



# Urban mobility in the developing world

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## Abstract

Mobility and accessibility are declining rapidly in most of the developing world. The issues that affect levels of mobility and possibilities for its improvement are varied. They include the rapid pace of motorization, conditions of local demand that far exceed the capacity of facilities, the incompatibility of urban structure with increased motorization, a stronger transport–land use relationship than in developed cities, lack of adequate road maintenance and limited agreement among responsible officials as to appropriate forms of approach to the problem. The rapid rise of motorization presents the question: At what level will it begin to attenuate for given economic and regulatory conditions? Analysts have taken various approaches to this problem, but so far the results are not encouraging. Developing cities have shown significant leadership in vehicle use restrictions, new technologies, privatization, transit management, transit service innovation, transportation pricing and other actions. Only a few, however, have made important strides toward solving the problem. Developing cities have lessons to learn from developed cities as regards roles of new technologies, forms of institutional management and the long term consequences of different de facto policies toward the automobile. These experiences, however, especially in the last category, need to be interpreted very carefully in order to provide useful guidance to cities with, for the most part, entirely different historical experiences in transportation. Continued progress in meeting the needs of the mobility problem in developing cities will focus on: (a) highway building, hopefully used as an opportunity to rationalize access, (b) public transport management improvements, (c) pricing improvements, (d) traffic management, and (e) possibly an emphasis on rail rapid transit based on new revenue techniques. © 1999 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

In the large cities of the developing world, travel times are generally high and increasing, and destinations accessible within limited time are decreasing. The average one-way commute in Rio de Janeiro is 107 min. In Bogota it is 90 min. The average vehicle speed in Manila is 7 miles per hour. The average car in Bangkok is stationary in traffic for the equivalent of 44 days a year.

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This is happening because vehicle registrations are growing fast on the basis of increased populations, increased wealth, increased commercial penetration, and probably an increasingly persuasive picture in the developing world of international lifestyle in which a car is an essential element. Accordingly, in much of the developing world the number of motor vehicles is increasing at more than 10% a year—the number of vehicles doubling in 7 yr. The countries include China (15%), Chile, Mexico, Korea, Thailand, Costa Rica, Syria, Taiwan, and many more.

What is the shape of increasing congestion and declining mobility? There are no widespread measures available for comparative purposes because decline in mobility is complicated. Congestion is always localized in time and space. A few things are nonetheless evident.

1. Congestion is reducing the mobility of auto users. It is clear by measures of traffic delay available and even by impressionistic evidence that in virtually all large cities of the developing (and developed) world congestion increasingly impedes mobility for auto users. The only exceptions are very poor metropolitan areas, some cities in the initial stages of relief from planned economy (e.g. Tashkent), and a very few with successful traffic management (of which the flagship example is Singapore).

2. Mobility is declining even more for public transport users. This is largely because transit routes characteristically follow the highest volume arteries, those most afflicted with congestion. Further, transit networks are usually dominantly radial, not permitting cross-town avoidance of congestion. Finally, transit users are not able to follow trip destinations that are displaced into the higher auto-accessible locations at the periphery because the transit network does not serve them. A policy emphasis on expanding the road system rather than improving transit often makes this quandary worse.

3. For the numerous individuals newly acquiring cars in the developing world, however, mobility is rising. This is simply because they are removing themselves from plight 2 above to plight 1, which is less severe.

The conflicting interest between group 3 above and the first two is, of course, one way to define the mobility problem. That is, no matter how bad congestion becomes, it is usually advantageous to use a car. It is a tragedy-of-the-commons situation.

This paper ranges among a series of topics that bear on mobility in cities of the developing economies. It is a search for elements of strategies to deal with rising motorization and falling mobility. In contrast to much of the literature, this paper focuses on personal mobility and access, rather than on their external impacts. The product will be not so much a list of recommendations as the threads of a process for thinking about this problem in the light of available evidence and candidate techniques from the developed economies.

## **2. Basic mobility issues**

The first obligation of mobility in the developing city is to enhance the unique, essential functions of the large city. They are of special importance to a country whose central concern is economic development. Bangkok includes only 10% of the population of Thailand, but accounts for 86% of the country's GNP in banking, insurance and real estate, and 74% of its GNP in manufacturing (Kasarda and Parnell, 1993). More broadly, large cities are sure to be centers of education, research, innovation of all sorts and the various aspects of globalization that are

bringing the developing countries into the world-wide production system. The decline of mobility is damaging these roles significantly. Bangkok loses 35% of its gross city product in congestion.

The basic characteristics that differentiate the developing city from those of more advanced economies in regard to transportation are

1. Rapid pace of motorization. There is a significant portion of these cities where motorization is increasing at more than 10% a year. In China vehicles are increasing at 15% a year, automobiles at 25% a year. In Korea there was an annual increase averaging 23.7% for some 7 yr following 1985. Pace of motorization is important because related systems, such as transportation facility capacity and urban structure adjustments cannot keep up, resulting in enormous congestion. How else could Bangkok be more congested on a national average of 54 vehicles per 1000 population than American cities on national average 750 vehicles per 1000.

2. Travel demand that far exceeds the supply of facilities. High levels of congestion and high latent demand for travel is the result of motorization outstripping any possible expansion of highways. This condition exists in nearly all developing countries, except for a few very wealthy ones (c.f. some of the Gulf States) and some with such low initial motorization rates that the increase has not yet caught up with capacity. In some cases the prospects for privatization are sufficiently good and right-of-way acquisition obstacles so benign that the question of “how many highways to build?” is topical (viz. Guangdong, China). But there are not many areas in this situation.

3. High share of trips by public transit. Across much of the developing world urban vehicular trips are around 75% by transit. Exceptions include China, where a significant percentage are bicycle trips. This means that making public transport work has high priority and buses swamped in auto congestion is a difficult problem, but in most settings public transport is ridden with politics and institutional problems that make it very difficult to improve.

