AIR QUALITY AND TRANSPORTATION CHALLENGE IN SOUTH ASIA: AN AGENDA FOR ACTION
IN FOCUS: DHAKA AND DELHI

Overview

Some of the worst cases of outdoor air pollution are found in Asian cities. Although cities like Delhi and Dhaka have reported drop in air pollution levels but more recent information shows reversal of trend in few cities as levels of key pollutants take a u-turn. Even some medium and small-sized cities are also witnessing a phenomenal spurt in pollution as severe as any megacity.

This has called for renewed action in new areas where the action have been minimal, for instance vehicle technology / fuel quality improvement has been implemented in many Asian cities, but off late the cities are also realizing that growing number of vehicles is undermining the gains as cities are caught in a gridlock of cars, ubiquitous two wheeler and three wheelers and various types of non-motorised vehicles.

The Asian streets give a glimpse of transition from non-motorised to motorization and marginalization of green modes of commuting like walking, cycling and rickshaws. People are exposed to vehicular fumes – which largely remains unmonitored – but still these cities have commuting pattern that are different from western mobility patterns which are heavily depended on cars. Asian cities can still take a alternative path which provides mobility to all with lower pollution and energy impacts. South Asia being a largest integrated region in the world can set an example of the alternate path. South Asian economies have achieved impressive rates of economic growth since the 1980s. India, Pakistan, Bangladesh, and Sri Lanka have grown more rapidly since 1980 than any other region except East Asia.[1] This region has enormous opportunity to build their economies but not get caught in the spiral to toxic fumes, wasteful energy use in transport and gridlocked streets.

Box: South Asia facts

The region has no universally agreed definition as regards the countries that constitute it. However, as per the definition adopted by the United Nations, it is the region that includes nine countries namely, Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka.[2] Apart from high economic growth the region is also experiencing high population growth. According to the United Nation's estimates, Southern Asia's urban population is expected to reach the figure of close to one billion by the year 2030 that is about 120 per cent increase in three decades beginning with the year 2000. [3]

Four countries namely India, Pakistan, Bangladesh and Iran would accommodate an overwhelming 95.4 per cent of the region's urban population in 2030 as compared to 97.3 per cent in the year 2000. This marginal decline in the share of urban population of larger countries in the region is because of relatively fast increase in the urban population of the smaller countries like Afghanistan, Bhutan, Maldives and Nepal. However, growth rates of urban population are estimated to decline in successive decades in all the countries of the region, except India and Sri Lanka. [4]

As of 2000, over half the 20 megacities in the world were in Asia: Tokyo, Mumbai, Delhi, Shanghai, Kolkata, Jakarta, Dhaka, Osaka–Kobe, Karachi, Beijing, and Manila.[5] Amongst the countries in the South Asia region, there is a trend of population to concentrate in large cities. Number of mega cities (ten million plus population cities) is increasing in the region. In 1995, there were only three mega cities in Southern Asia although Dhaka (8.2 million) and Karachi (8.5 million) were just behind. However, by 2015, the region is projected to have five mega cities and four more cities namely Chennai (8.3 million), Bangalore (7.9 million) and Hyderabad (7.4) in India and Tehran (8.4 million) in Iran following closely. The population of these cities is increasing at a rapid rate except that of Kolkata which is presently stagnating.[6]

Coping with these challenges and meeting the travel needs of people in a equitable and sustainable manner is a challenge as private motorization is increasing and at the same time cities are failing to pay attention to green modes of commuting like public transport, walking, cycling etc. With increase in number of vehicles the air quality is also deteriorating after short respites.

Asia's sooty air: Health effects of air pollutants worse in Asian cities

ECONOMIC boom in Asia has come with a price. Health effects of particulate pollutants in Asian cities are similar —even greater—than those in most industrialized western cities. Effects of gaseous pollutants are also higher in Asian cities. These are the conclusions of a study conducted in Bangkok and three Chinese cities—Hong Kong, Shanghai and Wuhan. It assessed the effects of short-term exposure to air pollution on mortality. [7]

It is part of the Public Health and Air Pollution in Asia (PAPA) project, undertaken by the Health Effects Institute (HEI) in Boston (study released in 2008) in partnership with the Pasig City, Philipines-based Clean Air Initiative for Asian Cities (CAI-Asia). Researchers used health data, including natural mortality and that of cardiovascular and respiratory diseases, provided by health departments. Four pollutants, namely, NO2, SO2, PM10 and O3 were used as air quality indicators. The research teams adopted a common protocol. [8]

PM10 levels were well above WHO guidelines. Wuhan and Shanghai had the highest PM10 levels. NO2 levels in Bangkok were slightly lower than the other two cities but were above WHO guidelines. Wuhan reported high O3 levels. Natural mortality was highest in Shanghai, followed by Bangkok and Hong Kong. Wuhan had the lowest. But deaths due to cardiovascular and respiratory diseases was the highest in Wuhan followed by Shanghai, Bangkok and Hong Kong. [9]

Air pollution levels of the four Asian cities were compared with 20 largest cities in the US using data collected between 1987 and 1994 by the country's National Morbidity and Mortality Air Pollution Study (NMMAPS). The Asian cities fared poorly in the comparison. Mean PM10 levels were 33 microgrammes microgrammes per cubic metre in the US cities while the PM10 levels in the Asian cities varied between 52 and 142 microgrammes per cubic metre. [10]

The combined effects of all the four pollutants were equal or greater in the Asian cities compared to the US cities. The excess risk of mortality for all pollutants in Bangkok was higher than reported in the three Chinese cities. "The results provide important information on pollution related health effects in Asia especially for areas known to have high exposures but are underrepresented in the literature,'' says the study published online on July 9 in Environmental Health Perspectives. Researchers also observed that the effects were stronger for heart diseases than natural causes. The effects of the pollutants were stronger on the aged, particularly in Bangkok. [11]

Multicity studies are very important in Asia as pollution effect estimates for the region can be generated. These in turn can provide relevant estimates of local impacts of environmental conditions to decision makers.[12]

