

URBAN TRANSPORT IN ASIA: AN AGENDA FOR THE 1990S

by **Peter Midgley**

Asia is estimated to have had a total population of 2.9 billion inhabitants in 1990 or half the world's population. The vast majority are concentrated in the 16 countries classified as low-income economies with GNP per capita below \$545 in 1988. This group of countries also contains the majority of the region's (and the world's) urban population and the majority of cities with populations in excess of one million.

In terms of economic growth, Asia is undoubtedly the most dynamic region in the world today. Notwithstanding the disparities in the economic performance of individual economies, the growth in GNP of the region as a whole has averaged nearly seven percent per annum during the 1980s. This compares with world economic growth of around three percent per annum and less than two percent for developing countries. Thus the record for the Asia region is impressive when compared with the world as a whole, and particularly when compared with developing countries in other regions.

The impressive performance of Asia in terms of economic development and the growth in population is causing the region to grapple with extremely rapid rates of urbanization. Already, more than half of the World's urban population increases occur in Asia and the majority of this growth is occurring in the region's low income countries.

It is estimated that by the turn of this century, the urban population in Asia will increase by 420 million from 1.2 to 1.6 billion. The resultant increase in the proportion of urban residents within the total population would be from 39 percent in 1990 to 46 percent by the year 2000.

By the year 2000, there is expected to be 13 megacities (cities with populations in excess of 10 million) in Asia with a combined population of 179 million. Within a decade, more than half the world's 21 megacities and just over two thirds of the 18 megacities in the developing world would be located in Asia. And the majority of these would be in low income countries.

The extent to which Asian cities meet the challenges of urbanization and contribute to macroeconomic performance will, to a large extent, depend on how efficiently they can transport the goods, services, information and people upon which their economic activities depend.

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Performance of the Urban Transport Sector in Asia

A greater variety of approaches are being used in Asia to manage urban traffic than in any other region of the world: area licensing and road pricing in Singapore; with-flow, counter-flow and tidal-flow bus lanes in Bangkok, toll expressways in Jakarta, area wide traffic control in Hong Kong, Tokyo and Singapore, non-motorized vehicle only routes in Shanghai, and "bike and ride" in Osaka and "park and ride" in Adelaide.

However, with few exceptions these measures are having little effect on the rising tide of motorization confronting all countries in the region. The high rates of urbanization, economic growth and rises in personal incomes are generating demands for personal mobility that threaten to engulf the region's cities with very high levels of congestion and air pollution, as being experienced in Los Angeles and Mexico City.

1 Non-motorized Transport

Non-motorized transport forms the backbone of the transport system for the poor in many cities for both personal and goods movements. Bicycles are by far the most numerous and the most used mode of personal non-motorized transport. Exact numbers are hard to come by, but it is estimated that there are some 300 million bicycles in China, 66 million in Japan, 45 million in India and six million in Korea. These four countries alone account for more than half of the world's estimated total bicycle population of 800 million.

Outside of China, the trend over the past decade has been a reduction in the number and use of non-motorized vehicles (NMVs). City expansion and increasing travel distances is one factor contributing to this decrease. In other cases, Government attitudes to NMVs as being unsafe, inhumane or symbols of "backwardness" have led to the discouragement or eradication of cycle taxis.

Only in Japan are NMVs coming back into vogue as an alternative mode in journeys to work. Census figures for 1980 showed that 7.2 million commuters (15 percent of the total) rode bicycles to work or to commuter rail sta-

tions. Bicycle ownership in Japan has climbed from an average of one per household in 1970 to 1.5 today.

China and Japan provide examples of avoiding automobile dependence and reducing the impacts of motorization through encouraging NMV use (and heavy investment in efficient public transport in the case of Japan).

2 Motorization

Some of the world's highest and lowest motorization rates are to be found within the region. In low-income countries vehicle ownership rates range from as high as 63 persons per vehicle in Sri Lanka to as low as 250 in India; in middle-income countries they range from as high as 10 in Malaysia to 124 in the Philippines; and in high-income countries they range from as high as 2.3 in Japan to 18 in Hong Kong.

