# A Policy Perspective for Sustainable Cities

# Non-Motorized Transport (NMT) in Asia

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## 1. Introduction

Non-motorized transport (NMT) consists of all non-motorized vehicles (NMVs) pedestrians. In Asia, NMVs take several forms such as bicycles, bicycle rickshaws, animal carts and human powered carts. In different countries of Asia, they go by different names such as Rickshaws in Bangladesh, India and Nepal, Becaks in Indonesia and Cyclos in Vietnam. These NMVs together with bicycles and pedestrians form the backbone of the urban transport systems in Asia.

Photo 1 Million bicycles on a rainy day (Beijing, China)

As incomes increase, the desire for improved personal mobility increases. Given the lack of adequate and efficient public transport, people with higher incomes opt for MVs. Many of these households start with the acquisition of the cheapest version of the motorcycle (MC), the Moped.

Currently, motorization levels in Asia are quite low in comparison to those in developed countries. There are a number of factors, in addition to incomes, which significantly influence motorization rates: availability of credit, cost of maintenance and parts, cost of fuel, and national policies regarding motorization and environment. However, if the current trends in income increases and inflation hold, even the cheapest moped will be beyond the reach of the majority of the population in Asia.

Photo 2 Bullock carts are common in many Asian cities (Bombay, India)

National polices, with regard to transport investment and regulation, have a major influence on the choice of transport modes and attitudes towards environmental quality. They influence household spending on vehicles and vehicle use, professional training, institutional responses, citizen participation, infrastructure priorities and concerns about the urban poor. The international aid and lending institutions also have a major influence on national policies and transport investments and regulation. In general, these international agencies are often substantially more influential in shaping the thinking of the professionals and bureaucrats and therefore, their attitudes towards full cost accounting, consideration of environment friendly modes such as the NMT, mobility, and accessibility of the urban poor.

Photo 3 Bicycles and walking are the predominant modes in many smaller cities (Hospet, India)

In recent years, many authors have discussed the importance of NMT and its appropriateness in the urban transport system: Dimitiriou[1], Hook[2] [3], Khisty[4], Kuranami et al[5], Midgley[6], Pendakur[7] [8] [9], Replogle[10] and Stickland[11]. This paper is a continuation of this discussion regarding the role and importance of NMT in the policy context.

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1 Dimitriou, H.T. Policy making and planning for NMT systems in third world cities: A developmental approach. "Transportation Research Record " #1396 (1993).

2 Hook, W. Economic importance of NMT. "Transportation Research Record" #1487 (1995).

3 Hook, W. Transport, poverty alleviation and sustainable human settlements. UNDP. New York (1998).

4 Khisty, C.J. Transportation in the developing countries: Obvious problems, possible solutions. "Transportation Research Record " #1396 (1993).

5 Kuranami, C., Winston, B. and Guitink, P. NMVs in ten Asian cities: Policies and issues. The World Bank. (1994).

6 Midgley, P. Urban transport in Asia: An operational agenda for the 90s. The World Bank. (1994).

7 Pendakur, V. S.. NMT equivalents in urban transportation planning. "Transportation Research Record" #1487 (1995).

8 Pendakur, V. S. Congestion management, NMT and sustainable cities. in V. S. Pendakur (ed) Non-Motorized Transport. The World Bank and the Inter-American Development Bank. (1996).

9 Pendakur, V.S. Planning for NMT in China. Paper presented at the World Bank-Austrade Urban Transport Management Seminar, Shenyang, September 1997, The World Bank Resident Mission in China, Beijing, (1998).

10 Replogle, M. NMVs in Asia. The World Bank. (1992).

11 Strickland, R. Bangkok's urban transport crisis. "Urban Age", 2:1(1993).

## 2. Population, Urbanization and Poverty

With 58% of the global population concentrated in about 25% of the total global land surface, the Asia-pacific region is one of the two most densely populated regions of the world, the other being Europe. Population density, at about 95 persons per $km^2$ is more than twice the global average. Given the substantial projected population growth to 2020, the Asia-Pacific region is likely to become the most populated part of the world[12].

More than ever before, people around the world are moving to the cities in search of better lives. Consequently, cities are growing at a very high rate in terms of population, geographic area and economic output. In 1995, 45% of the global inhabitants lived in urban areas. By 2020, this is expected to increase to about 66%[13]. More pronounced is the rapid urbanization in Asia. By 2020, more than 50% of its population, nearly 2 billion people, are likely to live in the cities.

The Asia-Pacific region has about 58% of the global population. Unfortunately it is also home to 75% of the world's poor (those with incomes and consumption below the nationally defined poverty levels)[14]. **More than half of the world's poor live in seven Asian countries:** Bangladesh, China, India, Indonesia, Pakistan, Philippines and Vietnam. The poor, primarily because their discretionary income is extremely limited, have no choice but to use the cheapest modes of transport, generally NMT. As well, a very large portion of trips made by the poor are by foot.

As the cities grow larger, the travel distances (trip lengths) and therefore, the travel costs increase geometrically. What is generally within walking distance in smaller cities will tend to require vehicles (both NMVs and MVs) in big cities. Often, the poor are pushed to live in the periphery and consequently, they are required to travel longer distances and pay substantially higher costs for transport.

[12] State of the environment in Asia and the Pacific 1995. United Nations ESCAP and the Asian Development Bank, (1996).
[13] World urbanization prospects. United Nations, (1995).
[14] World Development Report 1996. The World Bank, (1997).

## 3. Urban Transport Context in Asian Cities

Rapid urbanization is increasing travel demand in the cities. The increasing economic activity combined with the increasing geographic size of the city produce a pattern of travel where people make more trips, which are even of greater distance than before. This has pushed the existing road capacity to its limits and often beyond, causing severe traffic congestion. This rapid growth has seriously deteriorated air quality, increased trip costs and substantially extended the commuting times[15].

The largest cities in Asia are growing at an unprecedented rate, doubling their populations every 12 to 18 years and increasing greatly in geographic area. This, combined with increasing incomes, has been the impetus for transport demand to increase exponentially. In some countries, the number of cars have been growing at an annual rate of 10 to 12% and motorcycles at 15 to 20%, resulting in increasing traffic congestion. During this period of high economic growth and the increasing size of cities, traffic demand has increased but available road space has remained about the same. With all these increases in travel demand, the congestion management techniques used in many Asian cities, have remained much the same as before[16].