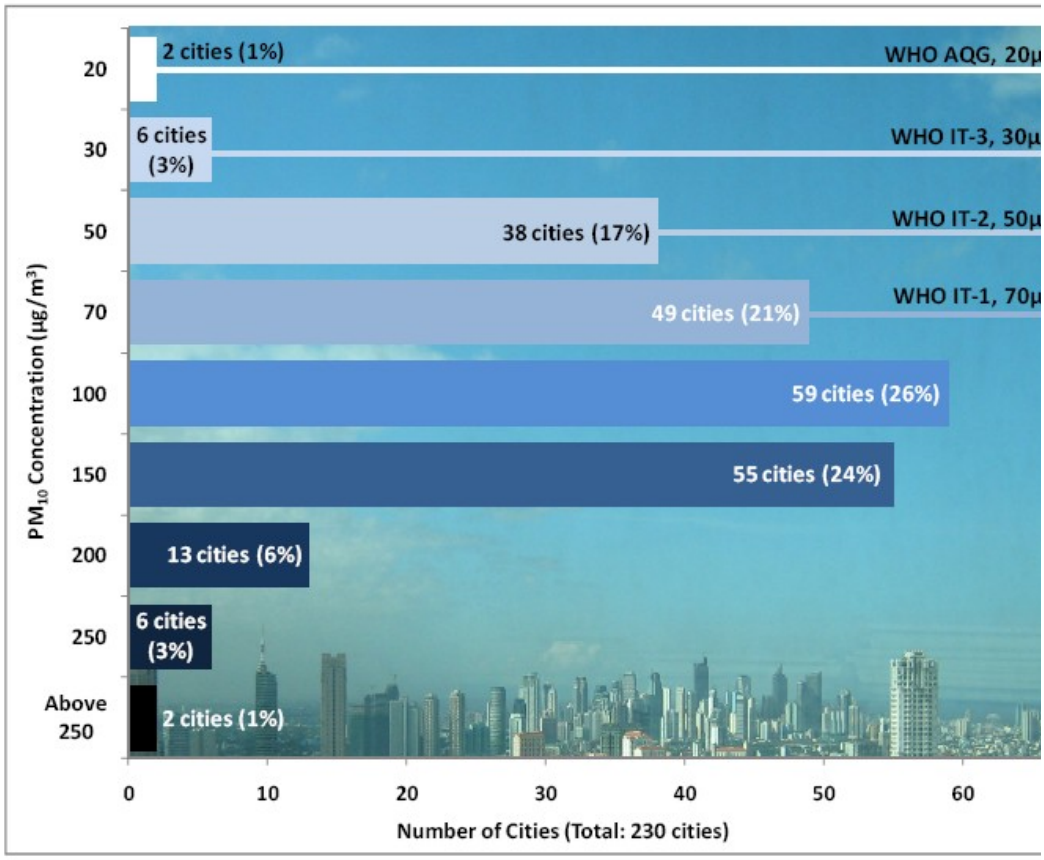
What are the current air quality challenges in Asian cities?

The most commonly reported parameter as an indicator of air pollution which is also blamed for severe health effects is the particulate matter. Not many cities in Asia separately monitor the smaller PM2.5 but cities are building up the capacity. Data for PM10 and TSPM for the particulate pollution and that of nitrogen dioxide and sulfur dioxide is available for many cities.

Cities have already begun action to reduce air pollution and seen some improvement. But several cities are in danger of losing the gains of its first generation action as particulate pollution levels are once again rising and are elevated. In most big cities in Asia the PM10 is the routinely monitored. The PM10 annual average levels in the cities including Beijing, Dhaka, Hanoi, Kathmandu, Kolkata, New Delhi, and Shanghai are more than 5 times the WHO guidelines limit on PM10 of 20 microgramme per cubic metre.[13]

An assessment by CAI Asia Centre called 'Air Quality in Asia: Status and Trends 2010 Edition' has undertaken a long term assessment for the period 1993 to 2008. This analysis indicates that while some improvements in air quality have been achieved, levels of PM10 and SO2 continue to exceed World Health Organization (WHO) air quality guidelines (AQG). But there is not enough air quality data to assess PM2.5 and ozone.[14] It further adds that the ambient air quality standards of most countries lag behind WHO AQG and US EPA (Environmental Protection Agency) NAAQS. Most Asian countries have already adopted National Ambient Air Quality Standards (NAAQS) for criteria pollutants (except for PM2.5).[15]

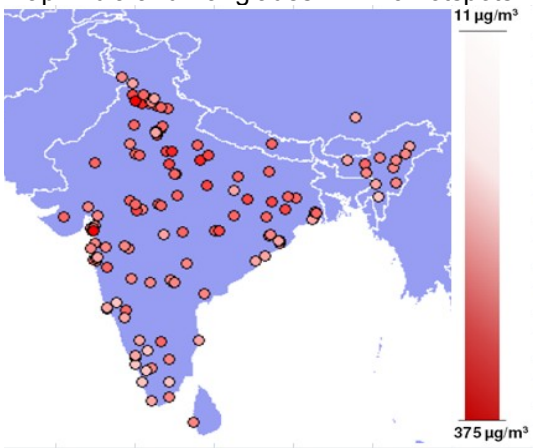
Figure 2 Distribution of Asian Cities relative to 2008 PM_{10} concentration.



WHO = World Health Organization; AQG = air quality guideline; IT = interim target; $\mu g/m^3$ = microgram per

Source: Clean Air Initiative for Asian Cities (CAI-Asia) Center, 2010. "Air Quality in Asia: Status and Trends – 2010 Edition". Pasig City, Philippines.

Map: India and Bangladesh PM10 hotspots in 2008



Source: Clean Air Initiative for Asian Cities (CAI-Asia) Center, 2010. "Air Quality in Asia: Status and Trends – 2010 Edition". Pasig City, Philippines.

A joint report of World Health Organization's (WHO), United Nations Environment Programme (UNEP) among others called *Air Pollution in Megacities of Asia, 2002,* shows that since 1990, there has been a consistent increase in PM10 levels across the region, which shows a distinct regional pattern. The Boston-based Health Effects Institute (HEI) reports that annual mean PM10 levels tend to be higher in middle-income east Asian — mainly Chinese — cities, and in lower-income south Asian — mainly Indian — cities compared to middle or high-income Asian cities, including Bangkok, Busan, Hong Kong and Seoul. One of the cleanest in Asia is Singapore. Beijing, Shanghai, Hanoi, Kathmandu and Jakarta are reeling under severe PM10 load. Particularly, in south Asian countries like Pakistan, Bangladesh, Sri Lanka and Nepal, fine particulate pollution has acquired worrisome proportions.

