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ISSUES IN BRIEF

Transportation in Mega-Cities: A local issue, a global question

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The Frederick S. Pardee Center for the Study of the Longer-Range Future *at Boston University convenes and conducts interdisciplinary, policy-relevant, and future-oriented research that can contribute to long-term improvements in the human condition. Through its programs of research, publications and events, the Center seeks to identify, anticipate, and enhance the long-term potential for human progress, in all its various dimensions.*

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Travelling on the streets of Mumbai is no easy task. In a city of 18 million people with a population density of 22,000 people per square kilometer, one can expect to dawdle wearily in traffic, inching forward at no more than about 5 or 10 kilometers per hour. The same road space is shared by buses, cars, motorbikes, three-wheelers, bicycles, wheelbarrows, trucks, throngs of pedestrians, street dwellers, and hawkers that constantly come within inches of disaster. The train is a dangerous alternative; 4,000 people per year are killed crossing the tracks or falling out of over-crowded compartments.

In Mumbai, Delhi, Karachi, Jakarta, Beijing, Lagos, or any mega-city in the developing world, the problems are the same. Transportation in developing country mega-cities (i.e., cities with a population of 10 million or more) is in a state of crisis. Extreme congestion, long commute times, choking air pollution, deadly traffic accidents, and inadequate public transport are the norm. Billions of dollars in economic productivity are lost due to congestion. Air and noise pollution severely impact health and quality of life. The poor lack affordable or comfortable mobility. Transportation is also one of the most significant contributors to climate change, accounting for 25 percent of global emissions (IEA, 2003).

Continued rapid urbanization, particularly in the mega-cities of Asia and Africa, is magnifying the problem. Already, more than 50 percent of the world's population lives in cities. By 2030 that figure is projected to jump to 80 percent, with 90 percent of that growth taking place in Asia and Africa. By 2020, Mumbai, Delhi, Mexico City, Sao Paulo, Dhaka, Jakarta, and Lagos will join Tokyo in a new category of meta-cities with populations that cross 20 million people (UNFPA, 2007). The already overwhelmed transport systems in these crowded centers will have to adapt to massive population influxes, coupled with increased personal vehicle use.

Will we see bluer skies in Beijing and Jakarta in the future? The answer to that question will affect quality of life and economic development at a local city level and will have far reaching global consequences for human health, poverty, economic growth, and climate change. This

Population of Mega-Cities with 10 Million Inhabitants or More, 1950, 1975, 2000, 2015

(All populations in Millions; estimated population for 2015)

1950

New York, USA **(12.3)**
Tokyo, Japan **(11.3)**

1975

Tokyo, Japan **(26.6)**
New York, USA **(15.9)**
Mexico City, Mexico **(10.7)**

2000

Tokyo, Japan **(34.4)**
Mexico City, Mexico **(18.1)**
New York, USA **(17.8)**
Sao Paulo, Brazil **(17.1)**
Mumbai, India **(16.1)**
Shanghai, China **(13.2)**
Kolkata, India **(13.1)**
Delhi, India **(12.4)**
Buenos Aires, Argentina **(11.8)**
Los Angeles, USA **(11.8)**
Osaka, Japan **(11.2)**
Jakarta, Indonesia **(11.1)**
Rio de Janeiro, Brazil **(10.8)**
Cairo, Egypt **(10.4)**
Dhaka, Bangladesh **(10.2)**
Moscow, Russia **(10.1)**
Karachi, Pakistan **(10.0)**
Manila, Philippines **(10.0)**

2015

Tokyo, Japan **(35.5)**
Mumbai, India **(21.9)**
Mexico City, Mexico **(21.6)**
Sao Paulo, Brazil **(20.5)**
New York, USA **(19.1)**
Delhi, India **(18.6)**
Shanghai, China **(17.2)**
Kolkata, India **(17.0)**
Dhaka, Bangladesh **(16.8)**
Jakarta, Indonesia **(16.8)**
Lagos, Nigeria **(16.1)**
Karachi, Pakistan **(15.2)**
Buenos Aires, Argentina **(13.4)**
Cairo, Egypt **(13.1)**
Los Angeles, USA **(13.1)**
Manila, Philippines **(12.9)**
Beijing, China **(12.9)**
Rio de Janeiro, Brazil **(12.8)**
Osaka, Japan **(11.3)**
Istanbul, Turkey **(11.2)**
Moscow, Russia **(11.0)**
Guangzhou, China **(10.4)**

Source: United Nations, Department of Economic and Social Affairs, Population Division (2006)

paper identifies five major trends that are shaping the future of urban transportation in developing countries and explores the global implications of these trends.