Increasing economic growth and personal incomes have allowed many people to own MVs, primarily motorcycles, to increase their mobility. However, these highly polluting two stroke combustion vehicles have led to increasing pollution and decreasing air quality. This, in turn, leads to greater health risks for the whole population such as respiratory illnesses and heart related illnesses.

New investment in public transport has lagged far behind substantially. This has resulted in the overloading of buses, long waiting times at bus stops and terminals and obsolete bus fleets. In most public transport systems, there are not enough buses to meet the demand and in addition, these buses are not maintained in good order, resulting in breakdowns and accidents.

Outdated traffic control systems and traffic management techniques compound the problem of traffic congestion. The increasing number of vehicles, both NMVs and MVs, and the increasing number of trips (short and long distance) combined with the limited amount of road space, are leading to major reductions in traffic safety (accidents, injuries, death and property damage). Furthermore, available pedestrian walkway space (footpaths), which in itself is quite limited, is often occupied by parked motorcycles, cars and by an ever increasing number of street vendors.

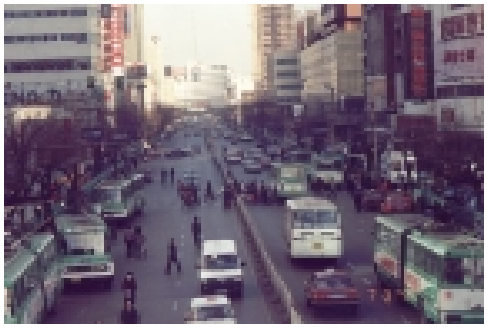


Photo 4 Traffic control and management can provide orderly traffic flow (Fushun, China)

Photo 5 Street vendors extending to street itself, in addition to occupying foot paths (Bangkok, Thailand)

Photo 6 Public transport, bullock carts, pedestrians all share the same road space (Bangalore, India)

[15] Pendakur, V. S. Urban poor and urban transport: Their mobility and access to transport services. UN Center for Human Settlements, (1998).

[16] Pendakur, V. S. Congestion management and air quality: Lessons from Bangkok and Mexico City. "Asian Journal of Environmental Management". 1:2, (1993).

## 4. Travel Modes in Asian Cities

Travel modes in **22 low-income cities of Asia** are shown in **Figures 1 to 3. Figure 1** shows the travel modes **for 11 smaller cities ( 1-5 million people) from 6 countries** of Asia: Ahmedabad, India; Anshan, China; Bandung, Indonesia; Fushun, China; Guangzhou, China; Hanoi, Vietnam; Kanpur, India; Kathmandu, Nepal; Phnom Penh, Cambodia; Louyang, China; and Zhengzhou, China. **In all of these cities, more than about 66% of trips made are by NMT.** Private motorized transport share is quite small, even in prosperous cities such as Guangzhou. However, where public transport supply is drastically low (Hanoi, Kathmandu and Phnom Penh), private motorized transport share (primarily motorcycles) increases and varies between 15 to 22%. In all other cities, NMT is the dominant mode.

### Figure 1. Mode Split in Low Income Countries of Asia Small Cities: 1-5 million People

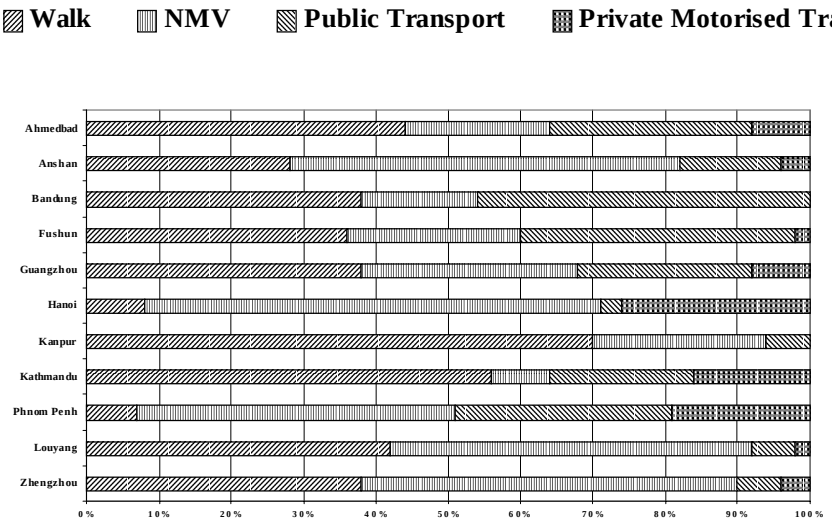



**Figure 2** shows the travel modes in **5 medium size cities (5-8 million people) from China, India and Indonesia**: Bangalore, Surabaya, Shenyang, Madras and Tianjin. In Bangalore and Madras, NMT share varies from about 42% in Madras to 55% in Bangalore. This can be attributed to the availability of a substantially better transit system in Madras. In Shenyang and in Tianjin, the NMT share is very high, 82%-90%. In Surabaya, public transport quality and availability is substantially worse than in the other cities and hence, a large portion of the people resort to motorcycles.

### Figure 2. Mode Split in Low Income Countries of Asia Medium Size Cities: 5-8 million People

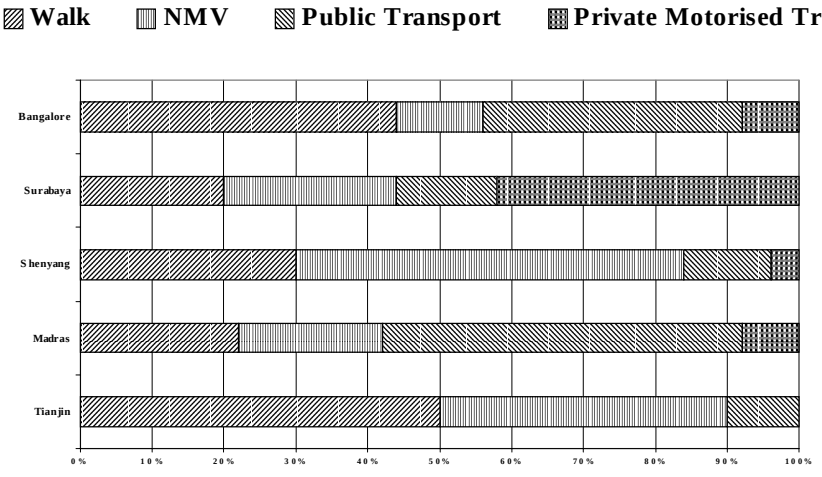


**Figure 3** shows the travel modes in **6 large cities (>8 million people) from Bangladesh, China, India and Indonesia.** NMT share in the Chinese cities (Beijing and Shanghai) is quite high at >60%. In Delhi the NMT share is >40% whereas in Bombay the NMT shares is much lower at 23%. One of the reasons, for this difference, could be that Bombay has excellent commuter train systems whereas Delhi has none. In Dhaka, the NMT share is 60%, primarily walking and rickshaws. In Jakarta, however, NMT share is lower at 35% and there is a fairly high use of MVs, primarily motorcycles.