Particulate trend

Reviews of air quality trends in Asia shows that PM10 concentrations in Asia also have been declining but this does not necessarily means that cities are meeting the clean air standards. Review by the HEI in 2010 'Outdoor Air Pollution and Health in the Developing Countries of Asia: A Comprehensive Review' shows that the aggregated annual average in Asian cities decreased by approximately 25% between 1993 and 2005, as compared with the reduction by about 50% in SO2 concentrations over the same period.[16] Although PM2.5 is not yet part of most regulatory ambient air quality monitoring networks in Asia, several studies have conducted systematic monitoring of PM2.5 and PM10 in Asian cities. A study by HEI points out that annual average PM2.5 concentrations are generally above 25 microgramme per cubic metre (micro-gm/cu.m) and as high as 150 micro-gm/cu.m, with PM2.5:PM10 ratios ranging from roughly 0.4 to 0.7 in urban areas of rapidly developing countries in Asia. On the basis of these studies, longterm concentrations well above the WHO guidelines' PM2.5 limit of 10 micro-gm/cu.m would appear to be the norm in urban areas throughout much of Asia.[17]

At high-impact locations (e.g., in traffic) short-term concentrations and concentrations measured indicate that concentrations of PM much higher than the estimated annual average are also present intermittently or in specific geographic areas. The WHO limits for SO2 and NO2 are 50 micro-gm/cu.m and 40 micro-gm/cu.m, respectively, with only Beijing exceeding the SO2 limit and 9 cities (Bangkok, Busan, Hong Kong, Jakarta, Kolkata, Seoul, Shanghai, Taipei, and Tokyo) of 20 major cities exceeding the NO2 limit.[18]

SO2 trends

Annual trends in air quality (1993–2005) across major Asian cities suggest a significant downward trend in annual average SO2 concentrations in urban areas in contrast to the increase in overall country-level emissions, with the exception of an average increase in SO2 concentration during 2005. These SO2 reductions occurred in spite of increasing fuel consumption. Regulations requiring the use of low-sulfur fuels and relocation of major coal-fired power plants and industrial facilities to outside of cities were responsible for these decreases. Overall, the trends in urban air quality measurements of SO2 broadly follow the emission estimates described earlier in this section. However, the emission estimates suggest a substantial increase in SO2 emissions at the country level in Asia that has been driven by increases in industrial emissions in China since 2002.[19]

In focus: air quality challenges in Dhaka and Delhi

Dhaka

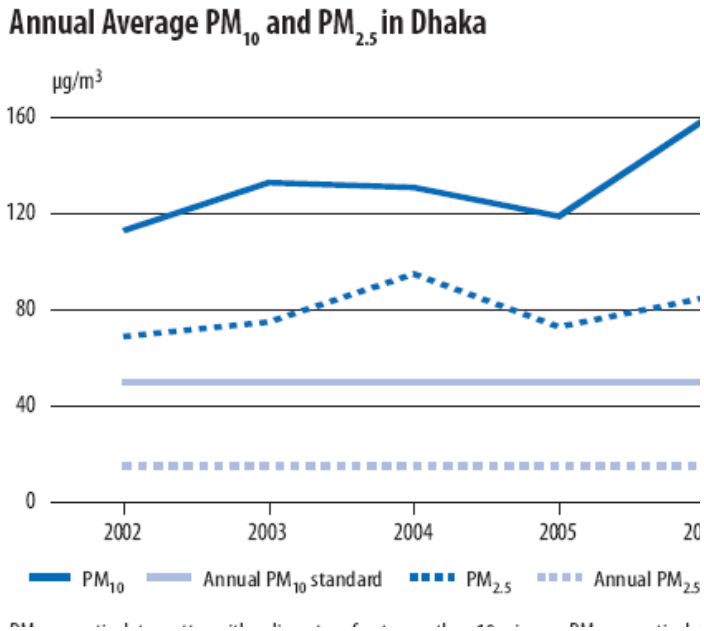
A Country Environmental Assessment (2006) conducted jointly by the Government of Bangladesh (GOB) and the World Bank identified air pollution as the leading cause of mortality and morbidity in Bangladesh. It is estimated that if the exposure to urban air pollution were reduced by 20% to 80%, it would result in saving 1,200 to 3,500 lives annually and avoiding 80 to 230 million cases of disease.[20] In economic terms, this is equivalent to an

estimated US$170 to 500 million in savings due to reduced health care costs and increased productivity per annum[21]

According to reports air quality has a taken a reverse trend in Dhaka, Media reports that Dhaka's air quality has almost returned to its notorious levels as a rise in vehicle numbers, brick kilns, and building constructions wiped out improvements made by the phasing out of two-stroke vehicles in 2003. The annual average of PM have risen significantly despite a massive dip in pollution levels in 2004 after the ban on two-stroke vehicles in 2003.

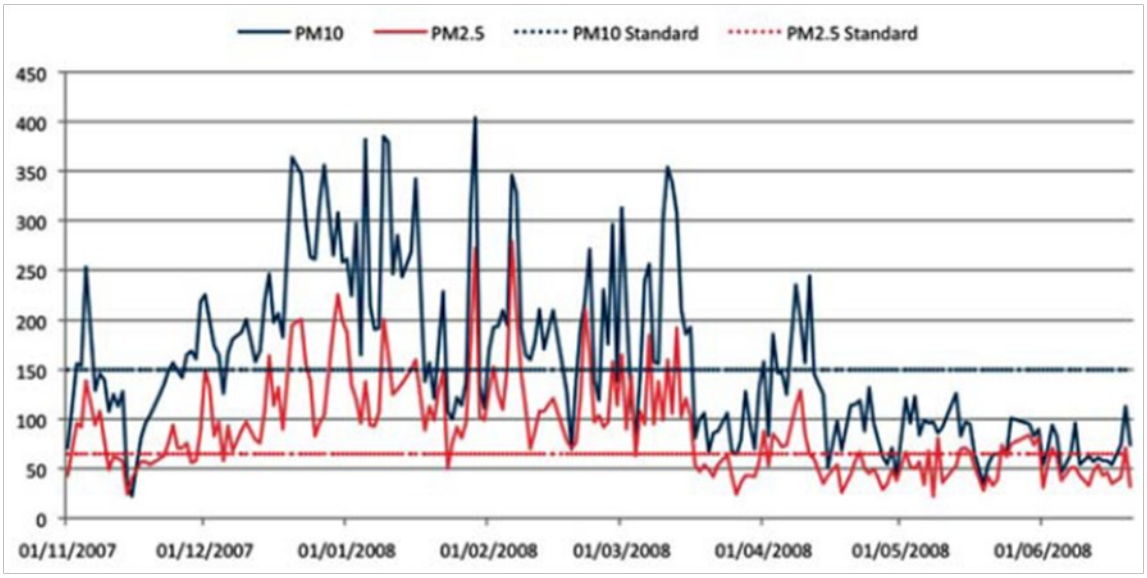
The levels of PM2.5 levels were nearly halved when they dropped from 266 micrograms per cubic metre in 2003 to 147 micrograms per cubic metre in 2004. By 2008, PM2.5 levels rose to 191.83 micrograms per cubic metre. PM10 levels had also improved dropping from 330 micrograms per cubic metre in 2003 to 238 micrograms per cubic metre in 2004 but it went up to 291 micrograms per cubic metre in 2008. [22]