Trend #1: More people are buying personal vehicles

The most obvious and dominant trend in urban transportation is the increase in personal vehicle use. More people are buying cars and motorcycles and doing so in large numbers. The prospect of owning a car or a motorcycle represents access, mobility, comfort, and status as well as an additional measure of safety from fatal traffic accidents and freedom from the drudgery of woefully inadequate public transportation. Not surprisingly, studies show that city dwellers will generally purchase motorized vehicles as soon as they can afford to do so. (Sperling and Salon, 2002).

With rising incomes and availability of consumer credit, vehicle ownership is growing 15 to 20 percent in much of the developing world (WBCSD, 2007). Car ownership in China grew a staggering 300 percent from 2002 to 2008 (Fan, 2008). In the past 10 years, Beijing has experienced a tenfold increase of private cars and Shanghai a 25-fold increase. In Bangalore, India's new Silicon Valley, 900 new vehicles are registered every day. Motorbike sales have been rising even more quickly than cars. Between 1981 and 2002, the number of two-wheelers in India rose from fewer than 3 million to more than 42 million (Pucher et al., 2007).

Still, vehicle ownership in the developing world is far behind the developed world. There are nine cars per 1000 people in China, compared with 700 per 1000 in the United States and 500 per 1000 in Western Europe. In China, 50 percent of all urban trips are by public transport and another 40 percent are walking and cycling (Ng and Schipper, 2005). In Delhi, only five percent of total trips are taken by car, while 15 percent are by motorcycle, 42 percent on public transport, and 39 percent by walking (Badami et al., 2004).

Why are the attendant problems of motorization so much worse in the major developing country cities than the developed world, even though per capita car ownership is so much lower? Part of the answer lies in the speed of motorization and the sheer size and density of the urban populations involved. When developed countries were building their transportation infrastructures, populations were far smaller and the cost of vehicles was higher, allowing cities to develop their road systems gradually (Sperling and Salon, 2002).

> **"A car is almost always the only safe and convenient means of urban transport, precisely because of the danger and pollution caused by all the other cars on the streets."**

In the developing world, motorization has occurred so quickly that road infrastructure and traffic management systems have not been able to keep up. Buses, cars, rickshaws, motorcycles, cyclists, pedestrians, and even animals all share the same road space, causing severe motor vehicle traffic disruptions, long idle times, and high fatality rates (Badami et al., 2004). Sidewalks are either non-existent or filled by hawkers and street dwellers. In Indonesia, 60 percent of all paved roads do not have sidewalks (WBCSD, 2007). Air pollution is exacerbated by the use of old, cheap technologies, such as two stroke engines and diesel vehicles that emit high volumes of particulate matter (Singh, 2005). Reckless driving and violation of traffic laws are rarely punished and the vast majority of fatalities are borne by cyclists, motor cyclists, and pedestrians. Consequently, the safest place to avoid the chaos on the streets is inside a car.

How are cities responding to the transportation overload? They continue to build more expressways and flyovers for cars (Badami et al., 2004). Pedestrians, cyclists, motorcyclists, and rickshaws are generally ignored or even discriminated against. In 2003, Shanghai banned bicycles from all its major roads to make more room for cars. In many Chinese cities, pedestrian sidewalks and bicycle rights-of-way have been eliminated (Pucher et al., 2007). Buses often are not given priority in the design of new roads, in spite of their widespread use by the majority of the population. Worldwide experience has shown that the construction of highways and flyovers has increased congestion, by releasing latent demand for personal vehicles, and has made public transit and non-motorized transport even more inconvenient and unsafe (Badami et al., 2004).

