

Nonmotorized Vehicles in Asian Cities: Issues and Policies

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Although the numbers of automobiles and motorcycles are increasing in Asian cities, nonmotorized vehicles (NMVs) such as bicycles and cycle-rickshaws still play a significant role. Some cities have experienced substantial growth of NMVs over the past several decades as a result of pervasive rural poverty and subsequent migration to urban areas. Because city buses usually provide poor services to the low-income areas in the periphery of cities and often are very crowded, and because motorcycles and private cars have been unaffordable for the majority of households, many persons still depend on NMVs. They offer low-cost personal mobility, are nonpolluting, use renewable energy, are labor intensive, and are well suited for short trips in most cities in Asia. However, NMVs operate at relatively slow speeds, are incompatible with the faster-moving flow of motorized traffic, and, compared with buses, tend to reduce road capacity in city centers and at certain intersections where they are heavily concentrated. For example, city officials in Dhaka (Bangladesh) criticize NMVs as the main cause of crime and the principal obstacle to the city's modernization; consequently, they plan a phased elimination of NMVs by continually introducing NMV-restricted streets. On the basis of a World Bank-funded inventory of NMV needs and opportunities in 10 Asian cities, major NMV issues in the categories of (a) urban transport systems issues; (b) economic, social, and environmental issues; and (c) general NMV planning and policy issues were addressed. Recommended policies are presented in response to each issue.

This paper assesses major nonmotorized vehicle (NMV) issues as distilled from a World Bank-funded study on NMVs (1) that inventoried needs and opportunities of NMVs in Asian cities. Sixteen issues have been identified, falling into three basic categories:

1. Urban transport system issues;
2. Economic, social, and environmental issues; and
3. General NMV planning and policy issues.

Table 1 gives the 16 issues, policy prescriptions at the local level, and implications for donor agencies. The discussion that follows focuses on the first two columns of Table 1: issues and policy prescriptions at the local level.

Throughout this paper local terms for NMVs are used to provide some sense of the flavor of the characteristics associated with each type of vehicle in different cities. The English term "bicycle," "cycle-rickshaw," and "cart" are used as common nouns, but local names are also used and are shown in italics. Cycle-rickshaws are, for example, referred to simply as *rickshaws* (also an English word) in Bangladesh and India, *cyclos* in Cambodia and Vietnam, *becaks* in Indonesia, *pedicabs* in the Philippines, *samlors* in Thailand, and *trishaws* in Malaysia.

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ISSUE 1: LACK OF APPROPRIATE NMV FACILITIES

Issue Statement

Facilities for NMVs are inadequate in most of the study cities. For example, in Phnom Penh, where all vehicles share the same road space, regulations require NMVs to occupy the far right-hand lane; however, without physical distinctions between lanes, many vehicles weave between and among lanes as they overtake slower-moving vehicles. Hanoi has physically separated lanes for motorized and nonmotorized traffic, with the lanes separated by a raised curb; however, the physically separated lanes are relatively ineffective because they do not provide continuous travel paths. Dhaka has NMV lanes, but only at three locations; Dhaka also has rickshaw waiting areas along certain road segments, but these facilities are not clearly marked and their capacities are insufficient to meet the demand. Surabaya offers few NMV-dedicated facilities, mainly parking facilities for bicycles at certain places, such as the city's night markets, transport terminals, and schools. Metropolitan Manila also offers few NMV facilities, except for faded yellow-striped lanes for bicycles on a small number of city streets and *pedicab* terminals designated by local governments in residential areas or along side streets. Although Chiang Mai has successfully implemented a *samlor*/bicycle lane on Nakhonping Bridge traversing the Ping River, dual-use motorcycle and bicycle lanes implemented several years ago were discontinuous, poorly maintained, and are now used mostly for parking by cars and trucks. George Town offers only a limited number of *trishaw* parking stands.

Policy: Development of Appropriate Facilities for NMVs

A few of the study cities provide examples of how adequate facilities for NMVs can be developed. Shanghai, perhaps the leading city in Asia in providing NMV facilities, had a 91-km NMV network in its urban area as of September 1992. This included NMV-exclusive links (including bridges and tunnels), NMV lanes demarcated with a physical barrier (e.g., a raised concrete median or a temporary barrier), and NMV lanes delineated by lane markings. Japanese cities are also very advanced in providing bicycle lanes, with more than 70 000 km (43,498 mi) nationwide; however, most (93.3 percent) bicycle lanes in Japan are shared bicycle/pedestrian facilities. An important feature of the Shanghai and Japanese examples is that the network provided is reasonably continuous, offering a relatively direct and convenient path between trip ends. Also worthy of note is the experience of Kanpur, where traffic authorities are experimenting with yellow lane markings on certain main streets, effectively separating fast- and slow-moving vehicles.