Reports blame the rise of diesel-run buses and trucks and the large number of unfit and dilapidated vehicles that refuse to retire from the capital's roads, spewing out more pollutants than new, reconditioned and well-maintained combustion engines.[23]



Source: Country synthesis report on urban air quality management, Bangladesh, discussion draft, December 2006, Asian Development Bank, CAI Asia

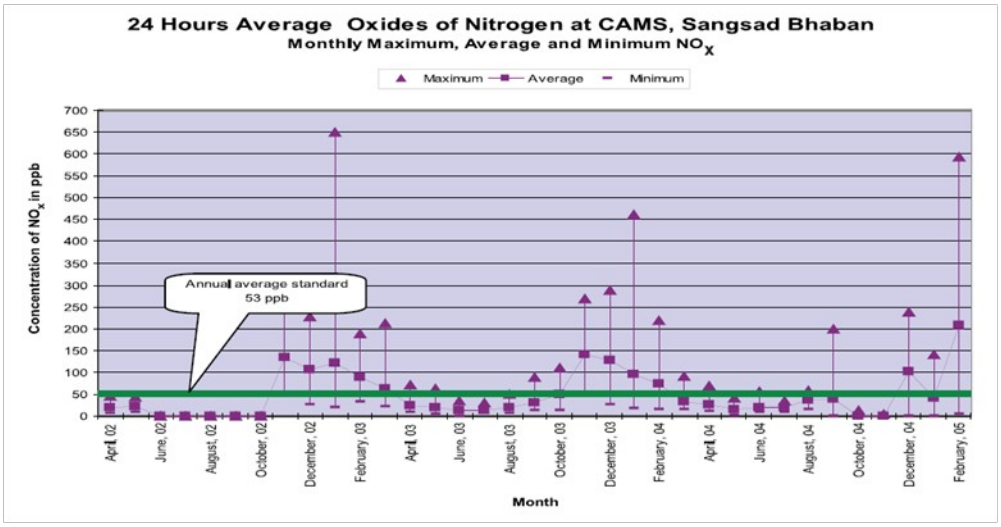
Graph: 24-hourly PM trend in Dhaka (November 2007 to June 2008)



Source: Counting the Cost of Vehicular Pollution in Dhaka, Bangladesh, Policy brief, No, 43-10, May 2010, SANDEE

NO2 trends

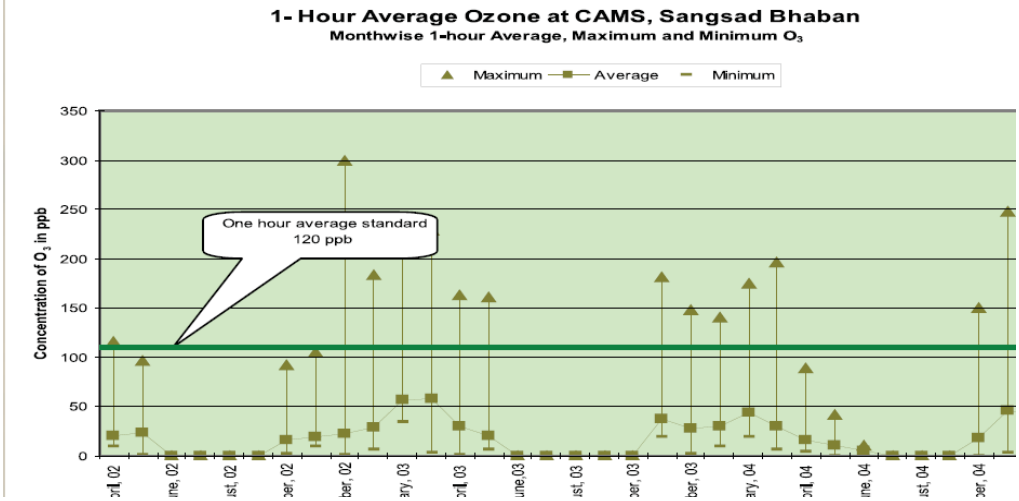
NOx levels in Dhaka exceeds the NO2 levels in Sangsad Bhaban exceed the safe levels during the winter months.



Source: Male declaration: on control and prevention of air pollution and its likely transboundary effects of South Asia: Bangladesh, Status of Implementation 2008

Ozone

Short term peaks exceeds the standard



Source: Male declaration: on control and prevention of air pollution and its likely transboundary effects of South Asia: Bangladesh, Status of Implementation 2008