Due to an inadequate data base, it is difficult to assess present and future levels of motorization within urban areas. In Thailand, it is estimated that the Greater Bangkok Metropolitan Area accounts for more than one-third of the national vehicle fleet. Between 1982 and 1988, this "urban" fleet doubled in size and between 1989 and 1990 automobile sales registered an astonishing 40 percent growth.

Motorcycles are increasing in numbers throughout the region as people strive for cheaper and more usable alternatives to the motor car for urban personal mobility. For some, the motorcycle is a logical progression from the bicycle and for others it offers a faster alternative to slow and crowded buses.

Most developing countries in Asia have some form of deterrent to vehicle ownership. High import duties, registration fees, excise taxes and road user charges are the main forms currently in use. Such restraints also form a ready source of tax revenue and are relatively easy to impose.

Few Governments have attempted to use control mechanisms to "clamp down" on vehicle ownership. Restricting car ownership is unpopular in any society, but in the developing economies of Asia it is seen by politicians as going against the aspirations of the rising middle class

and depriving them of one of the most important benefits of development - personal mobility.

From available data it has been possible to tabulate a total of 120,000 vehicles in the bus fleets of 48 of the 101 cities with populations in excess of one million. To this must be added the 1,900 LRT units and 6,500 MRT units identified in the larger cities of the region all of which run on some 1,300 kilometers of electrified double track. Japan alone has 120,000 traffic signals; the total for the region is probably well over one million.

3 Traffic Congestion

Not only does traffic congestion promote greater fuel consumption, and the resulting increase in air pollution, but the severe increase in transit times can have substantial impact on economic productivity.

Few countries in the region have made a serious effort to reduce congestion and even fewer have succeeded. There is an argument that all major cities suffer from traffic congestion and, as no city has found a solution, congestion is a way of life that has to be accepted.

Peak hour travel speeds average about 16 kilometers per hour in the center of most large cities in the world. Singapore is one of the few large cities in Asia where inner city travel speeds exceed this average and this is because a conscious decision has been taken to manage congestion for the well being of citizens and for the well being of the economy at large.

4 Environmental Impacts

Vehicle emissions are polluting the atmosphere, motorized vehicles are generating intolerable noise levels, traffic accidents are claiming more lives and the road infrastructure being built to accommodate urban traffic is often visually intrusive and blocks access from one community to another. In the battle to combat congestion and increase personal mobility, the environment of Asian cities is paying an increasingly heavy price.

In virtually every city for which data is avail-

able, carbon monoxide, lead and particulate levels are the primary source of the emissions causing air pollution problems. Further, vehicles contribute significant amounts of hydrocarbon and oxides of nitrogen emissions which are frequently toxic as well as contributing to photochemical smog in cities with the appropriate meteorological conditions.

Traffic noise is becoming an increasingly worrying irritant in most cities in Asia. Little data exists on noise levels but buses and trucks are major culprits, as is evidenced by data from Bangkok where more than 75 percent of buses, 60 percent of trucks and 25 percent of minibuses emitted noise levels in excess of 100 dB at a distance of 0.5 meters.

Traffic accidents are one of the major causes of mortality and hospitalization in developing countries in Asia. Traffic growth, undisciplined road user behavior, poorly maintained vehicles and inadequate traffic control and engineering all contribute to increases in the incidence of traffic accidents.

Accidents can have important adverse socio-economic impacts. Various research studies have assessed the economic losses associated with traffic accidents to amount to as much as one percent of national GNP in developing countries. Between 1985 and 1987, the material loss caused by traffic accidents in Shanghai increased by 33 percent per annum, totaling US\$ 2.6 million in 1987.

In any city, traffic reduces the visual quality of streetscape and of the city in general. The visual quality of most Asian cities has deteriorated, and much of it is due to traffic related visual intrusion. In road widening schemes, trees and green verges have been removed; where they remain, they can hardly be seen or appreciated among the traffic and air pollution. Increasing use is being made of elevated roads, flyovers and pedestrian overpasses which obstruct views and dwarf adjacent buildings.