TABLE 1 Issues, Policies, and Implications for Donor Agencies

Issue	Recommended Policies at the Local Level	Implications for Donor Agencies
<i>Urban Transport System Issues</i>		
1. Lack of Appropriate NMV Facilities	o Develop appropriate facilities for NMVs	o Assist governments by funding adequate NMV facility improvements
2. Low Priority Accorded NMVs	o Accord appropriate priority to NMVs	o Provide governments with guidelines that accord priority to NMVs in relation to passenger and freight throughput
3. Lack of Compliance with Traffic Regulation by NMV Users	o Increase compliance with traffic regulations	o Support the efforts of local governments to increase compliance with traffic regulations by organizing seminars and training courses
4. Inappropriate Pricing/Tax Policies in the Urban Transport Sector	o Revise pricing/tax policies to reflect costs occasioned by vehicle use	o Assist governments in developing appropriate pricing/tax policies for private vehicles and assist in the provision of sustainable transport alternatives
5. NMVs and Congestion	o Improve public transport o Combat illegal bicycle parking	o Provide loans for economically justified public transport improvements o Provide guidelines for alleviating illegal bicycle parking
6. NMVs and Road Safety	o Improve traffic management and enforcement o Improve safety equipment o Establish safety education programs	o Fund programs to improve NMV safety
7. NMV Theft	o Provide secure parking for NMVs o Register NMVs to reduce theft	o Provide guidelines for promoting anti-theft programs
<i>Economic, Social, and Environmental Issues</i>		
8. Affordability of NMVs for the Poor	o Supply credit and offer targeted subsidies for the purchase of NMVs o Reduce tariffs on NMVs	o Fund programs to increase NMV ownership by the poor
9. NMVs and Economic Development	o In the short and intermediate term, promote NMV use and manufacturing o In the long term, ease the transition from NMV industries to other kinds of enterprises	o Provide framework for local governments in adopting appropriate policies to promote NMV industries in the short and intermediate term, and the conversion of NMV industries in the long term
10. NMVs and the Environment	o Implement pricing/tax policies that reflect environmental costs occasioned by vehicle use	o Fund research on the economic impact of NMVs and MVs on the environment
11. NMVs and Energy	o Consider the relative energy impact of MVs and NMVs	o Fund small-scale research on the energy impacts of NMVs
12. NMVs and Land Use	o Adopt land use policies that reduce commuting distance o If land use planning policies are ineffective, promote intermodal integration between NMVs and public transport	o Provide guidelines for planned urban development and the use of NMVs as a feeder mode for public transport

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Such low-cost solutions may be particularly appropriate for cities with limited financial resources. Lane markings, however, may not work without disciplined traffic or strict enforcement, or both. In Lima (Peru) lane markings turned out to be a complete failure; the bicycle lanes were used as parking spaces by motor vehicles (MVs).

ISSUE 2: LOW PRIORITY ACCORDED NMVs

Issue Statement

A case can be made for giving priority to the movement of persons and goods rather than to vehicles (2). Preliminary studies suggest that the least efficient modes in terms of capacities measured by person-throughput are low-occupancy automobiles, whereas the most efficient modes are rail and bus. Bicycles tend to fall in the middle of the range, whereas cycle-rickshaws are relatively less efficient (3). Moreover, for short trips, NMVs are particularly efficient; in large, low-income cities NMVs are arguably the most efficient modes for trips of up to 10 km (4). Nevertheless, in most Asian cities a disproportionately high allocation of street space has been accorded to relatively inefficient low-occupancy automobiles compared with that allocated to NMVs.

Policy: According Appropriate Priority to NMVs

It is recommended that NMV priority schemes be considered in NMV-dependent cities where MVs are accorded greater priority than NMVs. The provision of NMV lanes and paths, as discussed

earlier, is one kind of solution. Other NMV priority schemes are possible. Beijing, for example, has implemented bicycle priority traffic signals, which include bicycle detection loops. Preliminary findings indicate that a 15 percent reduction in delays for bicycles (and a 24 percent reduction in delays for car traffic) can be achieved with this system (5). Netherlands Railways gives higher priority at station entrances to bicycle users than to bus riders, taxi passengers, and private cars (6).

ISSUE 3: LACK OF COMPLIANCE WITH TRAFFIC REGULATIONS BY NMV USERS

Issue Statement

A lack of compliance with traffic regulations by NMV users was found to be a serious problem in many of the study cities. One problem is that traffic laws in many Asian cities, which often date to colonial times, need updating to reflect current conditions. Another problem is that the police force allocated to traffic duties is typically understaffed and inadequately trained. Finally, system users often are unfamiliar with existing traffic regulations (7) and need to be educated.

