, resulting in an increase in occupancy of buses and subways and an increase in the average vehicle speed in the downtown area. Also, many cities are adopting a park-and-ride system to promote a modal shift to public transport. These practices are summarised in Table 2.

4.2 Emission control

Improvements in emission control are among the most important challenges to mitigate air pollution in most Asian countries. Although vehicular emission control measures in Asian countries adopt European methods, they are still 5 to 10 years behind those in Europe as shown in Table 3. So far, Thailand and Malaysia have taken the lead in the introduction of restriction measures. A number of measures to strengthen vehicle inspection programs are also in place in a number of cities.

On the other hand, public transport largely relies on buses using low-quality fuels in many Asian cities, leading to further air pollution problems. From this point of view, promotion of cleaner fuel for buses and motor vehicles has been undertaken in major Chinese cities and Bangkok. China has started to improve air quality in major cities by using GECAM, which is a water diesel emulsion stabilised with additives and which produces less emissions of PM, NOX, CO, and HC compared with ordinary diesel fuels. As a pilot project, 500 buses with GECAM were introduced in Shanghai. Also, Beijing city agreed to consider launching several cooperation programs on mobility, in particular, i) provision of 300 CNG-fuelled engines, and ii) development of an advanced test station for the analysis of car emissions.

Table 2. Summary of various practices in Asia

Category	Measures	Practices	
		Asia	**Japan**
Provision of transport infrastructure	Building mass transit systems	LRT, MRT, Subways	Widely ranged rail transport systems Guide-way bus
	Upgrading the existing public transport systems	Introduction of air-conditioned bus	Improvement in transit convenience
		Easy transfer between intermediate public transport	Environmentally friendly pass
Transport management policies	Control on automobile ownership	Bidding for obtaining COE	
	Control on the use of automobiles	Park-and-ride	Park-and-ride
		Number-plate restriction	Smart parking by ITS
		Electronic road pricing	HOV practices Joint use of electric vehicles
Emission control	Maintenance measures	Vehicle inspection system	Inspection system on vehicles and emission gas
		Inspection system on emission gas	Engine cleaning
	Emission control	Emission control	Promotion of integrated anti-vehicular emission gas (NOX and PM)
	Promotion of low emission vehicles	Conversion to intermediate public transport (IPT) with low emission	Promotion of low emission vehicles Green taxation
	Conversion to cleaner fuels	Conversion to cleaner fuels on bus and IPT	
Urban activity related factors	More efficient distribution	Truck ban	Joint shipping delivery
	Modal shift (from truck to other modes)	Modal shift to shipping	Rail transport of domestic garbage
Land use related factors	Coordination of transport infra. and land-use development		Synchronisation of railway construction and residential development
	Traffic impact assessment on land-use development	Traffic Impact Assessment	Guideline for the large-scale retail store location law
	Campaign / incentives to raise environmental awareness	Partnership for clean air	Stop Idling
		No my-car day	No my-car day

Table 3. Timetable for introduction of new emission control standards in Asia

Country/ Region	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07
EU	Euro 1			Euro 2				Euro 3					Euro 4		
Bangladesh															
Cambodia															
Hong Kong			Euro 1		Euro 2				Euro 3						
Korea								Euro 2		Euro 3					
India (New Delhi)									Euro 2				Euro 3		
Indonesia								Euro 1 (proposed)							
Malaysia					Euro 1			Euro 2							
Nepal								Euro 1							
Philippines											Euro 1				
China								Euro 1			Euro 2				
Singapore		Euro 1							Euro 2						
Sri Lanka															
Taiwan							US Tier 1								
Thailand				Euro 1			Euro 2			Euro 3					
Vietnam						Euro 1							Euro 4		

Figure 9 clearly demonstrates the effect of the transition to unleaded fuel on CO emission. Ash-forming metal additives such as lead adversely affect the operation of catalytic converters, which helps to change poisonous carbon monoxide into carbon dioxide. Therefore, unleaded fuel is necessary for the function of catalytic converters to maintain low emissions over the lifetime of the vehicle.