## Figure 3. Mode Split in Low Income Countries of Asia Large Cities: 8+ million People

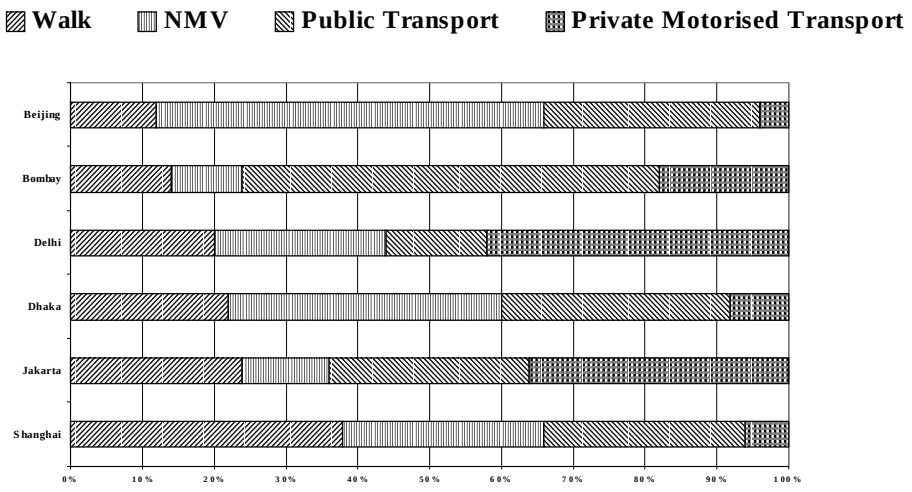
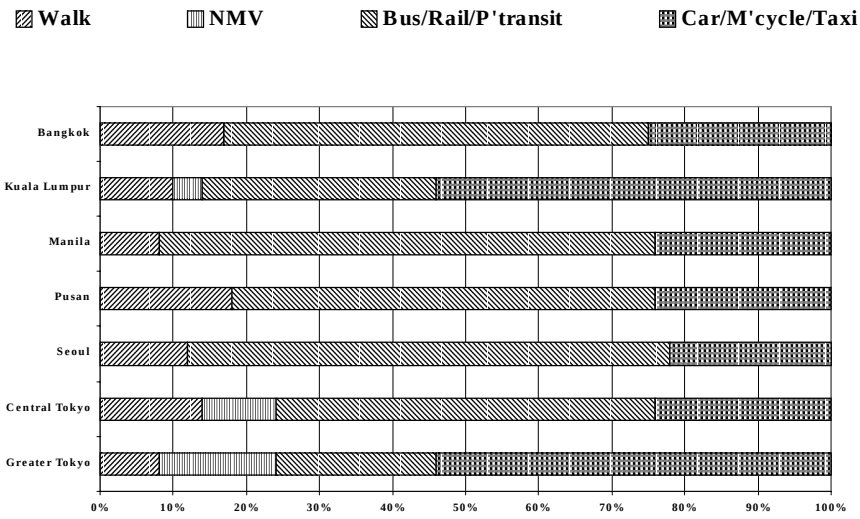



**Figure 4** shows the travel modes in **six cities from middle and high-income countries** of Asia. As incomes increase, motorization increases and generally, these cities also have slightly better public transport services. In large cities, the trip distances are quite high, thus limiting the use of NMT. Consequently, in these cities, the dominant travel modes are private vehicles and public transport.

Major factors influencing the mode choice in Asian cities are personal incomes, the availability, adequacy and cost of public transport, personal safety while traveling, trip lengths, trip times and public policies towards NMT. It is evident from **Figures 1 to 4 that NMT is the major travel mode used by a very large portion of the urban population in the low-income countries of Asia.**

## Figure 4. Mode Split in Selected Asian Cities Middle and High Income Countries




Source: Midgley, 1994

## 5. Urban Transport, Air Quality and Public Health

The rapid growth of cities, together with increased motorization, has resulted in an equally rapid increase in urban air pollution. Use of poor quality fuels, the poor condition of motor vehicles and roads, traffic congestion have been major contributors to increasing air borne emissions of sulfur dioxide (SO2), Nitrogen Oxides ($NO_2$), suspended particulate matter (SPM), lead (Pb), carbon monoxide (CO) and ozone.

Air quality is deteriorating in virtually all Asian cities except perhaps in Korea and Japan. The ambient concentration of SPM is increasing in every major Asian city and generally exceeds World Health Organization (WHO) guidelines. The trends for $SO_2$ differ by city but are getting worse in all Indian and Chinese cities. In a study of the eleven megacities (populations exceeding 10 million people) of Asia, the World Health Organization concluded that 10 megacties had serious problems of SPM which can have toxic effects if they carry heavy metals or hydrocarbons[17].

Among the ten Indian cities of more 3 million population (Ahmedabad, Bangalore, Calcutta, Chennai, Delhi, Hyderabad, Kanpur, Jaipur, Mumbai and Nagpur), studied by the Central Pollution Control Board (CPCB), six cities had Suspended particulate matter (SPM) levels varying from 220-460 micro grams / cu meter. These pollution levels far exceed the WHO limit of 200 micro grams / cu meter. This condition has led to a substantial increase in the incidence of various respiratory diseases including asthma, bronchitis and conjunctivitis and an ever increasing incidence of heart problems[18].

There is a relatively heavy concentration of road networks and motor vehicles in the major Asian cities which has resulted in high levels of air pollution which invariably become a major health hazard. The high density of motor vehicles caught in slow moving traffic aggravates this. For example, road transport accounts for a major share of air pollution in many Asian cities: Delhi 57%, Beijing 75%, Manila 70%, and Kuala Lumpur 86%[19].