Policy: Greater Compliance with Traffic Regulations

A variety of measures are recommended to increase compliance with traffic regulations by NMVs. Reflecting the problems set forth in the issue statement, these measures include revision of

TABLE 1 (continued)

Issue	Recommended Policies at the Local Level	Implications for Donor Agencies
<i>General NMV Planning and Policy Issues</i>		
13. Biases Against NMVs and Unbalanced Urban Transport Planning	<ul style="list-style-type: none"> o Implement institutional measures to address biases against NMVs o Promote balanced transport planning 	<ul style="list-style-type: none"> o Provide a forum to remedy anti-NMV biases and redress unbalanced transport planning
14. Over-Regulation of NMVs	<ul style="list-style-type: none"> o Limit the regulation of NMVs to safety- and security-related concerns 	<ul style="list-style-type: none"> o Provide framework for the deregulation of NMVs
15. Scarcity of Funds for Urban Transport System Improvements	<ul style="list-style-type: none"> o Consider low-cost solutions o Develop NMV facilities only when economically justified o Adopt innovative approaches to financing 	<ul style="list-style-type: none"> o Provide local governments with guidelines for low-cost solutions o Set guidelines for investments in NMV facilities to meet standard benchmark economic rates of return o Provide framework for innovative financing
16. Lack of NMV Data, Analytical Techniques, and Engineering Guidelines	<ul style="list-style-type: none"> o Improve data, analytical techniques, and engineering guidelines 	<ul style="list-style-type: none"> o Set guidelines for improving NMV data collection systems o Fund research to develop transport systems models incorporating non-motorized modes o Implement NMV pilot studies

Note: More detailed discussion of each issue and recommended policies at the local level are provided in the text.

traffic laws, strengthening of local traffic police, and education of system users (e.g., with billboards or decals, as used in Beijing and Lucknow, India, respectively).

ISSUE 4: INAPPROPRIATE PRICING AND TAX POLICIES IN URBAN TRANSPORT SECTOR

Issue Statement

Taxes (e.g., purchase taxes, fuel taxes, parts taxes) charged to MVs are not commensurate with the costs MVs impose on others (e.g., congestion, environmental damage) (8-10). Use of MVs tends to result in higher external costs than does use of NMVs. Bicycles, for example, are likely to impose significantly lower costs on others per passenger-kilometer than are low-occupancy automobiles and most other MVs, except for perhaps buses. Nevertheless, in certain countries customs duties and sales tax rates on bicycles are higher than on some MVs. In Bangladesh, for example, the import duty on bicycles (and other MVs) was 150 percent, whereas the rate for motorcycles and trucks (CBU) was 50 percent, and that for motor cars was 50 to 300 percent. In other countries (e.g., Cambodia), MVs are subsidized through the pricing of fuel at below-market prices.

Policy: Pricing and Tax Policy Revision To Reflect Costs Occasioned by Vehicle Use

The recommended policy prescription is to assess higher levies on automobiles relative to NMVs, both in absolute terms and measured in terms of charges per passenger- and ton-kilometer. Consider, for example, the case of Singapore, which instituted an area licensing scheme in its central business district in 1975 that is now being upgraded to full road pricing, to be extended over the entire island. Other measures implemented in Singapore include import duties, additional registration fees, bonuses for scrapping old cars, and a quota system for the maximum number of cars that can be registered (7). Also worth noting, Hong Kong in 1983 became the first city to test the technical, economic, and administrative feasibility of electronic road pricing. Although found effective for reducing congestion by time of day and location, the system was abandoned after 2 years primarily because of adverse reactions by motorists (7). Proposals for road pricing schemes in Bangkok, Kuala Lumpur, and Jakarta were also unpopular and never implemented.

It is important to note, however, that these pricing/tax measures are introduced most successfully in conjunction with the provision of appropriate alternatives, such as public transport or safe and convenient NMT infrastructure.

ISSUE 5: NMVs AND CONGESTION

Issue Statement

In certain NMV-dependent cities, NMV congestion on city streets is itself a major concern. In Shanghai, where 87 percent of all vehicles in traffic are NMVs, bicycles are seen as a less efficient user of the city's increasingly scarce road space than buses. In Hanoi, where 64 percent of all vehicles in traffic are NMVs, local

government officials have calculated the "interruption" of NMVs and certain motorized vehicles to traffic in terms of the road area taken up by one bus passenger. Although perhaps overstated, Hanoi authorities have estimated that a bicycle rider and a cycle-rickshaw (cyclo) passenger require an area 16 and 20 times larger than that required for one bus passenger, respectively. A congestion problem of a different sort is found in Tokyo, where illegal bicycle parking is a pervasive problem. Because the demand for bicycle parking at rail stations in Japan's urban areas far exceeds the supply, many people illegally park their bicycles within the vicinity of stations. In some areas, particularly on pedestrian sidewalks surrounding rail stations, the overabundance of illegally parked bicycles is a serious hindrance to pedestrian traffic flow.