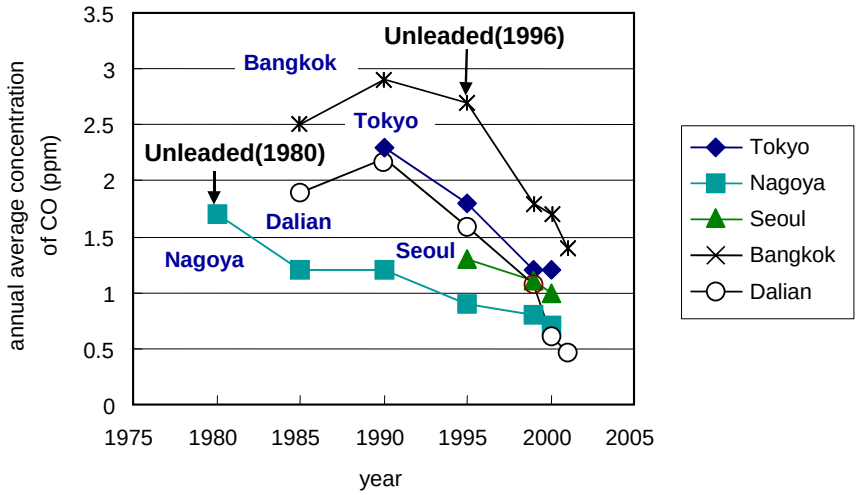


Figure 9. Effect of the use of unleaded gasoline on CO emission

While many Asian countries have adopted European emission standards for cars and trucks as shown in Table 3, they do not adopt similar standards for fuels. For example, Beijing is scheduled to introduce EURO2 in 2003; however, fuel quality is some way behind European standards. Project cooperation of the German Federal Environmental Agency, with Malaysia and Indonesia revealed a similar situation (OECD 2003). These lessons stress the need to develop and deploy different policy instruments according to each country's social and economic situation.

5. Perspectives of comprehensive and integrated approaches

Looking at current policy instruments and practices in Asian countries, major efforts have been made in the areas of emission control, traffic management, and transport demand management. However, transport related environmental issues are not isolated issues peculiar to the transport sector, but rather overlap with issues of urban activities and land use as shown in Figure 10 (Kii and Doi 2002).

The policies are likely to be more effective if the impact of other urban activities and land use are taken into account, rather than a narrow focus on transport alone. We should underline the necessity of taking a comprehensive approach to policy formulation. Unique practices related to a coordination of transport infrastructure and land use development are found in Tokyo and Osaka. By synchronising railway construction and surrounding residential development, they realised a kind of Transit-Oriented Development, leading to high dependency on railways and achieving compact cities (see Table 2).

Most Asian cities lacking rail infrastructures are forced to accept scattered and sprawling development, resulting in higher dependence on private cars and intermediate public transport systems. This is a different method from those in European cities where well-developed railways have contributed to achieve environmentally sustainable transport systems through the Transit-Oriented Development (see the 1st and 2nd ways in Figure 11). However, Asian cities have possibilities to find an alternative way (the 3rd way) for realising the TOD by a combination of existing systems for seamless travels. This means under a condition without rail infrastructures, sustainable transport systems might be accomplished by utilising and upgrading existing stocks.