The split of spatial domain between the motorized population and the non-motorized, transit-using population is great. In cities ranging up to 250 persons per hectare (as in China) auto ownership and use are heavily constrained. As a result decentralization with motorization is explosive. Valued urban functions in the hands of the motorizing part of the population evacuate to the suburbs, leaving the city for only low income activities. Employment, increasingly in decentralized settlements is not accessible to non-motorized, lower income workers.

Under these circumstances the viability of public transport is particularly important. But public transport in every city is dominated by buses and they, as mentioned above, are generally more susceptible to increasing congestion than cars. There are possibilities of escaping this problem by assertive management of transit rights-of-way through such means as independent lanes or signalization that favors transit vehicles. The prospects for the improvement of mobility by this means are important, but few cities have been successful because under circumstances of increasing congestion the pressure to favor general use of the streets is high – automobile owners are a powerful lobby in most of the developing world.

4. Intense desire for auto ownership and use. According to government surveys, Chinese families are likely to be prepared to spend 2 yrs' income for a car that is expected to last for 10 yrs. (Americans spend about 27 weeks' salary.) Auto shows are thronged.

5. Urban structure incompatible with motorization. Residential densities in China are as high as 200 to 250 persons per gross hectare. (The Western European city is about 50 persons/gross hectare.) Street space is around 10% of the city surface (rather than 25% in the western city). Land

use is likely to be more mixed than in the western city and the average urban trip length much shorter (The average bike trip in Shanghai is 3.5–5 kms. in a city of 20 million people.) The lack of street space and parking results in explosive decentralization of land use.

6. Stronger land use/transportation relationship. Changes in the road system, such as through the construction of a new urban highway, has much more impact on urban development in a developing city simply because there are fewer high speed roads. The new one therefore provides more comparatively attractive access than in the developed city, where peripheral access is high in every direction. Also, more rapid urban growth (likely to be in the range of 5% per year) produces more rapid change in urban structure.

Further, in some parts of the developing world where motorization is rapid, governments have considerable influence, current or potential, to guide land use into mobility-friendly forms. This is partly because local government, as in China and Korea, is less divided within metropolitan areas. Unified metropolitan administration is important because small sub-metropolitan jurisdictions seldom take great interest in access.

7. Greater differences in vehicle performance. The wide variety of vehicle types on the streets presents difficult problems of efficiency and safety. Many cities have passenger vehicles ranging from human traction to high-speed sports cars, and every scale of freight vehicle. According to Darbera and Nicot, 1984 there are 16 modes of public transport on the streets of the cities of India. In China, while it is surely essential to assure the survival of adequate ways for bicycles, it is unquestionably inefficient for the street lanes to be divided into motor and non-motor lanes, especially because of difficulties of movements at intersections. All this does not deny the benefits of specialized vehicles for different roles, but it makes traffic management much more difficult than in developed economies.

8. Inadequate street and highway maintenance. Highways and arterials are often built by national agencies and maintained by local governments. No funding provisions are made for the maintenance, however, and the local government often has scarcely enough revenue to collect the trash. As a result, transport ways are often in very bad condition. Indeed, sometimes they are intentionally left that way because the local administration hopes the national agency will step in again when the deteriorated condition of the road is so bad that repair is in effect full reconstruction, once again recognized as a national responsibility.

9. Irregular response to impacts of new construction. In some countries new urban facilities are very difficult to build. Projects encounter strong resistance movements from impacted institutions and communities (especially in Latin America). In others, there is very little resistance (e.g. China). Air pollution is a matter of intense concern in certain cities (e.g. Bangkok) and very little in others (e.g. Cairo). There are indications that air quality is increasing as a concern in areas where it was not previously a major preoccupation. For example, at one point an issue of *India Today* (December 15, 1996) had a cover headline “Choking to Death: Polluted Cities,” and a cover story titled “Gasping for Life,” though the problem had gotten relatively little attention earlier. Though unexpected participatory politics occur everywhere, in the developing world they are especially unstable.

10. Fewer legal constraints on the use of new technologies. One of the strongest constraints on the introduction of new technologies in the West, for example, for driver advisory functions, is fear of legal suit. This concern is less problematic in most of the developing world, making innovation more feasible on this account.

11. Weak driver discipline in many countries. While driver discipline is equally strong or stronger in many East Asian countries than in the West, it is certainly weaker in most of the developing world. This is a problem for the implementation of many forms of traffic management. For example, transit-only lanes have been attempted in several cities where it was found that drivers would simply not respect them. But cities are learning. Bogota recently enacted counterflow lanes without barriers, resulting in generally satisfactory improvement.

12. Very limited agreement on planning approaches. Whereas the Western countries have cadres of engineers and planners with reasonably consistent perspectives on dealing with urban transportation problems (however much they may disagree on the details), the developing countries characteristically do not. They tend to borrow method and professional perspective from elsewhere and to have professional communities that are at crossroads of ideas, without stable commitments. This results in turbulence in the course of transportation problem solving, stalemates when trying to marshal strength to a particular solution and rapid change of strategies over time that keeps any strategy from having sound effect. This is a serious problem in transportation because there are so many alternative views. It presents an important need for professional education and leadership as a foundation for meaningful problem solving.

13. Capital is scarce and operating subsidies difficult to sustain. Cointreau-Levine points out that solid waste management consumes 20–50% of local expenditures in megacities (Cointreau-Levine, 1994). Some of those cities are virtually unsewered (e.g. Bangkok, Riyadh), and most of them have severe deficits of sewerage. These are circumstances that leave high net expenditures for urban transport in discouraging prospect.

14. Local transportation development is more centralized in the hands of a few elite players. This is because governments are more centralized in general, because much of the expenditure is central funds, and because high profile ideological differences among competing political parties may make organized community participation less viable.