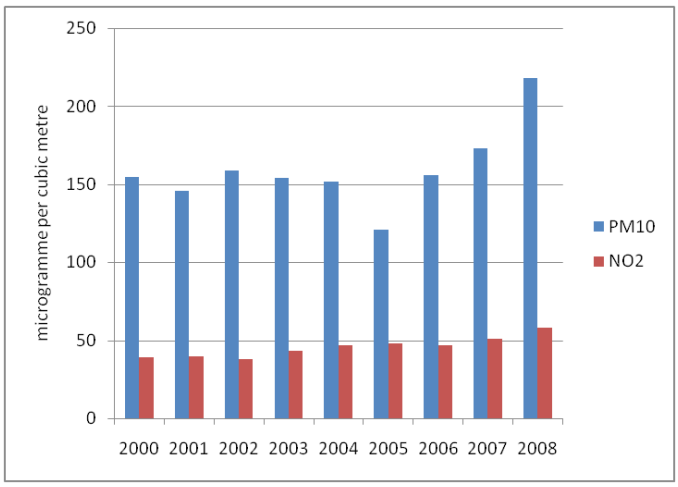
In Dhaka media reports blame significant rise in diesel-run buses, trucks and other vehicles has led to the increasing pollution levels. A large number of unfit, old and diesel-run vehicles continue to ply Dhaka streets worsening the pollution levels. At least 25 percent of vehicles in Dhaka are over 20 years old. Among the other sources brick kilns and factories are considered contributors to the rising pollution levels. The rise in air pollution has also increased the number of people suffering from bronchial diseases like asthma.[24]

Delhi

When the first phase of action was initiated in the city, Delhi had relatively lower level of PM10 at 159 microgramme per cubic metre. With onset of action to control emissions the levels of PM10 dipped to 121 microgramme per cubic metre in 2005, however since than the levels show an increase over the years, reaching to 218 microgramme per cubic metre in 2008. This is about 3.6 times higher than the India's national ambient air quality standards of 60 microgramme per cubic metre for PM10. The fall in "critical" zone as per the official air quality classification system which specifies the critical air quality once the annual levels exceed the standard by more than 1.5 times. Without aggressive measures the city may lose its breathing space. The PM10 levels in many big cities in India such as Hyderabad, Bangalore and Mumbai also show an increasing trend after few years of downward trend during 2002-2008.

- Levels of nitrogen oxides (NOx) are consistently increasing in the city and are above the standard (the air quality standard for nitrogen dioxide has been significantly tightened in 2009 and standard is 40 microgramme per cubic metre). The annual levels have increased from 43 microgramme per cubic metre in 2003 to 58 microgramme per cubic metre which is nearly 1.4 times higher. Further assessments of road side levels of NOx in the city are needed to understand the exposure levels of city dwellers.

Graph: PM10 and NO2 in Delhi
(PM standard 60, NO2 standard 40 microgramme per cubic metre)



Source: CPCB

- The city needs to take tough measures to control growing air pollution and fast. Otherwise, the city, will find itself in the toxic haze of the early days.

- The PM2.5 levels in Delhi often exceed the safe levels and especially during the winter season the levels reach the critical range as well. For instance, the PM2.5 levels exceeded the standards on 12 days in August 2010 But in November and the first week of December 2010 all days have violated the standards and the levels have also hit "critical level" which is more than 1.5 times the standards.
- Studies in the US show that an increase of only 10 microgramme/cu m of particulate matter of less than 2.5 micron (PM2.5) is associated with significant increases in health risks. High exposure to PM2.5 is known to lead to increased hospitalisation for asthma, lung diseases, chronic bronchitis and heart damage. Long-term exposure can cause lung cancer. Rising level of nitrogen oxides can also have serious implications for respiratory diseases.

Where is the pollution coming from?

Health Effects Institute in its 2010 review 'Outdoor air pollution and health in the developing countries of Asia" have summarized many studies conducted in Dhaka on sources of pollution. In traffic areas in central Dhaka, 50% of the total fine-particle mass could be attributed to motor vehicles, including those with two-stroke engines. In Rajshahi, a smaller city in the western part of Bangladesh, wood burning contributed 50% of the fine-particle mass, with a 23% contribution from motor vehicles. [25]

In the study 'Key issues in controlling air pollutants in Dhaka, Bangladesh' the scientists from Atomic Energy Centre, Dhaka, Department of Environment, Govt. of Bangladesh and Clarkson University conducted Particulate matter (PM) sampling 2005-2006. The study observed that vehicular emissions and emission from brick kiln are the major contributors to air pollution in Dhaka especially in the dry seasons, while contribution from emissions from metal smelters increases during rainy seasons.[26]

Vehicles pose a special challenge

We need stringent action in all the sectors to attain clean air. But vehicles are a special problem. Why?

Vehicle fumes cause maximum health exposure:
Vehicles are of very special concern because vehicle emissions take place within the breathing zone of the people. This increases our daily exposure to deadly dose of toxins. Vehicles are responsible for the maximum amount of human exposure to air pollution. Studies carried out by the World Bank in other cities have shown that nearly half of the total exposure to particulates that make people ill could be due the vehicles. That is why vehicles require more stringent measures.

Galloping number: Motorisation challenges in Delhi and Dhaka

The rapidly growing mega cities in South Asia already have serious concerns about the likely adverse impact of motorization on the rapidly growing cities. The scale of mobility crisis in the cities is showing its impacts – growing pollution, congestion, energy guzzling, and edging out of public transport and non-motorised transport by personal transport. Do we require some immediate and effective policies, and implementation to be on the sustainable growth path at this early stage of motorization?

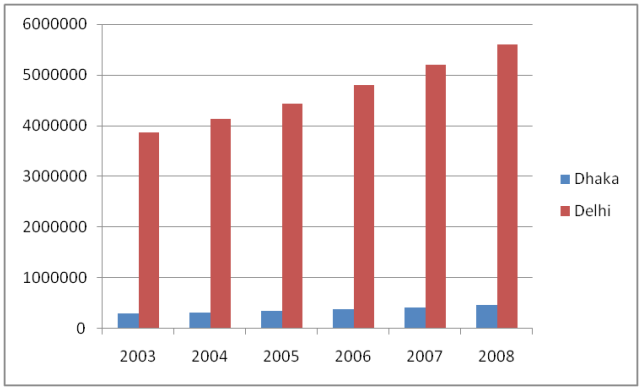
In Dhaka the annual vehicle registrations have almost doubled since 2005. Dhaka has registered about 5,27,285 vehicles as of 2009 with annual registration of about 56,778 vehicles during 2009. Delhi also faces a mobility crisis as vehicles registrations are about 1000 vehicles a day.

Strong public opinion, judicial and executive actions have accelerated action in many cities in India. The common minimum programme is evolving with milestones and timeline. Especially in India the city action planning for clean air has created an opportunity for change. This provides the framework for controlling different pollution sources – transport, industry, power plants and helps to achieve the balance between the composite action and priority action.