In many Asian cities, roads are beginning to separate people more than link them. Impassable barriers are being created by increasing conversion of four lane roads into one-way high-volume, high-speed roads. The addition of median barriers, protective fencing, flyover approach ramps and limited access express-

ways and toll roads are forcing pedestrians to walk further and further to "cross the road". In some cities, the technical term "traffic cell" is becoming a physical reality!

5 Urban Road Infrastructure

Most urban roads in Asia were designed and laid out before the advent of the massive levels of motorization and demands on personal mobility experienced throughout the region in the past decade. With few exceptions, the majority of the roads in urban areas are two lanes wide and the majority of arterial streets are four lanes wide.

In attempting to provide sufficient capacity for motor vehicles, most cities have sacrificed the needs of pedestrians. Road widening schemes have reduced sidewalks to less than one meter in width in many cities. Where sidewalks exist, they are poorly maintained with broken paving slabs and broken curbstones. In many cases, open drains force pedestrians to walk in the road which in turn reduces the capacity of the road widening scheme.

Outside of Japan and China, there is no evidence of special facilities for non-motorized vehicles in urban areas in Asia. This is especially surprising given the high concentration of such vehicles in the region.

In most cities in low-income countries the quantity of street lights is insufficient. In both low- and middle income countries there is little differentiation of street light intensity by road hierarchy. Most major arteries, expressways, city centers and high-income neighborhoods have some form of continuous lighting but rarely is it designed or located in response to driving, non-motorized vehicle or pedestrian needs.

In order to overcome the inadequacy of the street network in meeting motorized vehicle demands, seven cities have developed expressway networks and five cities in the region have urban toll road systems: Bangkok, Hong Kong, Jakarta, Osaka and Tokyo. Of these, Hong Kong and Jakarta have privately financed urban toll roads (three in Hong Kong and one in Jakarta); one more is under construction (in Bangkok); and several under consideration (in Bangkok, in Hong Kong, in Jakarta, and in

Kuala Lumpur).

6 Mass Transit

There are 37 mass transit systems carrying 17 million passengers per day in 26 cities in Asia. Over two thirds of these systems are in high-income countries and, somewhat surprisingly given their high capital and operating costs, the bulk of the remainder are in low income countries.

Of the cities in the region with populations exceeding one million, thirteen have operating mass rapid transit (metro or subway) systems and three more (Bangkok, Shanghai and Taipei) are planning or building them. The most extensive systems are found in Japan (in Tokyo) and the simplest systems in China (in Tianjin).

Eleven cities have light rail transit (LRT) systems. The majority are conventional "tram" systems which have been in existence since the 1930s; the Manila, Kitakyushu and Tuen Mun systems are more recently constructed LRT systems; and the Manila system is the only grade separated light rail system operating in the region.

Ten cities in the region have "hi-tech" guided rapid transit (GRT) systems operating, of which six are in cities below one million; all GRT systems, with the exception of those in Adelaide and Sydney, are in Japan.

As many as six mass transit schemes with varying levels of private sector financing and operation are under active consideration in the region (two in Bangkok, one in Manila, one in Karachi and two in Taipei).

Thailand is the pacesetter in attracting private sector finance for urban mass transit with a growing list of Build-Operate-Transfer (BOT) projects in and around Bangkok. It would seem that the levels of congestion are so high in Bangkok that private investors feel that such schemes can be financially viable.

Some systems in other cities are associated with property development schemes which are attractive to the prospective developers and are intended to contribute to the financing of the mass transit infrastructure.

7 Urban Bus Services

Most cities have bus systems which are owned and operated by the public sector but many cities have private sector operations and informal "paratransit" systems operate extensively in most cities in South East Asia.

In all cities in China, in the People's Democratic Republic of Korea and in Australia ownership is public. In Hong Kong, Korea, in Malaysia and in Singapore ownership is private. In all other cities ownership is mixed. Data on paratransit operations is incomplete but where it exists it suggests that paratransit is the predominant form of urban public transit in Bangladesh, Indonesia, Pakistan, the Philippines and Thailand.