### **3. Congestion and motorization in the developing world**

There are no satisfying widely used measures that document the decline of mobility and serve to project it. To even casual observation, however, it is clear that congestion is increasing in most major cities. In the cities of China, India and Indonesia, rush hour speeds got slower through the 1980s, reaching speeds of less than 10 km an hour in major cities of those countries. In central Bangkok traffic speeds declined by 2% per year in the second half of the 1980s. These figures are believable, not only through intuitive observations, but because it is an expected consequence of rapid motorization.

There have been few useful citywide analyses of congestion anywhere. It is worth mentioning the work of the Texas Transportation Institute. They have developed a Roadway Congestion Index in which the independent variables are freeway vehicle-kilometers travelled/freeway lane-kilometers and arterial kilometers travelled/arterial-kilometers. This index has increased for cities across the US by roughly 20% during the period 1982–1991 (with a good deal of variation among cities.) TTI also estimated that during 1984–1991, for 50 large US cities total daily vehicle hours of

delay increased by 21%. For a number of individual US cities it increased 30–50%. (Schrank et al., 1994 p. 31). (Note this is not per vehicle. It includes increases in number of vehicles and vehicle miles travelled.) These levels of increase under the circumstances of modest increase in motorization and urban population growth in US cities suggest the future consequences in the developing world because of much larger increases in both, and in many cases already more congested roads.

A somewhat similar measure has been attempted for the developing world for the UN Population Fund by the Institut d'Etudis Metropolitans de Barcelona (UNPF, 1988), but the effort is still in a primitive stage. There is no historical sequence of estimates and the survey appears to have included all roads (in part because freeways and arterials are hard to isolate in many developing cities). The measure uses vehicle registrations rather than vehicle kilometers travelled. Unsurprisingly, the ratio of vehicles per kilometer of road is much higher for the developed cities, even though congestion is worse in the developing cities. This tends to confirm the facts that (1) congestion is a condition localized to main ways that cannot be usefully averaged over a whole network and (2) that the developing, pre-motorized city has problems of adaptation to motor vehicles that are highly local in urbanized areas. We need further data to accumulate for developing cities (Table 1).

Perhaps the most telling data on mobility problems in the developing city is in journey-to-work travel times. It has been observed that travel times are remarkably similar from city to city. This was noted by Zahavi in the 1970s and recently concluded by Kenworthy et al., 1997a from survey data. On a world wide basis (excluding developing countries) the figure is roughly 30 min for a wide variety of different cities. In the developing world, on the other hand, in a set of data provided by UN Habitat there are several cities with average journeys to work (one way) around an hour for 1990. Those cities include Lilongwe (Malawi), Antananarivo (Madagascar), New Delhi, Harare, Quito, and Kingston in a list of 36. The top average work trip times were Rio de Janeiro at 107 min and Bogota at 90 min. Most megacities are for some reason missing from this list, but the cities with problematic commutes in general are not the larger ones included. If we isolated special suburban populations with long trip times it is probable that the set would include numerous fast-growing mid-sized cities. For example, commuting trips of 2 h occur from the suburbs of Kuala Lumpur – a metropolitan area of only 2 million (author's recent experience). Perhaps this is an indication that problems of urban mobility are not generic, but rather are special problems subject to correction.

#### **4. Paths of motorization**

Growth in the number of motor vehicles is at the base of mobility, on the one hand as an indication of increased motor mobility of the population and on the other as a force toward increased congestion. Although its significance to each is difficult to resolve, it is the best recorded variable. The work toward understanding future trends in motorization has been surprisingly limited, but there have been some recent interesting proposals.

One reason this analysis is of great interest is because it works toward understanding at what point rampant increase in motorization will approach saturation under given economic and regulatory conditions. This is an important question.

Table 1  
Population, income, and journey to work, travel time, selected cities, 1990

Country	City	Metropol'n population	Cars per 1000 pop. (country)	Metro. fam. income US\$ (1990)	Journey to work-(min. average)
Tanzania	Dal es Salaam	1 556 290	1.9	763	50
Malawi	Lilongwe	378 867	2.0	692	60
Bangladesh	Dhaka	5 225 000	0.4	1 352	45
Madagascar	Antananarivo	852 500	4.1	747	60
Nigeria	Ibadan	5 668 978	3.8	1 331	26
India	New Delhi	8 427 083	3.4	1 084	59
Kenya	Nairobi	1 413 300	5.5	1 500	24
China	Beijing	6 984 000	1.1	1 079	25
Pakistan	Karachi	8 160 000	6.4	1 622	NA
Ghana	Accra	1 387 873	5.5	1 241	35
Indonesia	Jakarta	8 222,515	7.2	1 975	40
Egypt	Cairo	6 068 695	19.8	1 345	40
Zimbabwe	Harare	1 474 500	30.2	2 538	56
Senegal	Dakar	1 630 000	8.6	2 714	35
Philippines	Manila	7 928 867	7.4	3 058	30
Cote d'Ivoire	Abidjan	1 934 398	12.9	3 418	38
Morocco	Rabat	1 050 700	26.7	4 158	25
Ecuador	Quito	5 345 900	15.4	2 843	56
Jordan	Amman	1 300 000	50.5	4 511	30
Colombia	Bogota	4 907 600	35.9	3 252	90
Thailand	Bangkok	6 019 055	21.4	4 132	91
Tunisia	Tunis	1 631 000	25.5	3 327	37
Jamaica	Kingston	587 798	28.3	3 696	60
Turkey	Istanbul	7 309 190	28.1	3 576	40
Poland	Warsaw	1 655 700	137.8	2 265	45
Chile	Santiago	4 767 638	53.9	3 433	51
Algeria	Algiers	1 826 617	29.0	7 335	30
Malaysia	Kuala Lumpur	1 232 900	103.3	6 539	34
Mexico	Monterrey	2 532 349	80.0	4 810	25
South Africa	Johannesburg	8 740 700	102.0	9 201	59
Venezuela	Caracas	3 775 897	80.2	5 123	39
Brazil	Rio de Janeiro	6 009 397	70.5	5 204	107
Hungary	Budapest	2 016 774	184.3	5 173	34
Czechoslovakia	Bratislava	441 000	207.0	3 677	40
South Korea	Seoul	10 618 500	32.1	19 400	37
Greece	Athena	3 075 000	172.9	14 229	40
Israel	Tel Aviv	1 318 000	174.5	16 680	32
Spain	Madrid	4 845 851	307.9	23 118	33
Singapore	Singapore	2 690 100	95.5	12 860	30
Hong Kong	Hong Kong	5 800 600	37.0	15 077	45
U.K.	London	6 760 000	363.5	18 764	30
Australia	Melbourne	3 035 758	435.6	26 080	25
Netherlands	Amsterdam	695 221	366.6	14 494	18
Austria	Vienna	1 503 194	387.9	22 537	25
France	Paris	10 650 600	417.3	32 319	40
Canada	Toronto	3 838 744	475.9	44 702	26