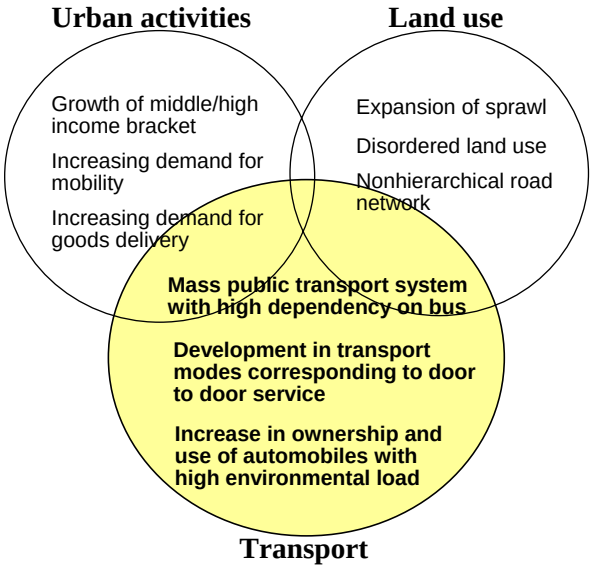


Figure 10. Relationship among transport, urban activities, and land use

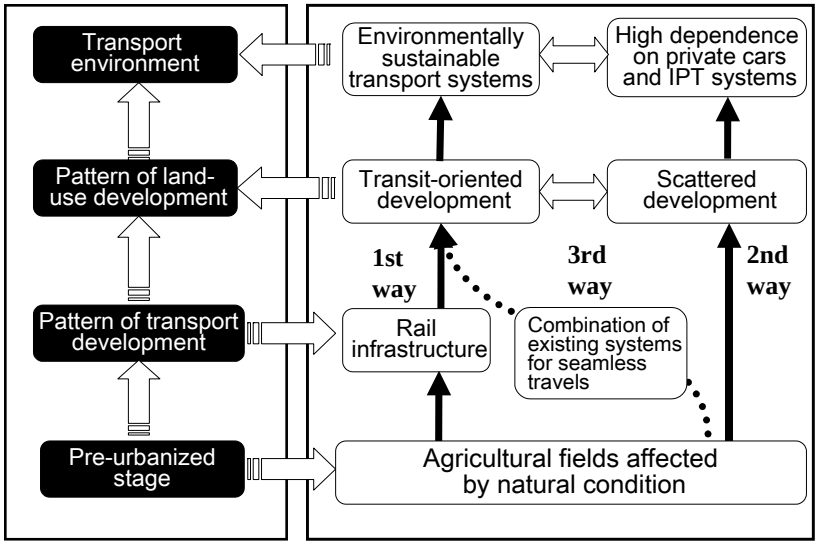


Figure 11. Different scenarios of transport and land use development

To cope with transport-related environmental challenges in Asia, we need to come up with a strategic and comprehensive approach that can reflect a variety of causalities of the problems described in Figure 3 in Section 2. It is required to understand the following key mechanisms: namely, i) growth rate of per capita GDP, ii) growth rate of urban area, iii) influence of per capita GDP on car ownership, iv) influence of car ownership on road length per passenger car, v) influence of suburbanisation on per capita transport-energy consumption, and vi) growth rate of pollution, as shown in successive curves in Figure 12 (Hayashi et al. 1995, 98). In the current situation, insufficient understanding of environmental deterioration mechanisms often delays the implementation of necessary measures in many Asian countries. Backcasting approaches towards a clear goal have to be supported by identification of these essential mechanisms and further monitoring of them.

Focusing on the higher rate of economic development and the shorter cycle of urbanisation in Asia than those experienced in developed western countries, timely and speedy implementation of effective measures is necessary. Furthermore, Figure 13 illustrates the approach to EST which Asian countries should take. It would be desirable to find a shortcut to sustainable transport without repeating the mistake of developed countries. This will be achieved by adopting appropriate measures of both technological improvement and mobility management in the earlier phase of economic development. In this context, developed countries are required to help developing countries take the alternative approach. In addition, there should be various ways to achieve EST in accordance with each country's socio-economic situation.

There is a substantial need for comprehensive measures learning from the experiences in European countries such as France and Switzerland where basic laws integrating transport modes have been enforced. For example, in case of France, the idea of an urban mobility plan (PDU), which aims at reducing private car traffic and increasing the use of alternative forms