National governments are eager to encourage motorization to create jobs and drive economic growth. The Chinese auto industry, now the third largest in the world, has been dubbed one of the pillars of economic development. It employs 1.8 million people and accounts for 1.5 percent of total GDP (Shiuen and Schipper, 2005). India also considers developing its domestic automobile industry as one of its the most important measures for promoting economic growth and employment.

The car industry is responding to this massive demand by driving down costs and scrambling to set up factories in emerging markets. In India, Tata Motors has produced the world's cheapest new car, the Nano, priced at US$2,500. The car also will be extremely fuel efficient,

achieving approximately 50 miles per gallon (mpg). It is dubbed the 'People's Car' — a car affordable to the average middle-class individual. Is the Nano a good thing? Yes and no. Yes, for all the families transporting their children on unsafe motorbikes or spending hours each day on the bus. A car is almost always the only safe and convenient means of urban transport, precisely because of the danger and pollution caused by all the other cars on the streets. However, there is not enough road space, clean air, or cheap oil for everyone to own a gasoline powered car. Cities must create viable alternatives to personal vehicles that are both safe and convenient. There is no other option.

Trend #2: The demand for safe and convenient public transportation is growing

Public transportation in many developing country cities is appalling. The public buses are old, crowded, and very slow due to congestion on the streets; they are often forced to stop in the middle lane of streets, making boarding and alighting difficult and dangerous. In Delhi, over a hundred people were killed in bus accidents in 2007, leading to calls for the death penalty on errant bus drivers. In many cities, informal paratransit operators, such as private minibuses, fill the gap in public transportation and provide mobility for the poor (WBCSD, 2001; World Bank, 2002; Pucher et al., 2007). However, informal transport networks are poorly regulated and can be dangerous, unreliable, and extremely crowded (World Bank, 2002). Without safe or convenient options, anyone that can afford another alternative will avoid taking public transportation.

Many larger cities are now building Bus Rapid Transit systems (BRTs). BRTs involve creating elevated boarding platforms and dedicated bus lanes. The cost of a BRT system can be a small fraction of the cost of a light rail or metro system. Mexico City built its entire BRT system for the same cost of two metro stations. BRT was pioneered in Curitiba, Brazil, in 1974. Today, in Curitiba, the BRT carries nearly 2.2 million passengers per day and is regularly used by more than a third of the city's population. The Curitiba system "may be the only transport system in the world that has developed along with urban growth rather than in reaction to it." BRT systems are now either in operation or being rolled out in 70 cities in 23 different countries around the world (EMBARQ, The World Resources Institute Center for Sustainable Transport, 2006).

Bus Rapid Transit in Jakarta — Mixed Reviews

According to a study by the World Bank, commuters on the Jakarta BRT system reduced their commute by one hour during peak time. However, the system has not reduced the congestion or the number of cars on the roads. Taking out two lanes of traffic for the bus way in some the city's busiest thoroughfares has made congestion even worse. According to the same study, almost 70 percent of the riders were former commuters on the regular bus system and only 14 percent previously used a private car. The bus system was only built to accommodate two-thirds of the total demand, resulting in heavy crowding. Logistical issues, involving the design of the boarding ramps and buses as well as the lack of feeder buses, also hamper the effectiveness of this system. (Hook and Ernst, 2005.)

A successful BRT system is difficult to implement. It involves a great deal of planning and coordination among different stakeholders. Studies have shown that the success of the system depends more on political will rather than financial resources (Wright, 2001). BRT systems have had the greatest success in Latin America, where they are credited with creating environmental benefits, calming influences, higher quality of life, improving health, reducing crime, and alleviating poverty (Wright, 2001). In Asian cities, success has been mixed. The strong mayors of Latin America often had enough central authority to create an effective umbrella over the various agencies involved, but the traditionally weaker Asian mayors have not had that same capacity (Hossain, 2006).

Unfortunately, there is less of a trend towards modernizing the regular public bus systems. Costs of technology upgrades and resistance by bus operators to change or greater oversight are large barriers. Formal incorporation of important paratransit systems into city transportation planning is now being discussed more widely, but regulating these operators is also notoriously difficult (World Bank, 2002). Although modern bus rapid transit and rail systems may benefit the middle class, the higher fares charged by these systems are often out of the reach of the poor. In sum, BRT is a step in the right direction, but still falls far short of delivering the kind of public transportation required to serve the current and future needs of the rich and poor alike.