Bangkok alone uses about 50% of the energy consumed by all of Thailand's transport sector. For example, more than 1.5 million of Bangkok's residents, nearly one seventh of the metropolitan population, suffer from respiratory diseases directly linked to air pollution. Bangkok reportedly has lung cancer rates three times higher than the rest of Thailand. The environmental costs of air and water pollution in Bangkok are estimated to exceed 2 billion US$ a year[20].

It has been estimated that nearly 1.4 million US$ worth of fuel is wasted daily by idling motor vehicles in traffic jams[21]. **Each car is estimated to spend an average equivalent of 44 full days a year idling in traffic jams.**

Even though ownership of motor vehicles is on the increase in all of the cities discussed above, **NMT plays a major role and is used by a majority of the population. In addition, it is environment friendly and pollution free.**

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17 Air pollution in megacities of the world. WHO and Blackwell, (1992).
18 Polluted cites: Choking to death., "India Today", (December 15, 1996).
19 Brandon, C. and Ramankutty, N.. Towards An Environment Strategy for Asia. The World Bank. (1993).
20 Strickland. op. cit.
21 ESCAP. op. cit. Chapter 12.

## 6. Motorization in Asian Cities

The current levels of motorization, in low income countries of Asia, are very low. In China, there were only 4.1 million cars and jeeps in 1997, of which only 0.6 million were privately owned and the remainder were government and corporate owned. In addition, there were 35.0 million motorcycles in 1997[22]. Another 6.5 million MVs, were buses, trucks and tractors. Total MVs (motorcycles, cars, jeeps, buses, trucks and tractors) add up to 45.6 million, which is still is very low at 36.2 MVs / 1,000 persons. In India, there were 3.8 million cars and jeeps, and 23.0 million motorcycles (mopeds and MCs), in 1997. Including trucks and tractors, there were a total of 28.0 million MVs in 1997. This is still very low at 30.0 MVs / 1,000 persons[23]. While the trucks and tractors are distributed fairly evenly in all the regions of these countries depending upon their economic output, a very large proportion of private and corporate MVs (cars and jeeps) are in the major cities. Even allowing for this skewed distribution of private and corporate MVs, the MV ownership rates are still very low.

In middle and high-income countries of South East Asia, the MV ownership rates are considerably higher, reflecting the emerging middle class ownership of MCs. Even these are concentrated in larger and richer cities of these countries. For example, more than 50% of the private MVs and MCs in Thailand are in Bangkok. A similar situation exists in Kuala Lumpur, Jakarta and Surabaya. These cities are primate cities and their economic outputs are very large and literally dwarf the second cities. Most of the country's privately owned MVs are located in these cities as well reflecting the concentration of economic activity and wealth.

Of all the cities in the Asia-Pacific region, Singapore is in a class by itself even though it has very high incomes, now approaching those in western countries. This can be attributed to very explicit transport policies which guide the orderly growth of privately owned MVs. It has an efficient rapid transit system complemented by an excellent bus system. Even though the MV ownership rates are very high compared to other Asian countries, there are severe controls and very high user costs regarding the peak hour use of MVs. It is the most advanced nation in terms of traffic management and has recently introduced electronic road pricing for peak hour MV use. In addition, MVs are subjected to regular inspections for their environmental and energy performance. Other Asian countries, when compared to Singapore, have a long way to go in achieving a well-managed and sustainable urban transport system.

**Table 1** shows NMV and MV ownership patterns in selected cities of Asia. In all of these cities, MV ownership rates are quite low. Bicycle ownership in all the cities, except in Manila and Dhaka is very high. There is a very high ownership of bicycles in Hanoi (909 / 1,000 persons), George Town (528), Kanpur (227), Shanghai (865), Anshan (600), Fushun (400) and Shenyang (792). In all these cities, the public transport (bus) supply is inadequate. Chiang Mai (100) and Phnom Penh (156) have very bus systems which has resulted in a very high ownership of motorcycles at 430 and 145 MCs / 1,000 persons respectively. The large number of bicycle rickshaws in Dhaka (59) is unique as it is a Dhaka tradition. Very high MC and MV ownership in George Town is indicative of high incomes combined with an inadequate and inefficient bus system.

**The emerging personal MV of the middle class is the "Motorcycle".** Lower priced versions are called the "Mopeds". Most of these MCs are 2-stroke engines, producing disproportionately high amounts of pollutants as well as being energy inefficient.

As incomes increase, the desire for increased personal mobility will increase the number of MVs, particularly the MCs. This will be more pronounced in bigger cities where the social infrastructures (educational, health and recreational) are inadequate and are not located within walking distance. Furthermore in Asia, the MC is a family vehicle. It is not uncommon in India and Indonesia to see 2-4 persons ( including children) on a single MC, particularly during the peak travel times. The cheaper mopeds are commonly used by university students and young professionals.

[22] Pendakur, V. S. Motorization and its impact on employment and training. International Labor Organization, (1998).
[23] Polluted Cities: Choking to Death. op. cit.

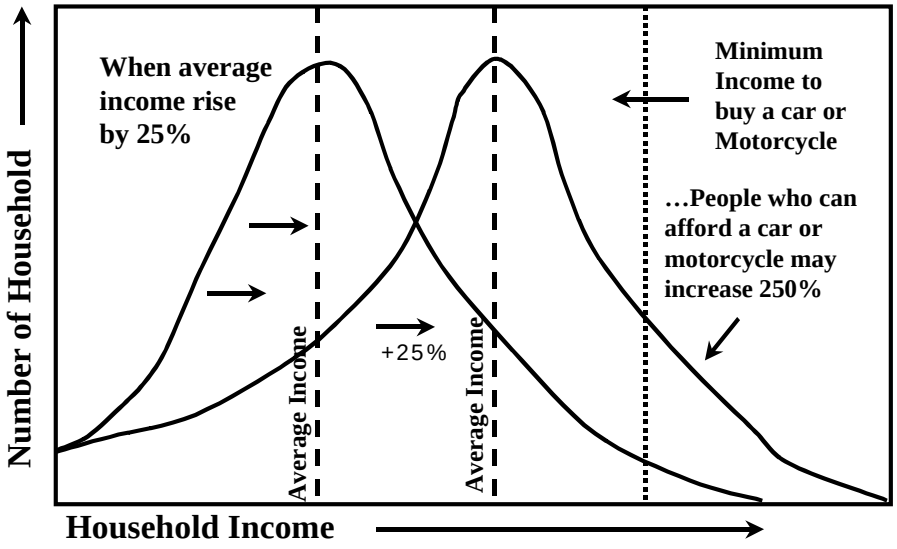
**Table 1. Motor Vehicles and Non-Motorized Vehicles in Selected Asian Cities: Vehicles per 1,000 Persons**