Mobility crisis begins to build up in a city when a large share of daily trips is made by personal vehicles that occupy more road space but carry fewer people, pollute more, and edge out walkers, bicycles, buses and intermediate public transport. There are early signs of this crisis. Most cities do not have space left to increase their road space for more personal vehicles – two-wheelers and cars. Existing space has been saturated. Congested roads have slowed down the journey speed led to fuel wastage and pollution.

Compared to Delhi and the rate of motorisation is still lower in Dhaka along with the total vehicle stock of 4,70,507 in 2008, Delhi has about 55,96,699 in 2008. But in terms of cars Dhaka has almost half of car ownership per 1000 people. Delhi has about 85 cars per 1000 and Dhaka has about 27 cars per thousand people. The new vehicle registrations are putting enormous pressure in cities city – as the road space is limited and it is increasingly becoming difficult to increase the road capacity further. To this is added daily influx of vehicles from outside the city and suburban areas poses threat to already congested road space in the cities.

Graph: vehicle registrations in Delhi and Dhaka



Source: Bangladesh Road Transport Authority and Delhi Transport Department

Dependence on personal vehicles is rising steadily in our cities. In mega cities of India the cars and jeeps have higher growth rate than two-wheelers. In terms of numbers both cars and two wheelers occupy the maximum road space. Each new batch of vehicles though a little cleaner barely makes an impact on air quality as its rising numbers swamp the effect. This will change the pollution and congestion profile of the city in the coming years.

In Dhaka, the current transport policy favors an increase in the number of private vehicles in major urban areas and in usage per vehicle. As a result, private cars are clogging major city roads. Non inclusive transport policy making and the minimal availability of land for public space worsen the situation.[27] Bangladesh Development Forum, under the aegis of Ministry of Communications had opined that a single mode of transport is unlikely to meet the total demand, given the rapid changes in commodity types, geographic distribution of trade origins and destinations, and development of domestic markets. As such, a secure, dependable and uninterrupted transport network requires inter-modal connectivity and a multimodal market.[28]

Vehicles threaten energy security

Vehicles not only pollute air but they also threaten energy security. International Energy Agency has predicted that the future increase in energy demand in the transport sector of India will be largely driven by the increase in personal cars. Asian Development Bank has predicted that transport energy use will increase six times by 2020 in India. This is ominous in a country where 72 per cent of the crude oil is imported. Energy imprint of motorization will have to reduced in each city. If energy use increases the emissions of heat trapping carbon dioxide that cause global warming will also increase.

Energy facts:

South Asian countries are highly dependent on imported crude oil and petroleum products. The imports range from 25% of commercial energy consumption in the case of Bhutan to 100% in the case of Maldives. The recent volatility and sharp increase in world oil prices has placed an unexpected and enormous burden on foreign exchange reserves, to the detriment of national economies. While countries like Sri Lanka and Maldives, which lack indigenous fossil fuel sources, are especially hard hit, even countries like India, Pakistan, and Bangladesh now meet less of their demand with indigenous fuel sources and face mounting energy import bills.[29]

Of interest from a national energy security viewpoint are oil, natural gas, hydro, coal, and renewable energy resources. India with an oil resource potential of 5,576 million tones of oil equivalent (mtoe) stands at the top followed by Pakistan 3,600 mtoe and Bangladesh 0.96 mtoe. Pakistan, Bangladesh, India and Afghanistan have gas resources ranging from 120 billion cubic meters (bcm) in Afghanistan to 7,985 bcm in Pakistan. [30]

The countries in the region have developed energy use strategies based on the resources available and the expected demand. Bangladesh intends to meet most of its commercial energy needs from natural gas in the near term. The transport sector is heavily dependent on imported petroleum fuels that are subject to high price volatility, and constitutes an energy security risk for all countries in the region. India, Bangladesh, and Pakistan have introduced compressed natural gas (CNG) as a transport fuel and are actively trying to enhance and expand its use. [31]

Experts opine that although an independent regional gas grid is today only a remote possibility, if major pipelines connecting India or Pakistan with Central Asia or the Middle East materialize, the feasibility of expanding the natural gas grid to Pakistan, India, and Bangladesh could be explored as a step towards the development of a regional gas grid. [32]

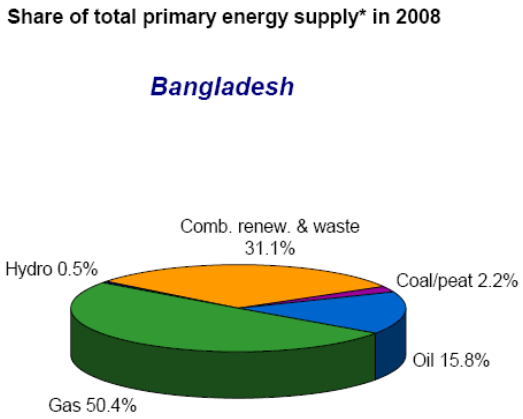
Commercial energy in Bangladesh is dominated by natural gas, particularly in power generation. This is supplemented by imported liquid fuel; indigenous coal is yet to make any significant impact in the energy scenario.[33]

While sustained energy supply is a prerequisite for economic development, current information indicates that the existing gas reserves will be able to meet the gas demand (at 7% per annum) up to 2016 though with the present production capacity it can not meet the existing demand. As such there exists a demand and supply gap. [34]

The demand would reach to 5.6 billion cubic feet by 2025. As the current reserves (12 trillion cubic feet) would be unable to meet the increasing demand, there will a requirement of investments of over $ 9 billion for exploration, development and transmission network expansion by 2025. The current average daily gas production is about 1970 MMCF against actual demand of 2200 MMCF resulting deficit of around 230 MMCF per day. About 3.3 billion tons of coal reserves comprising 5 deposits at depths of 118-1158 meters have been discovered so far. Out

of which 4 deposits (118-509 meters) are extractable at present while one deposit may not be viable for extraction by present day's technology due to greater depth (640-1158 meters). Only one deposit (Barapukuria) has been developed and coal is being extracted mainly for one thermal power plant. [35]