Policies

Improvements in Public Transport

In NMV-dependent cities such as Shanghai and Hanoi, where a preponderance of bicycles has overwhelmed the capacity of the urban street system (particularly on main streets), public transport services should be upgraded. In terms of persons per hour per meter lane width, buses provide a capacity of 2,700 in mixed traffic and 5,200 on a busway; comparable figures for NMVs are 1,330 for a bicycle in mixed traffic, 1,800 for a bicycle on a separated facility, and only 420 to 1,200 for a cycle-rickshaw in mixed traffic and 560 to 1,600 for a cycle-rickshaw on a separated facility. In certain large cities where buses cannot provide sufficient capacity (e.g., Bangkok), an off-street public transport system may be required to provide additional capacity. Estimated capacities in terms of persons per hour per meter lane width equivalent for light rail, suburban rail, and rapid rail are 3,600, 4,000, and 9,000, respectively (3,4).

An alternative for addressing the problem of NMV congestion, limiting the numbers of NMVs through regulation, is not recommended. Such a policy unduly constrains NMV use. When urban transport alternatives are properly priced, free markets can most efficiently allocate resources among modes, motorized and nonmotorized.

Illegal Bicycle Parking Laws

Japan, which has the most serious illegal bicycle parking problem in the region, enacted the Law for the Promotion of Bicycle Parking Facilities in 1980 to address the problem of illegal bicycle parking. Since passage of this national law, more than a third of all local governments in Japan have enacted ordinances to address problems with illegal bicycle parking. Typically, these ordinances require landowners with property near rail stations to provide land for bicycle parking, call for the impounding of illegally parked bicycles, or both. Similar approaches could be considered in other cities in the region with serious illegal bicycle parking problems.

ISSUE 6: NMVs AND ROAD SAFETY

Issue Statement

NMVs were found to be a relatively unimportant cause of traffic accidents in each of the eight study cities for which reliable data

were available. In each of these cities, the share of accidents attributable to NMVs is significantly less than the modal split of NMVs in vehicular traffic. Even though the impact of NMVs on road safety is relatively low and substantially less than that perceived by urban transport officials, there is still substantial scope for improving the safety of NMVs in Asian cities. The issue must be considered an important one, given the alarming rates of deaths from traffic accidents in Asian cities.

Policies

Traffic Management and Enforcement Improvement

As noted, traffic management and enforcement measures are required to reduce conflicts between NMVs and MVs so that traffic flows are improved and congestion is reduced. Such measures could also improve safety because they clearly allocate road space between MVs and NMVs and increase compliance with traffic regulations. Worth noting here is the case of Shanghai, which records traffic violations on bicycle driving licenses and requires repeated violators to attend a 2-day training program on safe bicycle riding. Another instructive case is that of Japan, where prefectures compete against each other to reduce the incidence of road traffic accidents and fatalities.

Better NMV Safety Equipment

NMVs in low-income cities in the region often lack basic safety devices such as rear-view mirrors, lights, and reflectors. Local governments should consider implementing policies to induce NMV owners to provide at least the most basic of safety devices, through the provision of financial incentives for doing so, through regulations requiring basic safety features (as has been implemented in George Town, for example), or through some combined "carrot and stick" approach.

Establishment of Safety Education Programs

The low educational background of NMV operators has created safety problems in certain low-income cities in the region. However, safety education programs can be beneficial, as the Japanese experience demonstrates. The bicycle law in Japan requires schools to teach children bicycle safety, which is usually done as part of "health and physical education" classes, in which the traffic police teach young children how to check a bicycle for safety and operate a bicycle in traffic. In cities where many NMV operators have limited educational backgrounds or are simply unfamiliar with urban driving conditions and levels of traffic (e.g., Phnom Penh and Kanpur), more general public education campaigns perhaps accompanied by special NMV safety "seminars" could be considered.

ISSUE 7: NMV THEFT

Issue Statement

Although there is little formal data on NMV thefts, the possible theft of NMVs was found to represent a barrier to NMV ownership

in some of the study cities (e.g., Dhaka and Surabaya). Even in low-income cities in which the statistical probability of NMV thefts is not high, the perception of the risk of losing a major investment in an instant likely deters many from owning NMVs.

Policies

Secure Parking for NMVs

One approach to combating the perceived or actual problem of NMV thefts is to provide secure parking for NMVs. Japan is the world's leading nation in providing advanced NMV parking areas. The Netherlands is experimenting with the *Ficarro*, a bicycle parking carousel that is secure against bicycle theft and that reportedly can cover its own costs even with a small number of bicycles, at least under Dutch conditions. Lower-technology solutions were also found in some of the study cities (e.g., extensive guarded bicycle parking facilities in Kanpur and Shanghai).