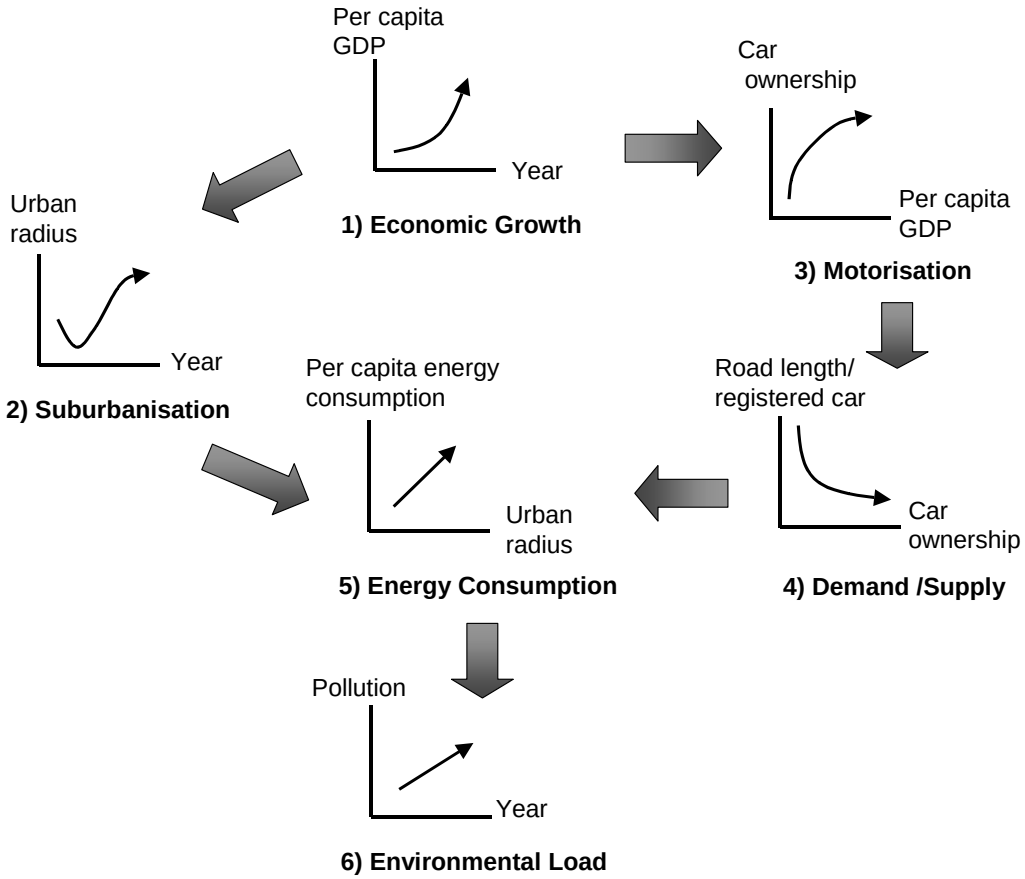


Figure 12. Quantification of causalities of deterioration in transport-related environment

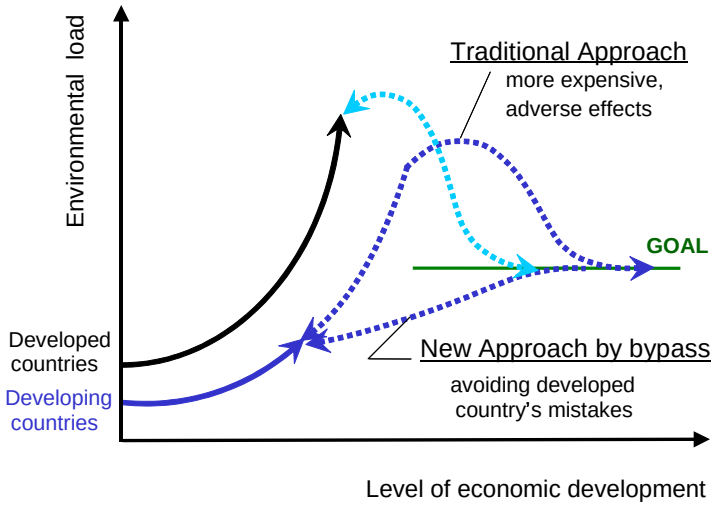


Figure 13. Illustration of approaches towards EST

of transport, namely walking, public transport, bicycles and car sharing, is included in the law on the development of internal transport (LOTI) enacted at the end of 1982. This was an important innovation intended to promote an overall travel policy, in contrast to the sectoral policies based on modes of transport that had been pursued hitherto. Furthermore, the 1996 law on clean air and the rational utilisation of energy modified the article of the 1982 law establishing guidelines for transport, relating to PDU.

6. Conclusions

The current situation and trend of transport in the Asian region presents a diverse picture stemming from geographical differences and levels of economic development. On the other hand, most Asian countries share similar concerns about transport-related problems, namely severe congestion, air pollution, and noise. As this paper described, common patterns can be identified behind these problems, which is:

1. large increases in traffic demand, resulting from rapid economic growth, urbanization, and rapid motorisation,
2. poor control of vehicle emissions and absence of effective inspection and maintenance systems,
3. lack of adequate and appropriate infrastructure (especially rail transport), and
4. poor coordination of transport and land-use policies.

Given the expected high economic growth and the shorter cycle of urbanization in the Asian region, immediate and effective measures should be taken to address those problems in order to achieve an Asian EST. There is no room to find solutions in a trial-and-error way. To this end, each country should find its best way to achieve EST as fast as possible by learning from others' experiences. Existing good examples in the region, such as intermediate public transport (IPT) systems and electric road pricing (ERP), can provide a strong foundation for this purpose. Comprehensive and integrated policies that include all transport modes and are suitable for each country's specific needs are required. Mechanisms of urban transport influencing on the environment together with a collection of policy instruments and good practices are recently summarised by CUTE (Comparative study on Urban Transport and the Environment)(Nakamura, Hayashi and May 2004). Most importantly, an Asian EST should reflect the diverse and unique patterns of socio-economic characteristic and transport systems in the region.