The government, acknowledging the severity of the gas crisis, has taken up an array of medium and long term plans to overcome the prevailing gas shortage. These target oriented projects (drilling of 7 appraisal/development wells, work over of 8 existing gas wells and drilling of 4 exploration wells) are expected to add about 300 mmcfd gas to the network by 2012. A fast track program will cover part of these drilling and a major seismic survey (3100 line km). The long term plan involves drilling of 9 appraisal/development wells and a number of exploration wells in PSC blocks including new blocks under award following Offshore Bidding Round 2008. This segment of activity is expected to add 300-500 mmcfd. There are plans to build permanent LNG terminal to import gas by 2013. Decision has also been taken to install three compressors at different points to improve supply situation of natural gas. The government is also actively seeking to strengthen cooperation in the sub-region involving India, Myanmar and Bangladesh. [36]



Source: IEA

News on the CNG crisis:

According to reports the State-run Bangladesh Oil, Gas and Mineral Corporation, Petrobangla, will double its gas production by 2015 by extracting nearly 1,800 million cubic feet per day (mmcftd) more. "In view of the ever-growing demand for natural gas we have taken massive programmes to produce additional natural gas over the next five years," said Mohammad Hussain Monsur, chairman of Petrobangla. He told Reuters that the demand of natural gas would rise to about at 4,500 mmcftd in 2020. At present Bangladesh's demand for gas is 2,500 mmcftd against the production of about 2,000 mmcftd. Bangladesh Petroleum Exploration and Production Company Limited (BAPEX), the exploration arm of Petrobangla, will drill eight exploratory wells by the year of 2012, Monsur said.[37]

"There may be 3 trillion cubic feet (tcf) of new gas reserves in those eight wells," he said. Monsur said that BAPEX is able to explore on-shore gas fields while Petrobangla was efforting to conduct seismic survey on off-shore gas fields with the help of international oil firms. The government says current gas reserves will run out by 2014-2015 at the present consumption rate. But exploration to tap potential new supplies have lagged as Bangladesh has failed to attract outside investment because of a ban on exports. A shortage of daily supplies forced the government to shut down several fertiliser factories, suspend operations of compressed natural gas filling stations for six hours a day and introduce staggered holidays in industries, crimping economic growth. [38]

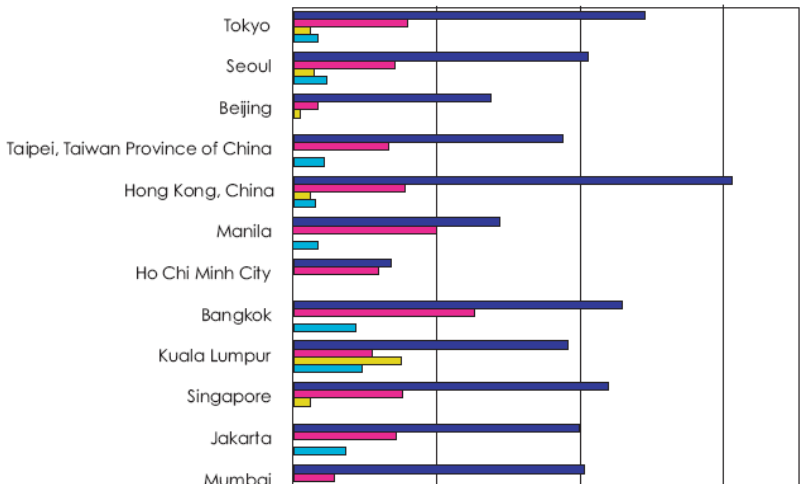
The CNG refilling station owners Sunday called off their proposed strike as the government cut the gas rationing time by two hours from existing six hours, officials said. As per the new decision, the CNG pumps will be shut down from 5:00pm to 9:00pm from today (Monday). Emerging from a fruitful discussion with the CNG owners'

association leaders Sunday, State Minister for Power and Energy Muhammad Enamul Huq told reporters that the government rescheduled gas rationing of the filling stations from 5pm to 9pm daily. The state minister Sunday held meeting with the leaders of the CNG Filling Stations and Conversion Workshop Owners' Association who earlier threatened strike from December 21. Protesting the government's decision on six-hour operation embargo, the filling station owners called the strike from December 21 if the government failed to withdraw the daily six-hour closure before December 20. The government on August 16 set embargo on the operation of the CNG filling stations from 3pm to 9pm every day in a bid to save gas for diversion to domestic users and energy-hungry power plants.[39]

The energy consumption per passenger-kilometer by transportation mode in selected large Asian cities shows that private cars have the highest energy consumption in most cities. Among public transport, buses are the least fuel-efficient mode. Although metros and suburban railways are not so fuel efficient in Kuala Lumpur due to low occupancy, trains generally are the most fuel-efficient urban transport mode.[40]

The easiest way to improve fuel efficiency is to increase vehicle occupancy. Passenger/private car trips currently constitute the most widely used mode of transport in many Asian cities and they have very low occupancy. High occupancy vehicles use fewer trips for carrying the same number of passengers and are thus more efficient. Public transport has a high potential for serving passenger trips at low energy consumption. With high enough load factors, public transport consumes less energy per passenger-kilometer than private transport.[41]

Graph: Energy consumption by transport modes in Asian cities (mega joules per passenger kms)



Source: Study by UITP (2001) cited in source[42]

Action in cities: key measures in Dhaka and Delhi

Dhaka: Key measures introduced in Dhaka

- Phase out of leaded petrol in 1999.[43]
- Introduction of Compressed Natural Gas (CNG) vehicles
- Introduction of unleaded gasoline from 1st July of 1999
- Notification of lubricant standards on 1st January, 2001
- Banning of two-stroke three wheelers from 1st January, 2003
- Banning of imported reconditioned cars older than 5 years
- Banning of commercial trucks in Dhaka city during day time (8am -10 pm)