Throughout the region, the level of service provided by bus operators in developing country cities has continued to deteriorate over time. In the case of public sector operations, companies are frequently observed to be saddled with poor management, operated by labor regulated by restrictive practices, constrained by inadequate investment policies, affected by poor maintenance of vehicles, and unable to provide adequate service frequencies and route networks.

Not surprisingly, urban bus services are perceived by most people in Asian cities as being inadequate, overcrowded and unresponsive to demand.

8 Traffic Management

In Singapore, these techniques have proven effective not only in reducing congestion but also in improving public transport speeds, reducing accidents and saving fuel. In other cities, they have proven difficult to sustain without complimentary measures to reduce car use.

Area traffic control (ATC) systems provide for the central computerized management of traffic signal controlled junctions along traffic corridors and/or within specific areas with complex or intense traffic flows (such as Central Business Districts).

Japan has the highest density of ATC systems in the region with a total of 34,500 intersections under area traffic control in 74 cities.

Bangkok, Bombay, Hong Kong, Jakarta, Kuala Lumpur, Manila, Pusan, Seoul, Shanghai, Singapore and Taipei have all, to some degree, developed ATC systems. ATC is the most technology-intensive traffic management measure and the one which relies most on imported hardware and software. ATC is being introduced in Beijing and more extensive ATC systems are being considered in Bangkok, Jakarta and Shanghai.

Many cities in Asia have introduced bus lanes and the most extensive bus lane networks are to be found in Tokyo and Bangkok. The Tokyo network comprises "with flow" bus lanes which provide priority only during the peak hour for peak direction bus flows. The Bangkok network is more sophisticated and comprises 24 hour bus lanes many of which are "contra-flow" (operate in the opposite direction to traffic flows along a one-way street) and provide "short-cuts" for buses through the one-way street network.

Unlike traffic management measures, which seek to manage existing traffic flows more effectively, traffic restraint measures seek to discourage the use of cars in order that other road users, especially public transport, pedestrians and goods vehicles may benefit. The main restraint measures in use in Asia are parking controls and area licensing.

Most cities in Asia control on-street parking with varying degrees of success depending on the level and extent of enforcement applied. Singapore is the only city, probably in the world, with effective traffic restraint measures centered on its famous Area Licensing Scheme (ALS) which was inaugurated in 1975.

Experience with area licensing, although effective in Singapore, has revealed the need for political consensus and commitment to enforcement which other countries in Asia have found hard to achieve. Attempts to institute area licensing in World Bank projects in the late 1970s in Bangkok and in Kuala Lumpur failed in part due to resistance from the car owning lobby and central area business interests.

Despite the apparent unpopularity of traffic restraint measures, further consideration needs to be given to them in Asia in the future if

central business districts are to survive. Current developments in electronic road pricing (ERP) technology and recent experience with such schemes in Scandinavia may provide a more palatable way for restraining peak hour demand for travel by car.

9 Administration and Regulation

In many cases traffic laws are outdated and do not reflect conditions in developing country cities and the police force allocated to traffic duties is usually understaffed and inadequately trained to manage the traffic flow let alone enforce the law. The result, in too many cities, is an unhealthy disrespect of traffic regulations.

There are considerable problems involved in managing urban transport services and in coordinating urban transport plans and the provision of urban transport infrastructure.

A characteristic of most cities is the very large number of different agencies responsible for the various modes of transport and infrastructure requirements as well as the overall planning and development of the urban transport system. This has often led to overlapping responsibilities with a resultant lack of clarity as to who does what.

There is also evidence of insufficient numbers of trained staff and this has been perceived as a major factor inhibiting the sector's development over the past decade.

10 Financing Urban Transport

Typically, the public sector is involved in financing some or all of the following: urban transport infrastructure, urban public transport equipment and operations, maintenance of urban roads, traffic management and traffic enforcement. In most countries the scale of funding in the sector is quite large. In many countries the distribution of funding is skewed over time, geographically, by city size and/or importance and by sub-sectoral preferences or demands.