The Nagoya Statement which was adopted at the International Conference on Environmentally Sustainable Transport in the Asian Region, 23-25 March 2003, Nagoya, Japan, sets forth specific future steps toward EST in cooperation with other countries in the region. These include: addressing pollution and energy efficiency issues, undertaking research activities, promotion of policy dialogues, exchanges of information and human resources, early stakeholder involvement, promotion of policy integration, and establishment of processes to monitor and report on progress.

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Appendix

Nagoya Statement on Environmentally Sustainable Transport
in the Asian Region

The International Conference on Environmentally Sustainable Transport was held on 23-25 March 2003 in Nagoya, Japan, jointly organised and hosted by the Organisation for Economic Cooperation and Development (OECD), Japan's Ministry of the Environment, and Ministry of Land, Infrastructure and Transport. The meeting reviewed major trends in Asian countries, highlighted progress and remaining challenges, learned from the OECD's work on environmentally sustainable transport (EST), and considered policies and measures for achieving EST. This statement summarises the findings and conclusions of the conference.

In the context of sustainable development, EST means transport development that meets the needs of the present without preventing future generations from meeting their needs. Achieving EST is a major challenge faced by countries around the world, not only OECD countries but also other Asian countries. In Asia, there are serious transport-related economic and environmental problems, including traffic congestion, inefficient energy use, air and water pollution, and noise. These problems are caused by significant increases in traffic demand resulting from rapid economic growth and urbanisation, poor control of vehicular emissions, and lack of appropriate infrastructure.

The diverse and unique transport systems in Asia have coped with different types of demand for over a century. The numerous positive Asian models are known throughout the world, particularly those concerning passenger transport. Among many examples are the dense urban and interurban railway networks of Japan and Korea and Singapore's advanced systems of demand management, including road pricing. In some Asian countries, public transport systems can provide seamless, almost door-to-door service for large numbers of residents. In other countries, a variety of non-motorised and economical transport systems provide essential service.

However, the high state of growth in motorised road transport—including two-wheeled vehicles, cars, and trucks—has partly offset the advantages of these transport systems. This rapid motorisation, together with weak land-use planning, fills urban space and accelerates suburbanisation, leading to development of an inefficient urban structure that results in unnecessary energy use and negative environmental impacts.

In developing countries, public transport is usually heavily road-dependent. Urban and inter-city rail transit systems are yet to be developed or need much further expansion and improvement. Economic conditions can require the use of low-quality fuels and poorly maintained low-quality vehicles, leading to high levels of pollution and inefficient fuel use.

Asia is expected to achieve significant economic growth during the 21st century. This growth will not be sustainable unless issues of transport-related air pollution and use of fossil fuels are addressed. There is need to establish clear environmental goals and timetables that are appropriate to local circumstances and to identify ways of meeting these goals while ensuring social and economic development. This is especially important for developing countries, which have shorter cycles of economic growth and urbanisation, and therefore need timely implementation of effective measures.

The significant achievements that have already been made throughout Asia provide a strong foundation for further progress towards an Asian EST. Development and promotion of an

Asian EST will require substantial improvements in technology and in transport demand management. Effective policy instruments could include pricing, spatial planning, development of green transport infrastructure, investment in technology, tighter emissions standards, vehicle inspection systems, and other economic and regulatory policy instruments. An Asian EST could build on the OECD's work on EST, including OECD's EST Guidelines and the proposals for use of a goal-oriented approach, while taking into account Asia's special transport characteristics and needs.

Asian countries and regions are encouraged to:

- work towards reducing transport-related pollution and improving energy efficiency by developing and realising an appropriate vision of environmentally sustainable transport firmly rooted in the concept of sustainable development. The vision should include short- and medium-term targets that address matters of urgent concern. The vision should also help ensure future economic growth and social development and take into account specific national and regional features.
- undertake research activities and feasibility studies towards realisation of an Asian EST. Promote policy dialogues, exchanges of information and human resources, and support for the activities of relevant non-governmental organisations. These activities could be helped by international organisations such as the United Nations Centre for Regional Development and regional initiatives such as the Clean Air Initiatives in Asian Cities.
- involve all stakeholders from an early stage in decision-making about progress towards EST, recognising their respective interests and responsibilities. Stakeholder consultations should be supported by programs of public information and education.
- promote integration of policies for the environment and for economic and social development, including inter-agency coordination and cooperation.
- establish processes to monitor and report on progress and make the reports widely available.

(endorsed at the International Conference on Environmentally Sustainable Transport in the Asian Region, Nagoya, Japan, 25th March, 2003)