| City | Bicycles | Cycle Rickshaws | Animal Carts | Buses | Motorcycles | Other MVs |
|---|---|---|---|---|---|---|
| **Phnom Penh** | 156 | 14 | 0.06 | 0.03 | 145 | 16 |
| **Hanoi** | 909 | 5 | 0.02 | 0.15 | 116 | 44 |
| **Dhaka** | 12 | 59 | 0.03 | 1.41 | 18 | 20 |
| **Kanpur** | 222 | 15 | 2.43 | 0.38 | 77 | 93 |
| **Anshan** | 600 | 0 | 3.40 | 1.30 | 12 | 19 |
| **Fushun** | 400 | 0 | 2.90 | 1.90 | 7 | 19 |
| **Shenyang** | 792 | 0 | 3.60 | 0.90 | 26 | 27 |
| **Shanghai** | 865 | 13 | 0.04 | 2.44 | 5 | 17 |
| **Surabaya** | 129 | 15 | 0.03 | 1.04 | 125 | 53 |
| **Manila** | 12 | 1 | 0.03 | 0.62 | 8 | 73 |
| **Chiang Mai** | 100 | 15 | 0.02 | 0.17 | 430 | 136 |
| **George Town** | 528 | 6 | 0.02 | 0.39 | 308 | 221 |

Sources: Chiaki Kuranami and Bruce Winston. Factors influencing the ownership and use of NMVs in Asian cities. Transportation Research Record #1441, 1994 and V. Setty Pendakur. Planning for NMT in China. op. cit.

**Figure 5** conceptualizes the impact of increasing incomes on the potential ownership of MVs. It reveals that if there is an increase of 25% in per capita real income, then there is a potential for up to 250% increase in the number of households which may consider buying a MV, probably a MC. This is possible because of the practice of pooling of household incomes along with credit and installment purchasing. There will certainly be an increase in the ownership of MCs and MVs as incomes increase. The quantity and quality of this increase will depend upon prices of MVs and MCs in relation to average incomes, inflation, cost of maintenance and the cost of fuel.

**Figure 5. The Income Effect**




The cost of a small car in China, Indonesia or India is prohibitively high in relation to average incomes. A small locally manufactured car costs about the equivalent of 5-10 years of income for a young professional in China. It is the same case in Indonesia and India. On the other hand, motorcycles, especially the cheaper mopeds, are within the purchasing power of many middle income households.

Considering all these factors: increasing average household incomes, inflation, cost of MVs and MCs, it appears that most of the households in Asia will not have the economic capacity to own and operate a MV, at least to the year 2010. **Figure 6** shows forecast for China[24]. It is estimated that households with no access to any kind of MVs will decrease from 93% to 85% by the year 2010. In 1995, only 5% of the households owned a MC and this is likely to increase to 12%. The households owning a MV will increase from 2.4% to 2.8% by 2010. These are substantial increases considering the population size of China. Yet, even with all these increases, **85% of the households will have to depend upon NMT and Public Transport.**

Photo 7 Motorcycle is the emerging MV of the middle class, carries 1-4 people (Bangalore, India)

**Figure 6. Access to Motorised Transport, China 1995-2010**

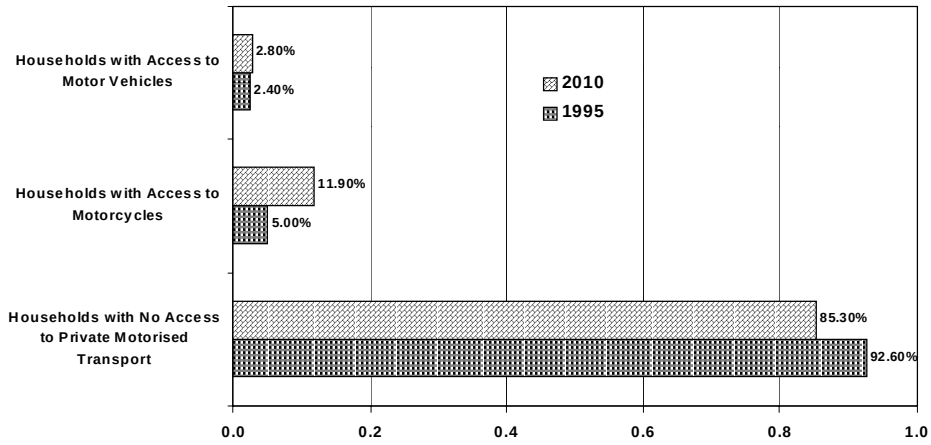
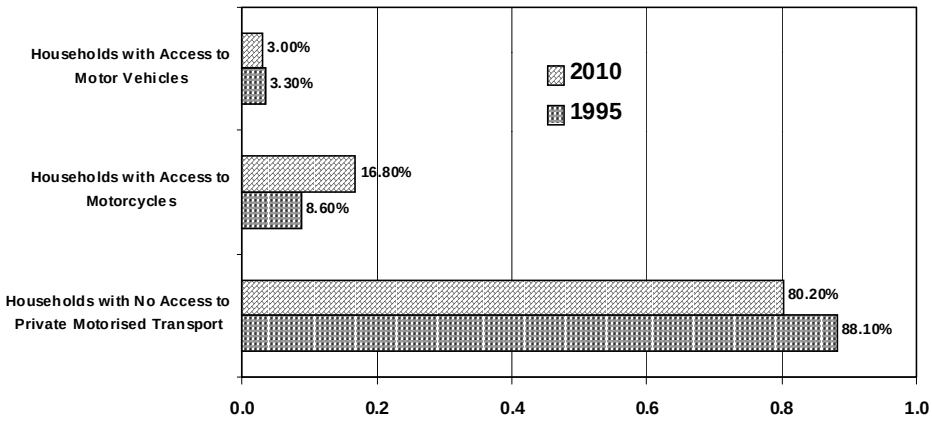



**Figure 7** shows the forecast for India[25]. It is estimated that households with no access to any kind of MVs will decrease from 88% to 80% by the year 2010. In 1995, only 8.6% of the households owned a MC and this is likely to increase to 16.8%. The households owning a MV will likely decrease from 3.3% to 3.0% by 2010. These are substantial increases considering the population size of China. Yet, even with all these increases, **80% of the households will have to depend upon NMT and Public Transport.**

**Figure 7. Access to Motorised Transport, India 1995-2010**




[24] Pendakur, V. S.. Planning for NMT in China. op. cit.
[25] Pendakur, V. S.. ibid.