Registration of NMVs To Reduce Theft

Another approach to addressing the NMV security issue, whether it is perceived or actual, is to implement a comprehensive system of bicycle registration. The bicycle registration system in Shanghai, which requires that registration cards be attached to bicycles at all times, has proven effective in reducing bicycle thefts in China's largest city. Also instructive is the experience of Denmark, where bicycle thefts in Copenhagen decreased by 23 percent after the introduction of a nationwide computerized bicycle theft register in June 1990 (11).

ISSUE 8: AFFORDABILITY OF NMVs FOR THE POOR

Issue Statement

One barrier to the purchase of NMVs in some study cities is their affordability, defined in terms of price relative to income. The price of a new standard-model bicycle consumes as much as 96 percent of the average monthly income in Phnom Penh. However, affordability tends to be a barrier to NMV ownership for those with below-average incomes, the availability of lower-priced economy and used models notwithstanding. Moreover, in certain countries such as Bangladesh, the affordability barrier is exacerbated by relatively high tariffs on NMV parts, which result in higher acquisition prices. Although loans are generally available for the more affluent to purchase an automobile or motorcycle, loans are rarely available to the poor to purchase a bicycle for personal mobility or a cycle-rickshaw to establish a small transport business.

Policies

Credit and Targeted Subsidies for NMV Purchase

The affordability barrier to bicycle ownership has been addressed in three study cities. In Kanpur, private and government organi-

zations offer low-interest loans for the purchase of bicycles. In Shanghai, employers provide commuters with subsidies of up to U.S. \$3 per month, which bicyclists can apply to the purchase of a new bicycle or the maintenance of one they already own. And, in Bangladesh, credit has been issued by various government agencies to *rickshaw* cooperatives on a limited basis, with the government financing the purchase of 3,300 *rickshaws* per year countrywide.

Bicycle subsidies would seem to be justified to the extent that they result in savings in spending on transport facilities or in subsidies to public transport operators. A Dutch study found that the incremental cost of travel by bicycle is approximately one-twelfth that of travel by car, principally because of the difference in facility costs. An Indian study concluded that the operating subsidy for the bus operator in Delhi in 1985 (on the order of U.S. \$150 million) would have been sufficient to provide a bicycle for every household below the poverty level (12).

Subsidies for the purchase of cycle-*rickshaws* would also seem to be easily justified given the return on investment in these vehicles; in Surabaya, for example, the return on investment in a new *becak* is significantly greater than 100 percent, which is not inconsistent with the high interest rates of 5 to 10 percent/month charged by users. However, to achieve their objectives, loans must be targeted at *rickshaw* drivers and not existing owners (13).

Tariffs Reductions on NMVs

In some countries, the affordability of NMVs is adversely affected by high tariffs, intended to benefit the local manufacturing industry. Even if high tariffs lead to increased local production, such a policy distorts free competition, resulting in unnecessarily high prices for locally produced bicycles. The price of a bicycle in Bangladesh, for example, is twice that in the neighboring Indian state of West Bengal (14). Because there is little evidence that such tariffs have led to increased local production of NMVs, the case for their removal is unambiguous.

ISSUE 9: NMVs AND ECONOMIC DEVELOPMENT

Issue Statement

NMVs play an important role in the local economy in many of the study cities. The *rickshaw* industry in Dhaka—including drivers, repair persons, owners, mechanics in assembly shops, and retailers in components shops—directly provides 23 percent of the city's employment. Similarly, approximately 20 percent of the jobs in Kanpur are in the NMV sector, which includes all employment related to bicycles, *rickshaws*, animal carts, and hand-carts. The NMV sector is also an important employer in Shanghai and Hanoi—two large bicycle manufacturing centers. To the extent that MVs replace NMVs in these cities, local economies will drastically change with consequent dislocation effects. Nevertheless, our inventory of Asian cities found that local governments often underestimate the economic impact of the NMV sector.

Policies

Short- and Intermediate-Term Promotion of NMV Use and NMV Manufacturing

Consistent with overall economic efficiency considerations, cities with high levels of NMV ownership and use should promote

NMV use and manufacturing in the short and intermediate term. NMV use can be promoted with a variety of measures specified elsewhere in this paper (e.g., improving facilities or providing potential users with access to credit). NMV manufacturing can be encouraged by providing credit and technical assistance to NMV manufacturing enterprises, identifying potential export markets for NMVs (15), and technology transfer between and among nations with large numbers of NMVs (4). However, it is not advisable to promote NMV manufacturing through high tariffs on NMV parts, a policy that merely increases prices for users. A bicycle consists of over 1,000 parts, and even in technically sophisticated Holland, large factories import two-thirds of their parts (14). An attempt by the government of Bangladesh to produce complete bicycles (Bangladesh Cycle Industries) has proven unsuccessful, with output only 10 percent of factory capacity (16).