Urban Transportation and the Poor — an Unfair Equation

The locus of poverty is shifting from rural areas to towns and cities. Currently, one out of three urban dwellers, one billion people, roughly 20 percent of the world's population, lives in slums. An incredible 72 percent of city dwellers in sub-Saharan Africa and 56 percent in South Asia live in slum conditions. It is predicted that the slum population of the world could rise to two billion by 2030 if no concerted action is taken (UN-Habitat, 2003).

The poor spend the largest amounts of time on the streets, bear the worst brunt of traffic accidents and pollution, and have the longest commute times. They depend on walking, cycling, and public transportation. On average, the poor spend between 25 and 35 percent of their disposable income on transport (Hook, 2006). However, urban sprawl is pushing many of the poor into slums built on the periphery of cities, which are underserved or not served at all by public transportation. This mobility deficit marginalizes the poor from public life and creates barriers to employment and education.

Public investment in infrastructure has focused on building highways and flyovers for the wealthy car-owning minority, diverting investment from public transportation and virtually ignoring non-motorized transportation. The visionary mayor of Curitiba who built the first BRT, Enrique Penalosa, rejected building a system of expressways and focused on public transport, pedestrian access, and bicycle paths. Enrique Penalosa describes urban highways as "monuments to inequality, built with funds diverted from the more important needs of the poor, only to cater to a small minority of the affluent" (EMBARQ, 2006).

Trend #3: Clean air concerns and energy costs are driving technological change

More mega-cities are mandating the adoption of new technology to relieve air pollution. The conversion of public vehicles to natural gas (CNG) all over the developing world has been one of the most successful adoptions of clean technology. CNG creates far less air pollution and carbon emissions than petroleum. In Delhi, the switch to CNG has improved air quality dramatically in what was once the most polluted mega-city in the world. However, these changes often face political opposition as they are expensive to implement and have socioeconomic costs. It took an order from the Indian Supreme Court and heavy NGO activism to finally get the CNG law in Delhi implemented as it was strongly opposed by vehicle operators (Bose and Sperling, 2001).

Rising fuel costs and government policy are also pushing vehicle technology towards cleaner fuels and higher efficiency. Major car manufacturers are finally shifting focus from faster and bigger cars to more fuel efficient ones and to alternatives like hybrids and electric cars. Tata Motors, the creator of the US$2,500 car, is trying to develop an electric car version of the Nano. Reva, another Indian car manufacturer, has produced a solar powered electric car. While uncommon in other parts of the world, 10 million electric bikes were sold in China

in 2005, up from 330,000 in 2000. China also has implemented some of the highest fuel efficiency standards in the world.

Technological advances in personal mobility are helping to shape a more sustainable urban future. However, cost and convenience mixed with some intervention from government are needed to accelerate this trend.

Trend #4: Governments are experimenting with creative traffic management regulations in the largest cities

Regulations to control car use are making a tentative appearance in mega-cities with mixed success. Singapore charges prohibitive fees for driving licenses and uses that revenue to fund its world class public transportation system. Some cities in Latin America and China allow odd and even numbered cars to use the roads only on alternating days. In some cases, this has led to people buying two cars. Jakarta has a policy requiring three people in a car on its busiest roadways during rush hour. This law gave birth to an industry of small children offering to ride as the third passenger. In Beijing, the success of the car ban in delivering better air quality during the Olympics encouraged officials to continue the ban in a modified form and to raise the price of gas. They are contemplating other measures such as limiting registration plates, raising parking fees and building more subway lines. London's congestion pricing significantly reduced peak time congestion and is now drawing favorable public opinion. However, it faced much opposition and criticism and required a strong mayor with expanded political powers to implement the policy (Litman, 2004).

> "The right to safe, convenient urban transportation is only beginning to emerge as a development priority."