Table 1 (continued)

Country	City	Metropol'n population	Cars per 1000 pop. (country)	Metro. fam. income US\$ (1990)	Journey to work-(min. average)
USA	Washington, DC	3 923 574	574.3	49 667	29
Germany	Munich	1 277 576	485.3	35 764	25
Norway	Oslo	462 000	380.0	34 375	20
Sweden	Stockholm	647 314	420.7	41 000	33

Source: United Nations Habitat, New York, 1993.

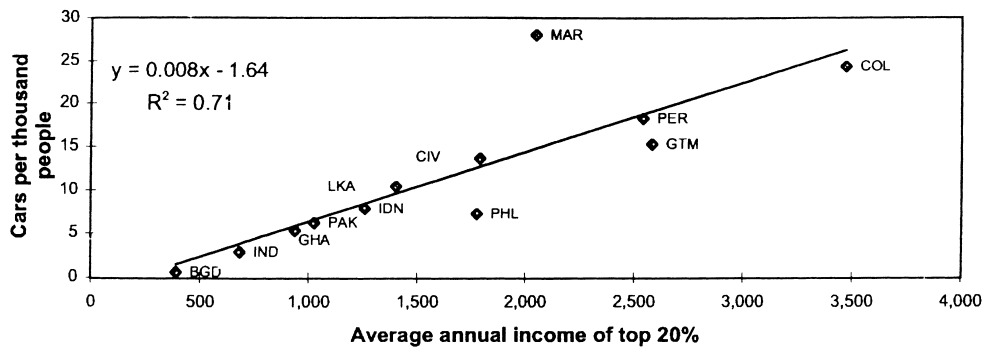


Fig. 1. Average annual income of top 20% of population vs. motorization (low income countries).

We have found that cars per 1000 population correlates very well with the annual income of the top 20% of population of the low income developing countries.<sup>1</sup> (See Fig. 1) Cars per 1000 also correlates well with percentage of the population in urban areas. To some extent, of course, percentage urban is a surrogate for income, since the vast majority of people in developing countries with incomes over the threshold of auto ownership live in cities (Gakenheimer and Steffes, 1995a) (see Fig. 2).

Other economic indicators perform very poorly in explaining patterns of motorization. We tried private consumption, industrial production (as a percent of GDP), openness of the economy (value of foreign trade/GDP), net current transfers (highlighting remittances from citizens overseas) and percentage of population in the labor force. None of these produced results of interest.

Several analyses have examined the income elasticities of motor vehicle ownership (based on GDP per capita), all yielding elasticities higher than one but with considerable variation (Stares and Zhi, 1996 p. 47). Most recently Kain and Liu found an elasticity of 1.44 for all motor vehicles and 1.58 for passenger cars, using a 52 country sample. Interpretation presents problems when considering that the part of the populations in the developing countries with incomes over the car-owning threshold is a very small part of the total, and their income growth probably does not vary with the average, particularly in transitional economies. One might expect better relationship with

<sup>1</sup> The low income developing countries are: Bangladesh, India, Pakistan, Ghana, Sri Lanka, Indonesia, Philippines, Ivory Coast, Guatemala, Morocco, Peru, and Colombia. (The lower middle income developing countries are Jamaica, Poland, Costa Rica, and Botswana. Upper middle are Malaysia, Venezuela and Brazil).



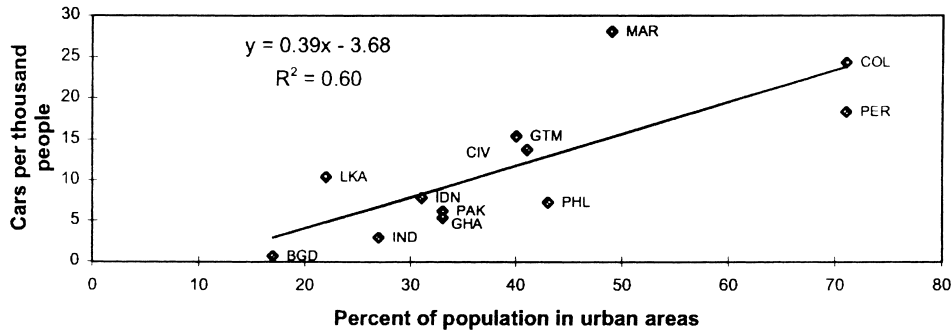


Fig. 2. Percent of population in urban areas vs. motorization (low income countries).

commercial vehicles, but their elasticity for commercial vehicles in the Kain and Liu study was only 1.15. At least, however, we can conclude that the elasticity is positive.

During the last 35 yrs most analysts have assumed that the variation conformed to a sigmoidal (logistic, “S” shaped) curve. This was established by J.C. Tanner in the early 60s (Tanner, 1962) and further developed in a number of papers, especially from the United Kingdom. The sigmoidal curve was originally introduced for biological, and epidemiological phenomena. It later became used for analysis of the diffusion of technological innovation. It is an intuitively satisfying curve for a process that begins slowly, matures into break-neck growth and must slow down at some point because of saturation. It has obvious special limitations, however, when applied to the developing countries where incomes are rising (or falling) and where motorization is far from reaching general saturation. In most of the developing world the decline toward the top of the “S” is not visible.