As in most parts of the world, in Asia urban transport investments and operations are financed from taxation, user charges (such as fares), borrowing and private investment. Cer-

tain countries in Asia, however, make also make use of the private sector in the provision of urban transport services.

Cost sharing schemes with participation from the public sector and private developers or the community are being used more and more in some Asian cities to finance urgently needed urban transport infrastructure.

The concession arrangements which provided the bulk of urban public transport in developing countries and in developed countries in the past are being revitalized and refurbished in Asia in the form of Build-Operate-Transfer (BOT) schemes as a way of attracting private sector capital, entrepreneurship, management skills and efficiencies into a sector which is unable to develop, modernize and expand under public sector tutelage.

11 External Aid

External aid flowing into the urban transport sector in Asia amounted to some US\$1.9 billion between 1980 and 1989. Just over two-thirds of this amount was allocated to what are currently defined as low-income countries and the bulk of the remainder to middle-income countries. The geographic distribution of urban transport aid varies considerably by country income group and by geographic location.

Asian low-income countries received two-thirds of this aid with Indonesia (the major recipient country for all urban transport aid in the region) receiving more than four times the amount allocated to India. Other Low income countries (Sri Lanka, China and Pakistan) received only small amounts.

The distribution among middle-income countries is more balanced with Thailand, the Philippines and Korea accounting for around one third each and with Malaysia accounting for the remaining two percent.

Japan was the main source of development assistance financing in the urban transport sector in Asia between 1980 and 1989 with US\$1.1 billion, which represents 59 percent of total aid and 91 percent of all bilateral aid.

Funding from multilateral agencies in urban transport in Asia amounted to US\$657 million

or 35 percent of the total for the period 1980 to 1989. The main source of funds was the World Bank Group which provided US\$ 603.1 million which represents 32 percent of the total and 92 percent of all multilateral aid.

The majority of external aid (US\$0.9 billion or 47 percent of the total) was allocated to urban road construction, improvement and maintenance. Japan contributed the most to the road sector (US\$445.7 million or 51 percent).

Urban rail investments take second place in terms of sectoral focus accounting for US\$613.9 million or 33 percent of all aid. Over 90 percent of urban rail related aid was provided by Japan which also allocated the majority (51 percent) of its aid to this sector.

Traffic management (US\$156.3 million) represented a modest 8.4 percent of all external aid. The majority of aid (62 percent) to this sector was allocated by the World Bank with Japan providing 30 percent and other donors the remaining eight percent.

Technical assistance and bus related activities account for seven and five percent respectively of total aid. The majority of technical assistance funds (43 percent) were provided by the World Bank; Japan and other donors provided the remaining 38 and 19 percent respectively.

The vast majority of assistance to bus public transport was provided by the World Bank which accounted for 70 percent of the total. Japan provided no assistance to the bus sector and for other donors it represented 18 percent of their total allocations.

The total volume of external aid has been very small and the scope of interventions has been very discrete. Total external aid in the sector for the whole of Asia between for the ten years between 1980 and 1989 is less than half of total urban transport expenditure of Hong Kong in the ten year period between 1976 and 1985, and a quarter of proposed expenditures on BOT schemes in Bangkok.

Prospects for the 1990s

The performance of the urban transport sector in Asia in the 1980s has been mixed. In city states

such as Singapore and Hong Kong it has performed remarkably well in keeping pace with the growth in demand of people and goods. Elsewhere, in low- and middle-income countries alike, conditions have deteriorated and as the decade of the 1990s unfolds, the predominant legacies of the 1980s in the region are:

- increasing motorization and unrestrained use of motor vehicles;
- chronic traffic congestion coupled with increased air-pollution, fuel consumption, travel costs and journey times; and
- insufficient roadspace to meet the competing demands of motorists, public transport, freight vehicles, non-motorized vehicles and pedestrians.