## 7. Current Urban Transport Policies

Transport investment and regulatory policies in most developing countries are derived and adapted from the concepts and models produced in the developed countries which have very high ownership of private MVs. The basic assumption is that motorization is not only good but it is also a must. These policies and related planning and implementation systems have been developed primarily based on the assumption that the private car will be used universally and such use produces more benefits than costs. Most of these models have not factored in the environmental and social costs of the universal use of private car.

The developing countries, on the other hand, have very low ownership of private cars and an emerging high ownership of MCs. Forecasts from several studies indicate that private car ownership and use in most developing countries is likely to remain quite low during the next twenty years and NMT will continue to be used by a large portion of the population. This will remain as such until the incomes of the whole population will increase substantially and not just for the emerging middle class. It is quite likely that most of the Asian cities will continue to be dominated by NMT and MVs will preponderantly be the MCs. What is overlooked is the principle question: **which trips are appropriate for MVs and which are appropriate for NMT?**

The policy and planning concepts which have been practiced in the developed countries since the mid-sixties have produced many sprawling cities which have high energy consumption and high cost urban transport, including automobile dependency. These policies emphasize speed, thus essentially favoring the MVs and disregarding the social and environmental costs. Most developing countries have adopted these policies, including planning and design manuals resulting from these policies, with very little change, if any.

The current urban transport policies are summarized in **Figure 8.** Investment and regulatory responses in all Asian cities, with the notable exception of Singapore, generally are focussed upon accommodating more and more MVs, often at the cost of those using NMT. However, in some megacities, there are indications of new quantum investments in public transport.

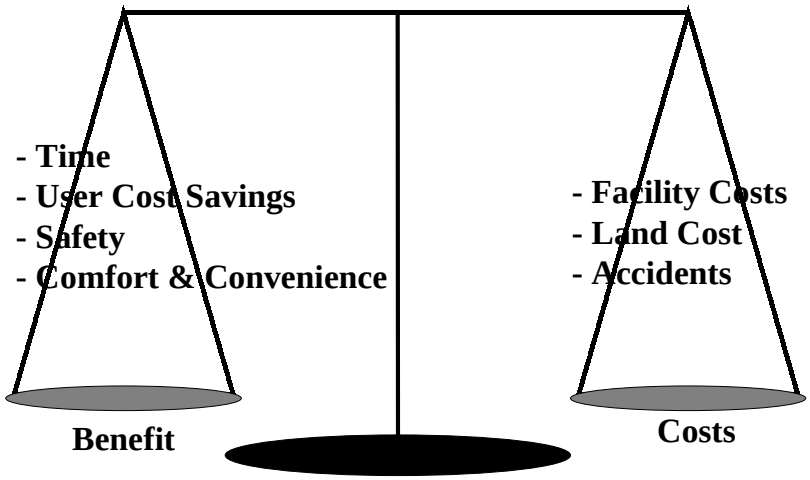
**Figure 8. Transportation Planning Now**

Current investment decision matrix is shown in **Figure 9.** Only the direct costs of transport systems to be built, are considered and all of social and environmental costs are generally either not quantified or ignored altogether. On the other hand, computed benefits include time savings, user cost savings, safety, comfort and convenience. Of these benefits, value of time savings is the bulk of the total benefits. This is based on the assumption that all time is productive time. However, whether people are willing to pay for these time benefits depends entirely on their income and their perceived values of time. Are these concepts suitable for poor countries? At what levels of income will these become relevant? How can we include environmental and social costs? Is the single occupant automobile cost effective?

The negative impacts of the universal use of the automobile, especially by single occupants, has been the subject of much debate in recent years in developed countries. The impact of the automobile on city form, urban efficiency, urban spaces, energy consumption, environmental impacts has been studied by many authors. These studies clearly acknowledge the high personal mobility afforded by the private automobile. They also conclude that many of costly impacts of intensive automobile use are long term and irreversible ( environmental and social) and generally in most countries, the automobile users are heavily subsidized by general revenues. The essence of the conceptual debate is that the intensive use of the single occupant automobile for peak period work trips is inefficient and leads to sprawling cities which are economically, environmentally and socially inefficient[26] .

Recent studies of NMT equivalents, for the use of land, road space, parking, energy, fuel consumption and initial investments, have shown that for certain types and lengths of trips, NMT are more efficient than the MVs[27,28] The key question is one of how to incorporate appropriate modes with different type of trips, with the goal of achieving the efficient functioning of the mixed traffic system.

**Figure 9. Current Investment Decision Matrix**



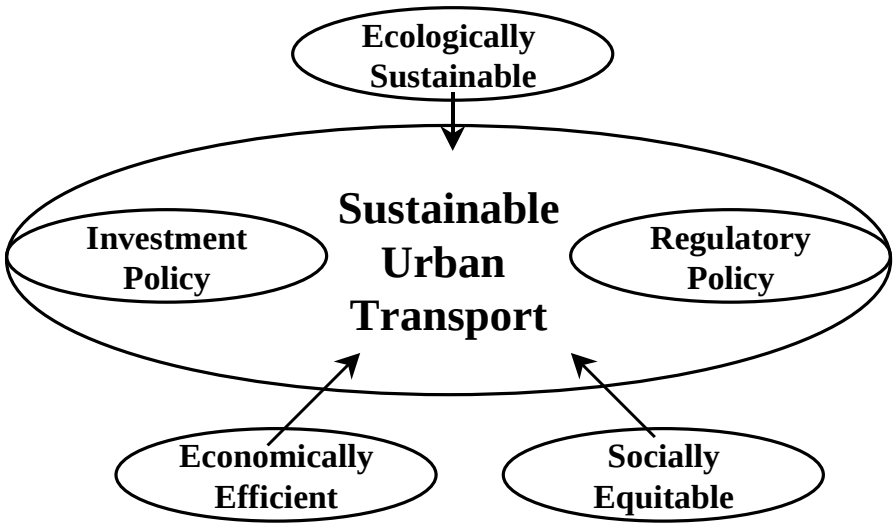

[26] Peter Newman. Cities and Automobile Dependence. Murdock University Press. Perth, 1996.
[27] Pendakur, V. S., Badami , M. and Lin, Y. NMT equivalents in urban transport planning. op. cit.
[28] Pendakur, V. S. Congestion management, NMT and sustainable cities. op. cit.