Some papers using the sigmoidal curve have interpreted the phenomenon as similar to technological innovation, where the process is one of increasing familiarity with the motor vehicle and adjustment of preferences to act on acquiring it (Jansson, 1989) Some have noted the need to shift the saturation rate upward repeatedly over time (Korver, 1993). Button et al., 1993 have proposed the use of a time variable to account for change in the relation between motorization and income. This may suggest the influence of increasing perception of a universal motorized life style, increasing market penetration of the industry, or similar effect. Mogridge, (1989 p. 55) points out that “automobile ownership and new car registrations show one of the largest year-to-year fluctuations of any economic variable.”

We may conclude that the sigmoidal curve surely has some interpretation that illuminates motorization, but that it does not usefully project any slow-down phase of motorization in most of the developing countries.

An entirely new interpretation has been introduced by Debu Talukdar, 1997. He hypothesizes the relevance of the Kuznets curve. Originally introduced by economist Simon Kuznets to examine the relationship between economic development and income inequality, it has been used more recently to model the long term relationship between economic development and the environment. It projects relationships in an inverse “U” form that rises, peaks and then falls. In the case of environment it suggests rising damage from development, followed by investor, citizen and policy reactions that reduce such impacts as development continues. Its relation to motorization might

suggest a rise in motor vehicles followed by a per capita (not necessarily absolute) decrease based on response to congestion, loss of novelty, and adjustments of public policy.

Talukdar presents this curve as a quadratic equation and tests it against the sigmoidal curve and the log-linear form, using a sample of 49 countries with substantial historical depth, and including 29 developing countries. He finds that the Kuznets curve provides a better statistical description of the long term relationship between economic development and per capita motorization than either of the other two.

His research was recently completed as a thesis at MIT. His data set indicates a peak in car ownership at the level of around \$21 000 annual income. This does not mean that the developing countries need reach that level before experiencing some attenuation of motorization but it does suggest that significant decline of auto ownership growth in the developing world is in the distant future.

Another perspective on the future of motorized travel is offered by Andreas Schafer, 1997. There has been a belief sustained by evidence over the last 35 yr, initially by J.C. Tanner and later Yakov Zahavi, that personal travel occupies a constant budget of cost and time on average. The cost amounts to some 10% of personal consumption expenditure. The time in travel is somewhat more than one hour per day. This means that as incomes rise and time availability remains constant, people will spend more on travel per unit time (presumably using faster modes). Schafer reasons that at very high incomes people will proportionally reduce street travel (though not necessarily motorization) in favor of faster modes.

Accordingly, modal adjustments may be in store. In 1990 about 50% of global travel (in passenger kilometers) was by car, 30% by bus, 10% by rail and 10% by air. (Almost 80% of global bus traffic occurred in the developing world.) Schafer estimates by the year 2020 a rise in air traffic at about double the 1990 figure, to 20%, and a consequent only gradual decrease in the share of bus and car traffic. Auto traffic is projected at 43–53% percent of total passenger travel. Putting this into the perspective of an expected increase in total travel by a factor of three, this means that auto travel will grow by a factor of 2.5–3 while high-speed travel increases by a factor of 6. Based on expected kilometrage per automobile, this anticipates more than doubling the size of the automobile fleet by 2020, but the faster modes will increase more rapidly.

This perspective is another way of conceptualizing the constraints on auto mobility in the future. It does not isolate the situation of the developing world, but it infers that the balance in growth of motorization will increasingly be in the developing world. It does not suggest limits to growth.

In summary, the projection of motorization with reference to the developing world is a very difficult task at which the work has offered certain interesting insights but is a long way from confident estimates for the future at the level of 20 yrs and beyond. It has attempted to cope in various ways with the perception that such rapid increase has eventually to attenuate in some form, but it has presented as yet no persuasive view of altering trends.

## **5. Sparks of mobility leadership from the developing countries**

Even though there is much less research and development on mobility and planning technique in the developing countries and public budgets are limited, they have certain important advan-

tages in mobility innovation relative to developed economies. These include some cases in which there is

1. Stronger authority to increase mobility. There are countries in which urban governments have much more authority than in the developed world (often because they are single metropolitan governments rather than balkanized into a number of local administrative units, and sometimes on account of vested authority). Many of the countries have more power in central government guidance of local action. In some cases there are remarkable levels of charismatic leadership, such as former Mayors Jaime Lerner of Curitiba, Jamil Mahuad of Quito and Ronald McLean Albaroa of La Paz.

2. Lower personnel cost relative to capital costs. This simply results in different choices of actions, sometimes with consequences worth the attention of wealthier countries.

3. Fewer regulatory and legal barriers. These permit the introduction of guidance that would be halted in the developed world by fear of law suits in the case of malfunction.

4. Less convention in problem solving. In countries where transportation planning is a professional tradition, thinking is more conventional and there may be less scope for innovation. Innovation is sometimes easier in a less structured professional environments like those of the developing world.

5. A larger stake in solving mobility problems that better supports public action. This is because the problems are worse. The cities of the developing world have motorized faster, leaving urban structure further out of adjustment than in developed world cities.

6. Perceptibly growing problems. In many developing cities congestion is growing at a rate easily perceived year to year by even a casual observer. Any observer over 40 yrs of age remembers when central Miraflores outside of Lima, or Providencia outside of Santiago were quiet semi-commercialized areas with stores in former houses. Now they are occupied by 20 story buildings surrounded by massive congestion. This public awareness is leverage toward action in some cities.

With the help of the factors mentioned above to stimulate action, these innovations, existing or incipient, are from the developing world.