It is clear that the demands on the sector will be even greater throughout the region in the 1990s and that new approaches are needed to rectify the issues inherited from the past and meet the following challenges of the future:

- enhancing economic productivity: through serving the transport needs of urban business and industry;
- increasing personal mobility: through improving access by all elements of the population to urban services and jobs;
- improving the urban environment: through the provision of environmentally friendly urban transport services and infrastructure which are beneficial to the form of urban growth; and
- ensuring financial viability: through the financing of urban transport services and infrastructure in a way which is affordable to local governments and to all users of the urban transport system.

1 Enhancing Economic Productivity:

1.1 Reducing Congestion

As vehicle ownership is the driving force in urban areas for stimulating demand and causing congestion, a clearer understanding of trends and possible control measures is essential.

Demand management is no longer a theoretical option. It is central to relieving congestion now and in the future and must be firmly placed on the urban transport agenda for cities throughout the re-

gion. Strategies and action plans need to be prepared for each major city and differentiated according to current and potential levels of congestion:

- curative strategies: to relieve high levels of congestion and avoid it increasing; and
- preventive strategies: to avoid congestion beginning.

1.2 Mass Transit.

The challenge for the 1990s is to take a balanced view in trying to resolve some of the following issues with regard to mass transit:

- how to take an incremental approach to the development of mass transit systems which takes account of present needs and constraints but allows for physical, operational, and technical evolution (such as transitways);
- finding ways to reduce the capital and operating costs of mass transit systems (through LRT for example) and in seeking ways to pay for them which reflect their benefits to users, developers and society at large (which avoid subsidies);
- in defining the role of mass transit within the urban transport system in terms of demand management and relative to other modes of public transport (including non-motorized vehicles);
- in assessing the potential inter-relationships between mass transit and urban development in managing more effectively urban growth and productivity.

1.3 Urban Freight.

Urban freight transport plays a critical role in the economic productivity of Asian cities and in the provision of essential supplies for urban residents.

In attempting to improve goods movements in Asian cities, a comprehensive approach is necessary which recognizes that urban freight handling is first and

foremost an inherently private sector activity which is flexible and responsive to demand; and secondly, that the freight handling system is composed of many closely inter-related elements; and finally that freight movements are of equal importance as passenger movements to city productivity and therefore deserve a more equal share of attention and resources.

2 Increasing Personal Mobility

Non-motorized vehicles offer a low-cost alternative to low-income groups for personal mobility in many cities in Asia. Walking is an important mode of transport in all cities and the only form of personal mobility for many of the poor and underprivileged.

Although improving access to urban services and employment involves motorized travel modes, avoiding the marginalization of non-motorized vehicles and the neglect of pedestrians warrants special attention in Asia in the 1990s.

2.1. Non-motorized Vehicles.

Non-motorized vehicles (NMVs) are an attractive form of transport in an increasingly environmentally conscious world. They offer low-cost personal mobility, are non-polluting, use renewable energy, are labor intensive, and are well suited for short trips in most cities in the region regardless of culture, income, location or size.

The future for NMVs in Asian cities is dependent on their being treated as an integral part of urban transport systems and on understanding the conditions under which they can be cost-effective relative to (and complementary to) other modes of transport.

Setting an agenda with regard to NMVs in Asia would initially involve subscribing to their importance within urban transport systems and would comprise:

- undertaking a detailed inventory of NMV needs and opportunities for their development;

- developing technical guidelines for the management of NMVs in mixed traffic and in urban environments (using experience in such measures from the Netherlands and China); and
- undertaking pilot schemes in selected cities to manage NMV movements more effectively and to encourage and expand their use.

2.2. Pedestrians

Walking is an important mode of transport in all cities and yet in low- and middle-income countries in Asia few facilities exist for pedestrians and pedestrian space is being progressively eroded by motorized vehicles.

The benefits of pedestrian improvement programs accrue to all sections of urban society but especially to low income groups. Pedestrian improvements will not alleviate poverty; but they will save lives and reduce the risk of injury. They will also improve walking conditions for the poor and underprivileged who are too often neglected and treated as second class citizens in urban transport programs.