## 8. Sustainable Cities as the Basis for Urban Transport Policy[1]

The conceptual basis for a sustainable urban transport policy spectrum is shown in **Figure 10.** It includes both investment and regulatory policies. It also encompasses urban transport services provided by both the public and private sectors. To contribute to the development of sustainable cities, urban transport policy must have three main components[29]:

1. It must ensure that a continuing capability exists to support an improved material standard of living for all people, especially the poor. This corresponds to economic and financial sustainability.
2. It must generate the greatest possible improvement in the quality of life, not merely an increase in goods and services. This relates to the concept of ecological and environmental sustainability.
3. The benefits generated by the urban transport structure and investments, must be shared equitably by all sections of the community, without penalizing the poor. This relates to social sustainability.

**Figure 10. Urban Transport Policy Spectrum**




Economic, environmental and social sustainability are often mutually reinforcing[30]. Urban transport improvements (road or public transport) that fall into disrepair, because they are economically unsustainable, fail to serve the needs of the poor and often have environmentally damaging consequences. However, there are some policy instruments that serve all dimensions of sustainability in a synergetic way. These instruments should include measures to improve asset maintenance, technical suitability and efficiency of supply, safety, design, administration and charges for external effects. However, this convenient synergy does not always hold. For example, increased mobility, particularly private motorized mobility, typically increases the measured GDP but damages the environment. Similarly, efficient provision of transport services in a competitive way may involve loss of jobs. Public transport provided cheaply by the informal sector may meet the needs of the poor and create jobs but not necessarily be economically efficient in terms of energy consumed and other associated costs. Motorized two-wheelers (MCs) may meet the mobility needs of middle income people and at the same time, be environmentally damaging. All these phenomena involve tradeoffs that governments must face. A sustainable urban transport policy is one that both identifies and implements win-win policy instruments and explicitly confronts the tradeoffs so that the balance is chosen rather than accidentally arrived at. It is a policy of informed, conscious choices.

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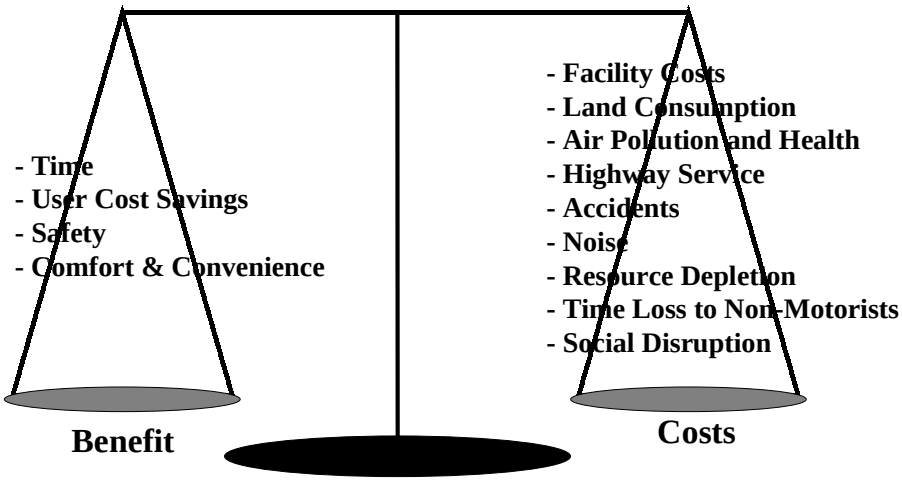
[29] Sustainable transport: A basis for policy reform. The World Bank., (1996).

[30] Munasinghe, M. Environmental economics and sustainable development. The World Bank, (1993).

**Economic sustainability** involves creating incentives for the efficient and coherent response to transport needs of all sections of the community and by a variety of flexible modes. A sound economic base is fundamental to economic sustainability. Transport investments should therefore be subject to rigorous cost-benefit analysis within the framework of full cost accounting, encompassing environmental and social costs of new transport infrastructure and higher mobility. **Figure 11** shows the important elements of such full cost accounting. This concept applies not only to new infrastructure but also to management, logistics and procurement.

**Figure 11. New Investment Decision Matrix**




The cost of maintaining excessively ambitious roads and other urban transport networks, and the subsidized operations of poorly managed public transport agencies also frequently impose unsustainable fiscal burdens in the developing countries. Conversely, where urban transport infrastructure is seriously deficient or inefficient, the economic and social development of the city is seriously constrained.

**Environmental sustainability** involves promoting more livable cities and reducing the adverse environmental effects of transport operations, both public and private. Dependence on private MVs increases aggregate energy consumption, increases air pollution, and increases costs. Furthermore, these effects although not necessarily cumulative and irreversible, are not sustainable in the sense that they do not represent the chosen outcomes. Adverse environmental effects are extremely difficult to reverse once the personal lifestyles and the location of activities have been arranged to accommodate trips on road transport, more particularly with a high dependence on personal MVs.

The relative importance of the components of quality of life varies between cultures as well as the stages of development. For example, low income countries may best be assisted by the provision of appropriate infrastructure, and efficient traffic management for both MT and NMT, and the provision of adequate public transport. On the other hand, medium and high income countries may benefit substantially more by policy reform or measures to improve the environment. Whatever the chosen balance, increasing economic sustainability can advance environmentally sustainable transport but does not automatically do so. Failure to incorporate external costs **(Figure 11)** and environmental considerations into investment and regulatory assessment is what creates the environmental sustainability gap.

**Social sustainability** involves assisting the poor to increase their incomes and not increase their costs. This is enormously important in many countries of Asia, where more than half of the world's poor live[31].

**Figure 12** shows the household expenditure patterns in Asia. Household travel expenditures vary from a low of 5% in Bangladesh to a high of 20% in Hong Kong. These are average expenditure patterns for all the households. Studies of low income households in China and India indicate that the poor pay a disproportionately high portion of their meager incomes for transport. This is even more pronounced for the urban poor living in the poorest areas of the low income cities[32]. Socially sustainable transport means that transport improvements do not require the poor to spend more for their daily trips.