Long-Term Easing of Transition from NMV Industries to Other Kinds of Enterprises

Realistically, the trend of increased motorization in Asian cities will lead to a reduced dependence of NMVs. However, considering the importance of NMVs in the economies of many Asian cities, ultimately it will be necessary to prepare for the conversion of some NMV industries into non-NMV industries—even into MV industries—which would be a logical step up the technological ladder. The alternative, permanently locking the region's poorest cities into an NMV-dependent economy, would hinder the technological development of local industry and block the aspirations of the many who wish to own and use motor vehicles.

ISSUE 10: NMVs AND THE ENVIRONMENT

Issue Statement

To the extent that use of NMVs reduces the number of motor vehicles-kilometers traveled, NMVs will have a positive impact on local air quality and noise environments. NMVs also can help to substantially reduce other adverse environmental impacts (e.g., visual intrusion and community severance). On the other hand, NMVs are not without adverse environmental impacts (e.g., the "bicycle pollution" problem observed in Japan, possible community severance impacts on bikeways, and animal waste).

Policy: Pricing and Tax Policies Reflective of Environmental Costs Occasioned by Vehicle Use

As recommended under Issue 4, pricing and taxing policies should reflect all costs engendered by vehicle use, including environmental costs. The problem of formulating technically defensible pricing and tax policies that would accurately reflect environmental externalities remains an obstacle to implementation. One study in the Dutch city of Groningen estimated a total environmental cost of 7.8 million guilders (U.S. \$4.3 million) if the modal share of bicycles in the city were reduced from 50 percent to 5 percent (16); more work of this sort is required, however.

ISSUE 11: NMVs AND ENERGY

Issue Statement

The limited available data indicate that NMVs are more energy efficient than MVs. Data from 1985 show that the transport sector used only 13 percent of the oil consumed in China, where NMVs predominate for short and moderate-length trips, but 35 percent elsewhere in Asia, where mixed traffic is the norm (4). One study concluded that bicycles consume only 22 kcalories/passenger-km, compared with 60 for walking, 575 for bus, and 1,160 for single-occupancy automobile (14); however, the ratio of energy use by bus passenger to energy use by automobile occupant reported in this study seems doubtful.

Policy: Consideration of Relative Energy Impact of MVs and NMVs

Further research is required to quantify the energy impact of NMVs in Asian cities. After the conclusion of such research, decision makers choosing among alternative urban transport policies should consider the energy efficiency of NMVs relative to that of MVs, especially in countries that are large energy importers. Nevertheless, it is important for urban transport policy makers to understand that energy efficiency is but one of the many considerations and that the policy that maximizes economic efficiency and some other objectives may often be the one that favors modes that are more energy intensive than NMVs (e.g., bus).

Better-balanced transport systems with less reliance on private cars means not only less energy consumption but also low dependence on foreign exchange. The large quantity of foreign exchange now allocated in many developing countries to import fuel, automobiles, and spare parts could be reduced substantially by encouraging the use of NMVs.

ISSUE 12: NMVs AND LAND USE

Issue Statement

Road-based NMVs, which by definition are either human or livestock powered, are most competitive for short trips. However, evidence indicates that the average commuting distance in several of the study cities has been increasing as the cities become more decentralized. The 1992 World Bank technical paper, *Nonmotorized Vehicles in Asian Cities*, included a box featuring Kanpur as a walking and cycling city. On the basis of data from the 1970s, the box indicated an average trip length of 1.4 km (0.9 mi) in Kanpur; however, by 1987 the average trip length in Kanpur had increased to 3.6 km (2.2 mi), principally a consequence of industrial expansion radiating to the southwest of the city.

Another case is Shanghai, a city where nearly 90 percent of all trips are made by NMVs, but where changes in land use have begun to alter commuting patterns. Longer commuting distances are becoming more common in Shanghai because of the expansion of the city and relocation of industries and housing. Many households will relocate to satellite towns now under construction at a rate of 80,000 dwelling units per year. The result will be a dramatic increase in the demand for public transport, with the role

of the bicycle changing from a door-to-door mode of transport to a bus-feeder mode.

Policies

Land Use Policies To Reduce Commuting Distance

A number of land use policies may be considered to address the growing trend toward decentralization and its consequent impact on commuting patterns, which will result in more travel by motorized modes. One such policy is the one traditionally followed in Shanghai, where employers have provided their employees with housing as part of the fringe benefits provided by enterprises, and the location of areas for worker housing has been based on two principles: (a) housing is to be located in close proximity to enterprises; and (b) residential areas are to be designed to minimize travel distances to shops, schools, and recreation centers (17). Another instructive example is Singapore, which has implemented a low-income housing program that locates residences close to workplaces, which thereby reduces trip lengths and increases the use of nonmotorized modes. A third instructive case is Karachi, where the so-called Metroville program enables individuals to build residences near their workplaces (18).