1. *High yield vehicle use restrictions.* Responsive to the severity of the problems, cities of the developing world often reach for higher achievement actions than developed cities. It is not unusual to have serious discussion or even attempts at implementation of actions that are almost patently impractical. For example, Bangkok made a recent serious effort to restrict all newly registered cars to use exclusively in non-rush hours.

Perhaps the most stringent restrictions have been imposed in China by municipalities concerned with mounting congestion. Some of them have limited the number of new motorcycle registrations each year. In Guangzhou it is not lawful to enter the city on a motorcycle registered anywhere but in Guangzhou. Many of them have limited the operation of commercial vehicles in unprecedentedly detailed ways (in terms of days, hours and localities). At last notice these restrictions had not been applied to private cars.

Some high yield restrictions have been associated with very high pollution levels. Restrictions in Santiago and Mexico City to limited days a week and limited parts of the city have emerged from this problem.

2. *New technologies.* Cities of the developed world have experimented with untried technologies. Brazil has been the first to build a substantial number of transitways. They have also been built in Istanbul, Ankara and Abidjan. The air propelled aeromovel has been introduced only in the

developing world (Sao Paulo, Porto Alegre and Jakarta). Whether successful or not, it is an example of adventuresome public innovation. In La Paz, Mayor McLean Albaroa advocated suspended cable car for new hilly transit routes. It may soon be implemented. Altogether, however, given current opportunities for private participation there is rather less innovation in developing cities than one might expect.

3. *Privatization of existing highways.* Certain countries have taken special initiative in the privatization of maintenance and extension of highways. It has been found a difficult job and there have been costly errors. These have included preparations that attracted insufficient bidders and excessively rapid pay-back schedules that produced very high tolls. But the efforts have generated valuable experience and may lead the way toward more general practice. Mexico, Argentina and Colombia have been particularly active in this matter. Other Latin American countries such as Chile, are following suit, in that case with the division of the Pan American Highway into several lengths for individual privatization. The Chilean government is adding the innovative dimension of contracting economic development services at the same time to convert the highway into a more significant development generator, at the same time, of course, creating market for travel on the highway.

In the construction of new highways there has been much activity engaging the private sector in the developing world for private toll facilities, build-operate-and-transfer (BOT) and other arrangements. While not originated in the developing world, the level of commitment to this form of new highway development may well exceed kilometrage in the developed world. Significant activity is taking place in India, Philippines, Indonesia, China (in Guangdong), Thailand, and elsewhere.

4. *Private non-unitary transit management.* The vast majority of public transport systems in the developing world are private and always have been. Most of them are made up of relatively small scale concessionaires each serving a limited number of routes and in some competition with one another. There is often a separate public transit authority serving a small portion of the demand. The management of transit is often a lively debate with cases of publicization of private systems as well as the privatization of public ones.

As a result, while not innovative, the competitive environment of privatized transit in much of the developing world provides a laboratory of experience in the management of concessions and other contractual arrangements for private service to the public under circumstances of competition among servers. Several cities have tried a number of alternatives, dramatically represented by the deregulation and reregulation of public transport in Santiago.

5. *Transit innovation.* There have been innovative ideas such as several from Curitiba: the platoon system of grouping buses, the boarding station enabling prepayment of the fare, and the practice of providing transit tokens for turning in a bag full of street trash. Brazil offers the experience of employer-provided transit passes for low income workers.

Perhaps the most useful experiences in this category have been those of flexible transit use under circumstances of permissive or sometimes unenforceable transit regulation. Routed vans and cars often switch to the role of taxis when business is slack and opportunity occurs. There is a variety of experiences with informally revised (i.e. unauthorized) transit routings, for example, that escape unprofitable congested streets at the city center through route terminations at the periphery of business districts. There have been informal resolutions of low volume service needs at urban peripheries and after hours requirements.

6. *Assertive Congestion Pricing and Other Ownership/Use Charges.* As means of controlling mounting congestion, high user charges are recurrently considered in many countries of the developing world. The examples of Hong Kong and of Singapore (where purchase taxes amount to some 300% of the price of the vehicle) are present examples. There have been temporary cases of high user charges in various countries, for example in Chile during the regime of the Unidad Popular in the early 1970s, when automotive imports were very heavily taxed, and in Korea during its period of rapid industrialization. Area licensing schemes resembling Singapore's have been repeatedly proposed, for example in Bangkok and in Kuala Lumpur. (Maybe replacing them eventually with broader congestion pricing, as in Singapore, will become a trend.) So far, no very assertive policy of pricing has appeared on a long-term basis in the lower income countries, but it remains a possibility as concerns rise and the dialogue continues.

7. *Rapid Transit Innovation.* There is incipient possibility of changing views on rapid transit in the developing world, especially suggested by recent discussions that now include its systems effects and other positive externalities. Up to now the position of the international lending institutions has been reluctant, or outrightly opposed, to nearly any investment in rail rapid transit on the grounds of its high capital cost and need for high operating subsidies. This is understandable since the only metros that currently recover their operating costs outside of Japan are Seoul, Santiago, and Hong Kong. Only Hong Kong covers full costs and is a very special case in various respects (e.g. 50 000 people live within 10 min of each stop, and a fare of over US\$1 is feasible). Even the widely touted high volume of use of the Mexico City subway yields only 40% of operating costs from the fare box. In many cases metros cannot be self-financing because cities cannot charge high enough fares. Very few of the world's metros could be financed, even for the cost of operations, only by their users.

However, now that there are over 14 rail transit facilities in the developing world with some twenty years of record, it has become evident that cities with metros have better preserved downtowns than others. Further, it appears that a capacity up to some 70 000 passengers/direction/hour in critical corridors has improved urban transportation systems in terms of overall system performance. These benefits are impossible to evaluate with any satisfying precision, but the visible evidence is persuasive.