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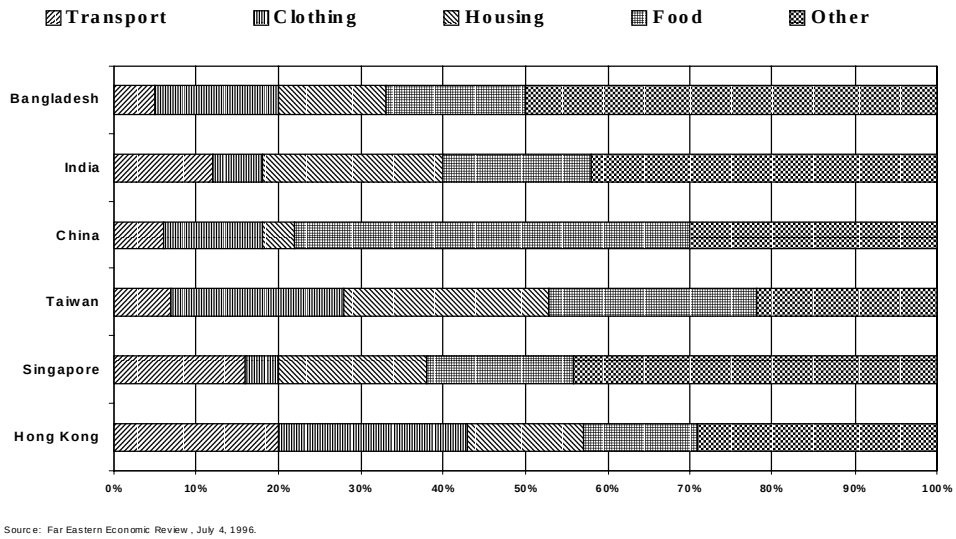
[31] ESCAP. op. cit.

[32] Pendakur, V. S. Urban poor and urban transport: Their mobility and access to transport services. op. cit.

In the cities, the principle resource of the poor is their labor. Therefore, adequate and affordable transport is one of their significant daily requirements. If the poor are required to make excessively long work trips at high cost as they do in many Asian cities now (Bangkok, Bangalore, Bombay, Delhi, Dhaka), the system is socially unsustainable. Where incomes are very low and transport costs are high, the poor make a very high proportion of their trips by foot and by NMVs.

**Figure 12. Household Expenditure Patterns**

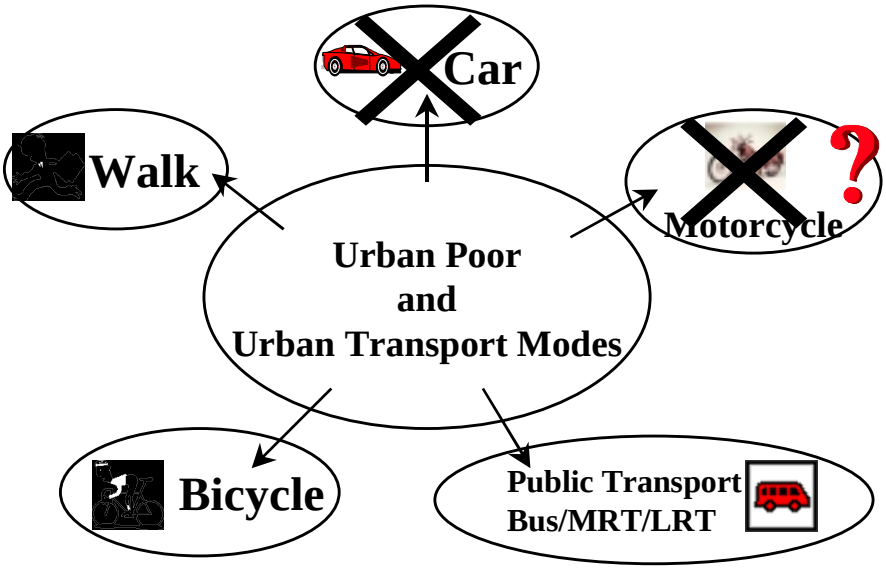



Source: Far Eastern Economic Review , July 4, 1996.

Central to these problems is the failure to provide or maintain those activities and services that are most critical in ensuring that the poor have access to markets, employment and social infrastructure facilities. Because planning skills and concepts that are relevant to developed countries have not been deployed in the Asian cities, **priority has been given to mobility rather than basic accessibility.** This has favored persons who are already mobile and have reasonable incomes, particularly the MV users.

Appropriate urban transport planning system for social sustainability is shown in **Figure 13.** The poor cannot afford to own MVs of any kind. Their dominant mode is NMT and public transport. Under these circumstances, it is imperative to consider the appropriate role of NMT and public transport in both investment and regulatory policies for urban transport.

**Figure 13. Urban Transport & Urban Poor**



## 9. Appropriate Role for NMT

A. Depending upon incomes, city size, population, urban densities and the availability of public transport at affordable prices, there are appropriate roles for both the MVs and NMT. The most sustainable city would be the one where the number of required MV trips can be kept at a minimum, and where most trips can be made by environment friendly modes such as walking and bicycling. This approach has to be tempered by the peak hour volumes, available road space, length of trips, climate, topography and ability of the population to pay for high level of services. The new paradigm is shown in **Figure 14.**

B. This approach requires a careful, systematic and dynamic balancing of all three components of sustainability: Economic, Environmental and Social. It will require **the inclusion, encouragement, and fullest use of NMT** in every step of urban transport policy formulation, planning, investment decisions and regulation. This should be done within the framework of total cost accounting, including all external costs. Such an approach will produce an environment friendly transport system that is economically efficient and socially sustainable. Serious consideration for the plight of the poor in relation to trip lengths, modes and costs should be mandatory. The end product will have to be a combination of all modes, with an appropriate fit into the system as a whole.

C. The new paradigm demands a complete overhaul of the currently used conceptual and analytical bases of transport policy and planning which have been in vogue since the late sixties. These methods have become obsolete as we have gained more knowledge about social disruption, air pollution, mobility and accessibility, and more importantly the overall consequences of automobile dependence.

**Figure 14. Sustainable Transportation Policy**