Promotion of Intermodal Integration Between NMVs and Public Transport

If land use policies are ineffective in reducing commuting distances and the demand for motorized transport increases, then policies to promote intermodal integration between bicycles and public transport can have positive effects. In Tokyo, one of the largest cities in the region and world, about 10 percent of all train and subway riders use the bicycle to travel to and from the station (14). Use of the bicycle as a feeder mode for bus is also prevalent in India; guarded bicycle parking facilities are provided at the Kanpur rail station on land rented from the city government by a private operator.

A caveat to the encouragement of the use of the bicycle as a feeder mode for public transport is the potential for the problem of pervasive illegal bicycle parking that afflicts Tokyo and other major cities throughout Japan. Since the passage of the Bicycle Law in 1980, over one-third of all local governments in Japan have enacted local ordinances to address this problem (e.g., requiring property owners near rail stations to provide land for bicycle parking and impounding illegally parked bicycles).

ISSUE 13: BIASES AGAINST NMVs AND UNBALANCED URBAN TRANSPORT PLANNING

Issue Statement

In several of the study cities it was apparent that policy makers were biased against NMVs. Hanoi, a city with an NMV mode share of 64 percent in 1992, plans to abolish NMVs by 2004 after "gradually moving all bicycles out of the city." The local government of Dhaka, a city where the NMV mode share was 52 percent in 1992, has repeatedly attempted to eliminate or reduce the number of cycle-rickshaws. Many local government officials

in Manila would like to see cycle-rickshaws eliminated because of their perceived impact on congestion and safety, as well as the "degrading" nature of the work required of the operator.

The consequence of anti-NMV biases among local public officials is unbalanced transport planning, which results in accommodating the needs of motorists at the expense of NMV operators and users. Such unbalanced planning can actually lead to a deterioration of traffic conditions for both MVs and NMVs in cities where NMVs account for about one-quarter or most of all vehicles in traffic (19). Consequently, it is in the best interest of all road users, motorized and nonmotorized, for NMV facilities to be planned in conjunction with those for MVs.

Policies

Institutional Measures To Address Biases Against NMVs

Anti-NMV biases should be counteracted with a host of institutional measures, ranging from national-level implementation of transport pricing and credit policies that do not discourage NMV use to the training of local personnel in comprehensive urban transport planning (i.e., encompassing both MVs and NMVs) and the upgrading of local data collection on NMVs. Also, wherever possible, the views of NMV users should be taken into account in NMV planning.

Balanced Transport Planning

Urban transport planning in Asian cities has been heavily weighted toward motorized transport. This approach, whereby nearly all energies and resources have been devoted to motorized modes, must be rejected in light of the unique and vital role that NMVs play in Asia, where in many cities they account for a significant proportion of all vehicle trips, and where they contribute in important ways to achievement of nontransport goals. On the other hand, NMVs should not be promoted merely because they are NMVs. Rather, the case for NMVs, if it is to be made, must be based on careful consideration of a city's transport system (present and future, both supply and demand) and the impacts that the system has on larger systems of which it is a part. In other words, the goal should be to promote NMVs not because they are "greener" than other modes (20) but because they have a useful role to play in particular cities in the region.

ISSUE 14: OVERREGULATION OF NMVs

Issue Statement

There are a number of examples of how government regulatory policies have reduced the supply and use of NMVs in Asian cities:

- In Jakarta, authorities seized 100,000 cycle-rickshaws, over one-third of which were dumped into the sea. A similar policy, albeit on a lesser scale, was implemented in Delhi in the late 1980s.
- In Dhaka, NMVs have been banned from certain "VIP roads," and it is likely that NMV-restricted areas will be extended in the near future. However, no clear guidelines have been estab-

lished for determining the areas in which cycle-rickshaws are to be prohibited.

- In Surabaya, the government enacted a policy of day- and night-*becaks* (i.e., cycle-rickshaws) to reduce the number operating at any given time. This regulatory system was implemented with the support of the operators and resulted in a stabilization of operator incomes. It nevertheless has resulted in a reduction in the availability of NMV transport services to local residents.

- In George Town (Malaysia), the city council in 1969 stopped issuing new cycle-rickshaw licenses and prohibited transfers except to cycle-rickshaw drivers registered before 1969. The number of cycle-rickshaw registrations has decreased 38 percent since that time, a surprisingly small decline considering that no new licenses have been issued in more than two decades.