3 Improving the Environment

An agenda for environmental action in the urban transport sector in Asia is already long overdue. Considerable urgency is now required on all fronts and in all countries on the following:

- urban transport investments should be designed to explicitly address environmental issues;
- an environmental stock-taking is needed to assess the extent of adverse environmental impacts resulting from the urban transport sector or prospective actions in it; and
- cost-effective environmental action plans and improvement programs specifically related to the needs of the sector need to be drawn up and agreed with local authorities.

3.1. Vehicle Emissions.

A major factor contributing to the quantity of vehicle emissions in urban areas is the fuel economy of vehicles. Fuel economy standards, differential vehicle taxes and "bonuses" for scrapping less fuel efficient vehicles are some of the measures which should be adopted to promote greater fuel efficiency.

The sulfur and aromatic content of diesel fuel must be decreased to achieve reductions in particulate emissions.

Alternative fuels such as compressed natural gas or alcohol fuels have the potential to reduce urban carbon monoxide and ozone levels, to solve the diesel particulate problem in city buses and supplement advanced emission control technology.

Regular and effective vehicle inspection and maintenance programs are essential to ensure that the anticipated benefits of emission control strategies are not lost through poor maintenance or tampering with emission control devices.

Although the need for action on vehicle emissions is urgent, remedial measures cannot be introduced all at once. A phased approach is necessary.

3.2. Safety and Accidents.

In the case of urban road safety in Asia, there are considerable challenges to be met in the 1990s. But the basis for action exists; the recently published TRRL report "Towards Safer Roads in Developing Countries" provides working examples and blueprints; and several countries in the region (Australia, Hong Kong, Japan and Singapore) have hands-on experience and expertise in developing successful operational programs. With the support of and collaboration between governments, action plans can become reality, the challenges can be met and less lives would be sacrificed to the cause of urban mobility.

3.3 Environmental Management.

An agenda to address environmental management issues and reduce unnecessary community severance and visual intrusion would involve:

- the definition of environmental areas and the establishment of environmental capacities and standards;
- the promotion of pilot projects to assess the costs and benefits of local improvement techniques and counter-measures;
- the development of technical guidelines for cost-effective urban transport related environmental management programs; and
- the establishment of procedures for financing such programs.

4 Ensuring Financial Viability

Constraints on public sector financing have resulted in innovative approaches to urban transport finance in several countries in the region. These will need to be developed further in the 1990s and will involve making more efficient use of more traditional financing mechanisms such as fares, local taxation, user charges (that reflect externalities), domestic borrowing and external borrowing as well as exploring further the potential for private investment.

Efficient mechanisms need to be designed to attract private sector finance to the sector including the use of bond issues, cost sharing schemes, cross subsidy of capital investment from the sale of property development rights, joint venture schemes and build-operate-transfer (BOT) schemes.

Perhaps the most important aspect with regard to private sector financing operations is the need to ensure the economic viability of such schemes within the overall urban transport system and the complementary roles that the pub-

lic and private sectors can most usefully play in the development and operation of the system as a whole.

Conclusions and Recommendations

The recommendations concerning actions which need to be taken for the sector to adjust and respond to the challenges of development and growth in the 1990s have several important implications for the nature and composition of urban transport investments.

First, urban transport investment programs should subscribe to overall urban development objectives and fit with urban development policies within the region and member countries.

Second, urban transport investments need to take account of the performance of the system as a whole in the assessment of costs and benefits.

Third, new approaches are needed to urban transport planning in Asia in the 1990s. One would focus attention on demand management; the other would focus attention on environmental management. Both approaches are interrelated and the emphasis toward one or the other or both would depend on the situation in a given city or country.

Finally, urban transport investments must be more responsive in terms of timing. The pace of change in Asia is speeding up and delays in decision making and project execution are proving to be more and more costly in terms of system performance and in terms of the measures needed to rectify problems not dealt with in a timely fashion.

The challenge before us is to ensure that the combined resources of the cities, the development community and the private sector can respond appropriately to the needs of individual cities in such a way that by the year 2000 Asia's urban transport systems are not unique due to congestion but are unique due to their efficiency in meeting the travel demands of all sections of urban society ■