Two conclusions can be drawn from these and many other examples from around the world. First, people want to drive their cars and do whatever they can to find a way around the rules unless there are viable alternatives. Second, citizens and industries will complain bitterly and campaign vigorously against a new rule only to find that, once it is implemented, it is not so bad after all and that, after seeing the reduction in traffic, they may even like it. Government regulation will play an important role in the future of urban transportation, but there is still no consensus on the right course of action.

Trend #5: Global civil society is lobbying for change

Civil society, both globally and locally, is becoming increasingly active in lobbying for sustainable and equitable solutions. One such initiative is the C40 Large Cities Climate Leadership Group, an association of large cities around the world that have pledged to accelerate their efforts to reduce greenhouse gas emissions. They have created a partnership with Microsoft to develop greenhouse gas online tracking tools for cities. The World Resources Institute's Center for Sustainable Transport program works with cities in developing countries globally to create partnerships between government, business, and civil society to find solutions to transport-related problems. The Centre for Science and Environment in Delhi has campaigned vigorously to improve air quality in India's cities.

Municipalities also are collaborating globally in search of innovations, solutions, and best practices. Consequently, victories for sustainable transportation practices in one city are very powerful because their successes inspire imitations. The examples of BRTs from Bogota and Curitiba have spurred copy-cat efforts throughout the world (EMBARQ, 2006). The CNG victory in Delhi led to many other cities in India to adopt the same policy.

The right to safe, convenient urban transportation is only beginning to emerge as a development priority. The Millennium Development Goals (MDGs) conspicuously do not contain transport specific goals, but this has been criticized as an oversight to be corrected. Attention to poverty alleviation and urban transportation considerations is growing amongst the development community.

Conclusions

What do these trends mean for the future of transportation in mega-cities in the developing world? They indicate that the urban transportation crisis will get worse before it gets better. In the short-term the number of personal vehicles on the roads is increasing and governments are pursuing policies whose net effect is still to promote the use of cars and build infrastructure to facilitate them. In the medium-term, there are signs of change. There are positive trends in the development of public transportation, the adoption of cleaner technology, experimentation with creative traffic laws, and recognition of the importance of building infrastructure for non-motorized transportation. The voices of civil society demanding change are growing louder. In the longer-term the sheer number of people in cities and size of the problem, coupled with global warming and rising oil prices, will force mega-cities to change their transport systems.

How might change happen? There are plenty of good ideas on how to improve the mobility situation, and even the financing available to do so. New transport infrastructure must be built to accommodate pedestrians, cyclists, and public transportation. Cities must switch to cleaner fuels, adopt higher emissions standards, and replace old polluting vehicles. City planners must create livable, walkable communities and fight sprawl and decentralization. Regulations are needed to discourage driving during peak hours and encourage use of new convenient and safe public transportation. However, even where low-cost technical solutions exist, institutions are the ultimate determinant of successful implementation (WBCSD, 2001). Consequently, efforts to bring change must focus on the institutions, governance and attitudes and not just technical solutions.

Ultimately, turning the corner on sustainable mobility will require a major paradigm shift from transportation systems designed to move vehicles to ones that are designed to move people.

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URBAN TRANSPORT BY THE NUMBERS

10
kilometers per hour
average downtown weekday traffic speed in Bangkok

85
percent
proportion of worldwide road-related deaths that occur in developing countries

120
minutes
average one-way commute in Manila

60,000,000
cases per year
incidents of respiratory illness in developing countries due to urban air pollution

1,000,000,000
individuals
living in urban slums, worldwide

1,100,000,000
dollars per year
economic loss of being stuck in traffic in Mexico City

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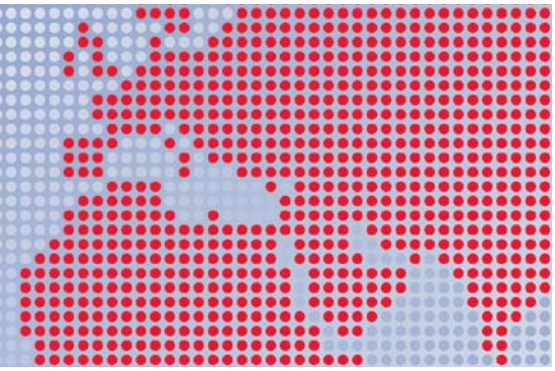

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