This has led the World Bank to issue a surprising discussion paper, "Approaching Metros as Potential Development Projects" by Slobodan Mitric, 1997. Whereas World Bank transport policy up to now has been that metros are reasonable only in very exceptional cases when they are "likely to produce high rates of return," taken to mean very seldom, this new paper sustains the position that

"...neither the state of the art of economic evaluation of metro projects nor its quality as practiced by consultants working in the developing countries are strong enough to justify treating the assessed economic rate of return as both a necessary and sufficient condition for project acceptance. It is simply too narrow, doing injustice to the complexity of the subject of cities in developing countries and their strategic decisions in the transport dimension."

The final section of the discussion paper reads like a design manual. It is difficult to say what impact this may have on the substantial number of cities in the developing world that recurrently debate the possibility of rail rapid transit, but it appears that encouragement might conceivably be in store. Successful management awaits resolution of the need to accommodate the contrasting concerns of public and private partners.

8. *Auto Cooperative Possibilities.* The movement toward car sharing (ubiquitous small scale rental locations) so far shows little evidence in the developing world, but there are grounds for regarding it as a hopeful possibility. Here are some reasons:

(a) In many of the more advanced developing countries there are significant populations with substantial incomes just under the threshold of auto ownership, with reasonable credit records and who share the world view that includes the personal need for auto mobility.

(b) The practice of sharing assets in general is a growing practice universally, and the developing countries are part of the trend. The trend may well be based, more than anything else, on institutional and advanced electronic developments. That is, it is now possible to negotiate and enforce more complex contractual agreements than formerly. Some countries are improving systems of these kinds. Further, in the developing countries' typically higher density cities there is considerable sharing of common building spaces and utilities connections. There is also sharing of vacation houses and work equipment (especially in fishing and agriculture). In some cases higher risks of breakdown and service interruptions have encouraged sharing agreements for back-up services (such as electric power generators).

(c) The issues of maintenance are surely a concern in auto cooperatives. This is a situation in which the relatively lower costs of labor in the developing world are significant. In many countries it would be practical to have a chauffeur capable of minor repairs permanently assigned to a particular car who would work in turn for its various users.

The actual existence of a market niche remains to be seen, but there are surely mobility behaviors that car share would fit in the developing world.

At the same time the environmental consequences should be considered. While car sharing among developed country car-owning environments normally reduces miles travelled (because people give up ownership and share), among developing country non-car-owning groups it would no doubt increase miles travelled with consequences in environmental and congestion impacts.

9. *Institutions for Credit Purchases.* The lack of credit to purchase vehicles has been a limitation throughout the developing world. There are, however, special institutions that have been used to overcome this problem. In the special case of vehicles in public transit, taxi and cargo service, there are several countries with special national funding for the replacement of vehicles in the public service. In Venezuela there has been a public *Corporacion Financiera de Transportes* making low interest loans for the replacement of buses, taxis and other vehicles that serve the public. A similar one has existed in Venezuela.

10. *Land Use Planning as a Mobility Tool.* Transportation and land use planning has a checkered history with limited achievement in the high income countries. This has been a consequence of limited metropolitan public powers, the need to accommodate varieties of stakeholders, and a limited need for such action in the eyes of responsible officials. There are indications of greater possibilities, however, in parts of the developing world. There are indications of this effect in the success of Korea in imposing development restrictions that have clustered demand around Seoul, special land assembly in Shanghai and Bombay, new cluster development in Bangkok, and other cases.

Reasons for the promise of transportation-friendly public action in land development include:

(a) High levels of public authority in the metropolitan areas of certain countries. In China the government owns the land, leasing it to private or public users through municipal district action. In Singapore government owns a large proportion of urban land (in fee simple). In Seoul, a mayor

of the city reportedly created a scandal ultimately terminating him in office when he attempted simply to extend a dwelling he owned in a green belt. In Bangkok the governor was able to focus his authority on sites where transformation was desired to create a submetropolitan center for future development. This does not ignore, of course, that land development control in most developing countries is very weak.

(b) The speed of urban development promises significant effects in limited time. At typical rates of 5% per year, new urbanization that doubles the population of the existing city is created in only 14 yrs. Since much of this new population is at decentralized locations on new terrain, it is an opportunity for urban development planning.

All these items represent possibilities for coping with rapid motorization on the part of the developing world by means that are not directly borrowed from the developed countries. They may also be approaches that bear watching from the vantage of the high income countries. Probably the most promising initiatives are congestion pricing, other traffic management techniques and land development planning.

## **6. Borrowing from the developed countries**

There is a pervasive belief in the developed world that it has much to teach the developing world about mobility and motorization. Holders of the this belief include people with contradictory different opinions. There can be little doubt that this assertion is certainly true in some sense, but its interpretation is bound to be controversial.

Let us divide lessons to be learned from the developed countries into three parts:

1. Lessons of technology. It is simply a fact that the vast majority of research and development funds are spent in the developed world (and for it). The developing countries are mostly borrowers of technology and some guidance would be in order.
2. Lessons of institutional management. The public and private sectors in the developed world have tried a number of things that don't work in administering public transport, managing vehicle use and so forth. This experience may be sufficiently basic that it could enable new managements to save costs and trouble. There have been success cases too.
3. Lessons of general experience. The urge to convey wisdom from past experience sometimes emerges from a belief that the developed countries have been along a path of mobility evolution on which the developing countries are coming along behind. Accordingly they should learn from the errors of the developed world, and its lost opportunities. This is the most complicated element of lessons to be learned. For one thing, it is not clear that the path is the same one. For example it was one thing to accompany the invention and industrial development of the automobile, and another to adopt it in later stages. Further, since these problems are often the by-product of a much-sought life style, recommendations sometimes bear the image of paternalism or even hypocrisy.

Let's look at some of these possibilities more closely. First, lessons of technology and technological loan possibilities. They include devices to reduce engine local pollutants, and global warming emissions. They include new low cost vehicle technologies, ITS equipment, and transport infrastructure designs such as transitways. The lessons and lending issues are straightforward in this category at the level of immediate workability. But there are questions to ask about the

alternatives and the subsequent consequences. Some technologies would reduce congestion and pollution. Others would increase them.