Policy: Limitations on Regulation of NMVs

The urban transport sector in general, and NMVs in particular, would benefit by substantially less regulation by local authorities in Asian cities. Kanpur, a city with a half million bicycles and over 30,000 cycle-rickshaws, presents a good example of how NMVs can thrive in a *laissez-faire* environment, in which the private sector is free to respond to the travel needs of the city's residents. Of course, in Kanpur and elsewhere certain regulatory policies can play a useful role in promoting NMVs, particularly with respect to the allocation of street space, safety, and security.

ISSUE 15: SCARCITY OF FUNDS FOR NMV FACILITY IMPROVEMENT

Issue Statement

Most cities in the region devote between 15 and 25 percent of their annual expenditures to their transport systems. However, over the last decade, traffic in most Asian cities has increased at a faster rate than has investment in the urban transport infrastructure. And with developing countries already strapped for revenues, the search for financing for the urban transport infrastructure, either for MVs or NMVs, is not easy (21). In most cases, both national and local governments have shown neither the willingness nor the ability to address urban transport needs by generating additional revenues from the sector, from increased prices or reduced subsidies.

Policies

Consideration of Low-Cost Solutions

In light of the budgetary constraints confronting most local governments in the region, careful consideration should be given to low-cost solutions to traffic problems. As noted, traffic authorities in Kanpur are experimenting with yellow lane markings on certain main streets, effectively separating fast- and slow-moving vehicles. The success of the Kanpur experiment suggests that the prime emphasis should be on simple traffic management approaches rather than the construction of "gold-plated" facilities.

Development of NMV Facilities

Given the constraints on public finance in Asian cities, investments in NMV facilities should be made only if the benefits to society outweigh the costs. Importantly, costs should be minimized for a given level of service. To the extent that NMVs can provide a level of service comparable to that provided by motorized modes, then consideration should be given to promoting NMVs. However, promotion of NMVs on the basis of the electric utility industry's "long-term, least-cost planning methods" should be rejected (4) because generally NMVs will not be able to provide service levels comparable to those offered by MVs.

Adoption of Innovative Approaches to Financing

A number of innovative approaches are available for the financing of facilities of NMVs and other urban transport modes. One approach, discussed earlier, involves the proper pricing of urban transport. An instructive case is that of Shanghai, where a highway maintenance fee (a tax on vehicle use), a bicycle tax, and vehicle authorization taxes raise approximately two-thirds of the funds spent on urban transport investment (7). A second approach involves a combination of public-private involvement to finance NMV infrastructure. In Kanpur, as cited earlier, the city government has rented public land near rail stations to private operators of bicycle parking facilities. In Japan, many local governments have met their legally mandated responsibilities to provide bicycle parking by requiring landowners within close proximity to rail stations to contribute by dedicating a portion of their land for bicycle parking. Another innovative financing scheme involves the use of concessions and "build, operate, and transfer" schemes, in which a franchise or license agreement is negotiated with the public sector by a private group responsible for the design, finance, construction, and supervision of the facility. The approach in the urban transport sector in Asia to date has been limited to highway and mass transit projects, but could conceivably apply to revenue-generating NMV facilities such as large parking structures.

ISSUE 16: LACK OF NMV DATA, ANALYTICAL TECHNIQUES, AND ENGINEERING GUIDELINES

Issue Statement

The efforts of this recent study for the World Bank notwithstanding, there is a dearth of data on NMVs in Asian cities. Such data are required to prepare urban transportation plans that will adequately meet the needs of NMV users. Similarly, there is a lack of proper analytical techniques with which to address NMVs. The majority of analyses of urban transport problems in Asian cities rely on the "tried and trusted methods" that have been developed and tested on transport networks in metropolitan areas located in developed countries, where NMVs generally are insignificant. Finally, at least until this recent study, there has been a lack of engineering guidelines for NMV planning in Asian cities.

Policy: Improvements in Data, Analytical Techniques, and Engineering Guidelines

Additional NMV-related surveys that would need to be undertaken would include an NMV facilities inventory; an NMV traffic vol-

ume survey; an NMV speed and travel time survey; a household survey; an NMV operator's survey; a road accident inventory; an inventory of NMV transport costs and fares; an inventory of traffic regulations, enforcement, and education programs relating to NMVs; and an outer cordon survey. Regarding analytical techniques, there is an urgent need to develop a transportation network model capable of reflecting both motorized and nonmotorized transport modes by adjusting link characteristics such as link capacity and speed-volume relationships. Alternatively, in certain circumstances it may be acceptable to model motorized and nonmotorized modes separately, with explicit interacting relationships between the models to ensure consistency. Finally, it would be helpful to refine the engineering guidelines developed during the course of this recent study through pilot studies in selected cities.

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The views presented in this paper and any errors are the responsibility of the authors.