The lessons of institutional management are also very good possibilities to facilitate mobility in the developing world. These are topics on which the developed countries have demonstrated capability, often learned through decades of trial and error. Items in this list are also restricted to those that are relatively non-controversial. Among the possibilities:

(a) Control of expenditures in the light of probable revenues and available budget. Transportation projects all over the world classically underestimate costs and overestimate receipts, resulting in serious financial problems. (This is particularly problematic in the liberalizing planned economies, where systematic concern for budgeting is not a strong part of their project administration background.) Learning on this problem is better characterized as a world-wide comparative experience, rather than a developed/developing country exchange. It is the case, however, that the problem is better documented in the developed world and refined techniques for cost and revenue estimation are more available from the developed world. This point is one way of introducing the whole subject of transportation systems planning technique, generally a useful contribution uncomplicated by controversy, and learnable as a set of skills. (Note that for the moment we ignore the *process* of transportation planning, which is in a different category.)

(b) Better privatization is a topic closely related to the last one. It is a second case of worldwide learning (with many of the important lessons coming from developing country experiences). It is nonetheless constructive for the developed community to convene the effort, bringing into play the considerable research that has been done on the subject.

(c) Traffic management techniques, including the institutionally complex issues of implementing ITS, is another potentially important contribution. Part of the challenge on this matter is assuring that the techniques installed respond to the serious needs of the developing world for high yield actions.

(d) Transit administration is an important possibility. While the developing countries have more public transport, their public management systems for transit are often poorly functioning concessionary systems that remain from the sector's early times and are not adaptive to contemporary scales of big city needs.

(e) Beyond this are numerous administrative practices ranging from vehicle registration systems to enforcement and educational needs in which the transfer or adaptation of management schemes would be very beneficial.

Lessons of general experience are the most complicated group, learning from the problems that have resulted from the whole overall prevalence of motor vehicles in the developed world. At one level we can pessimistically suggest that if the developed countries did not learn sufficiently to solve their problem while it was being created in their own environment, how can we expect a response from citizens of a country that has not experienced the problem yet? Further, in many cases the balance of advantages and disadvantages is such that final judgments about painful restraint behaviors during rapid motorization is subject to varying citizen values.

The emphasis here should be on descriptive analyzes of experience that are as value neutral as possible and which encourage independent decision on the part of developing country governments and private participants. They need to illustrate both the advantages and disadvantages. Such demonstrations have to relate to the experience of the listener. For example, it is



one thing to study problems in cities where the impacts of rapid motorization are already taking place (Bangkok, Cairo...), and another to discuss them where such changes are only incipient (Colombo, Tashkent...).

## 7. Conclusions

As stated at the outset, the intent of this paper has been more to stimulate a conscious approach to the complexity of the problem than to produce a prescription.

A few things are certain. Though we don't know where the growth of motorization in developing countries will attenuate, it will surely continue to be rapid, outdistancing any efforts to accommodate it or adjust to it during the next number of years. Accordingly, actions to confront it must be high yield actions to avoid high economic and social impacts costs.

How do we choose these actions? Looking at issues in both the developing and developed economies, roughly the same suggestions arise in each with respect to the other. Urban transportation issues penetrate all aspects of urban culture and economy. In one's own culture one typically subsumes sufficient understanding of these connections to be able to act intuitively. (The adequacy of that assumption can be examined elsewhere.) At least with respect to a foreign culture (whether borrowing or lending techniques) it is necessary to be conscious about these connections.

One has to know more about details of the microeconomy. There are different traditions of exercising authority, different styles of public administration and of private management. What are the reputations of different kinds of public imposition on private prerogative? To whom is the individual morally responsible—family, society, an institution? What are the relations among social strata and the status of efforts to realign them? What are the definitions and expectations of social opportunity? What are the sensitivities to noise, light and air quality? What is the working definition of “democracy”—decisions that are best for the most people or a negotiation that begins with the assumptions that the vested interest of each stakeholder is as legitimate as each of the other's? All this conditions what works.

At the same time there is an empirical definition of what works. After all, there is a substantial resemblance among solutions in place around the world. Discovery and fashion in transportation solutions have world wide span—the land use/transportation movement, the traffic management movement, privatization, ITS, and so forth. They are all present across the world. Within each there are elemental discoveries—features that improve management of privatization that are being assembled from experience. The subtle evolution from road pricing to congestion pricing to value pricing makes multiple appearances world wide. The field is rich with invention that needs careful dialogue to evaluate for each case. The structure of change seems to be characterized more by solutions looking for application than by problems seeking new solutions.

The outcome will be different for each venue. Perhaps a pattern will emerge, especially in the middle to upper-income part of the developing world, where the variety of solutions in play is the greatest. Though detailed selections of technique and implementation style must be gauged to each application, the basic menu is:

1. *Highways*. The sure thing is that more highways will be built. There should be careful attention to maximizing their network effects and creating positive land use relationships.

Rationalizing land use patterns to go with them is an obvious very valuable step where possible. Certain venues are capable of this.

2. *Public transport management improvements.* These must, and will, be laboriously accomplished in spite of the inertia of existing institutions. Whether privatizing or publicizing, the important thing is to shake off the accumulation of inefficient practice through institutional change.

3. *Pricing to pay for infrastructure and rationalize the use of its capacity.* There are many ways to do this and some venues will do much more of a job of it than others.

4. *Traffic management to rationalize the use of infrastructure.* Again, there are dozens of options to choose from, and some cities can go much further than others.

5. *High capacity public transport.* Current trends across the world already suggest substantial increase in high volume modes. Advancing forms of contracting and financing to expand the set of beneficiaries to be called upon to support new systems will help.

As a background for advice it is useful to tease apart the alternative actions under these headings and the multiple forms of detailed application possible for each action.

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