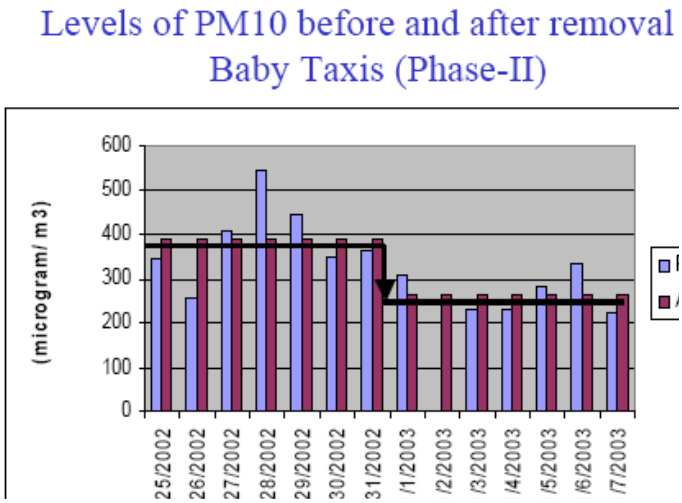
- Ban on trucks older than 25 years and buses older than 20 years from 2002
- Introduction of ambient air quality standards
- Introduction of EURO I for new diesel and EURO II for petrol vehicles from 2005
- Introduction of in use vehicle emission standards from 2005. [44]

Significant Achievements

- Introduction of 13,000 CNG 3-wheelers in Dhaka City as replacement of about 40,000 two stroke 3-wheelers in 2003[45];
- Introduction of 13,000 CNG 3-wheelers in Chittagong City in 2005[46];
- Introduction of CNG buses in Dhaka City in parallel with Diesel vehicles from 2003. At present there are 1600 CNG buses in Dhaka City[47];
- All 4500 Diesel bus/mini-buses plying in Dhaka, have been converted into CNG buses[48];
- A Circular water way has been introduced around Dhaka city from 2007 in order to reduce traffic congestion and pollution[49];

Replacement/conversion of all Diesel bus/minibus by CNG fueled bus/minibus by 2008 in Dhaka & Chittagong Metropolis has helped to cut down the emissions. But experts say that import of all old buses and trucks and import of old Diesel engines should be stopped and fuel quality norms should be tightened further.[50]

In the past few years, Dhaka has taken steps to reduce pollution, these measures have helped to arrest the runaway pollution in the city, but the levels are still higher. The fuel quality improvements helps as experienced in Dhaka with the replacement of two-stroke, three wheeled taxis fueled by compressed natural gas (CNG) resulted in decrease in pollution as PM10 and PM2.5 declined 30% and 40%, respectively, immediately after the ban.[51]



Source: 3rd-EST-Forum. Bangladesh Country Paper, Presentation by AMM Nasir Uddin (Planning Commission), Tazul Islam Chowdhuri (Ministry of Communication), Md Shahjahan (Department of Environment), Government of Bangladesh

Delhi Action on vehicles:

Delhi has fought hard to get breathing space
On vehicles
Introduced low sulphur fuels and petrol with 1 per cent benzene
Mandated pre-mix petrol to two- and three-wheelers
Moved from Euro I to Euro IV over the last decade
Implemented largest ever CNG based public transport programme (3,50,000 total CNG vehicles in the city, 203 refuelling stations, including more than 10,000 CNG buses)
Capped the number of three-wheelers

Phased out 15 year old commercial vehicles
Strengthened vehicle inspection programme (PUC)
Efforts made to divert transit traffic
Set up independent fuel testing laboratories to check fuel adulteration

On industry
Relocated polluting units
Tighter controls on power plants. No new power plants.

Air quality monitoring
Adopted new ambient air quality standards
Expanded air quality monitoring and reporting

Other sources
Emissions standards for generator sets
Ban on open burning of biomass

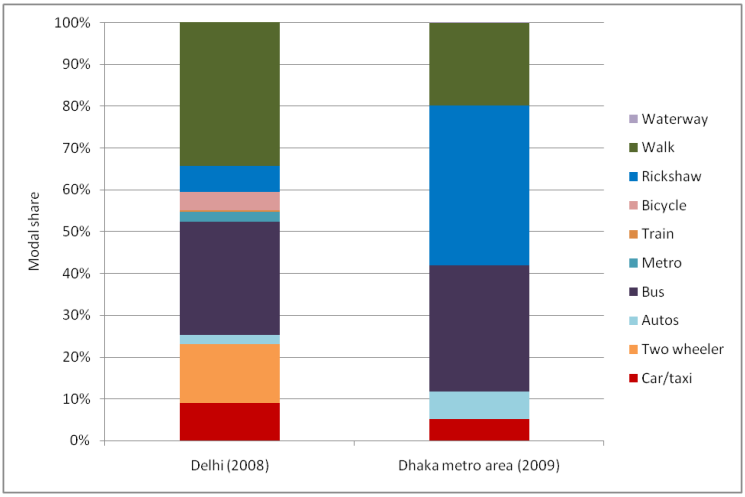
This now needs scale and stringent enforcement

Impact: Even without looking at the air quality data, people can feel the change in Delhi. The haze is thinner, the air clearer. Despite being one of the most polluted cities in the country, Delhi has succeeded in arresting the runaway air pollution. The Supreme Court's action and consistent directions have helped in the turn-around. These have, in a large measure, helped stabilise PM10 pollution in Delhi (ITO), the key target of action between March 1998 and December 2005. The CPCB has also reported a 24 per cent drop in PM10 levels in 2002 compared to 1996 levels.

For future action it is important to understand South Asia's strength

Even though personal vehicles -- cars and two-wheelers -- are the largest part of the vehicle fleet and are crowding the city, and their combined share in meeting the daily travel needs in the cities is miniscule. Therefore it is important to note that more than 2/3rd of the travel needs are met by the public transport systems, intermediate para-transit (autos/tempos), cycles, and walking in our cities. Majority of the city dwellers still use more sustainable forms of transport. This reflects the strength that our cities have. The usage of more sustainable model of public transport, intermediate transport and cycling and walking is still high. Urban and transportation plans should be made for these urban majority and not the car owning minority. Dhaka and Delhi -- both cities have advantage of very high share of green commuting modes. In case of Dhaka the rickshaws have highest share (38.3%) whereas in case of Delhi walking as a mode had a highest share (34.3%).

Graph: Modal share in Dhaka and Delhi
(Modal share shows the percentage of travelers using a particular type of transportation)



Source: Graph prepared on the basis of:
1. 'Developments in Environmentally sustainable transport in Bangladesh', Ministry of Environment and

Forests & Ministry of Communication, Thailand, 23 – 25 August 2010
2. Anon 2008, transport demand forecast study: study and development of an integrated cum multi modal public transport network for NCT of Delhi, RITES, et al, September

Delhi has not been able to solve its problem of pollution and congestion by building more roads and flyovers for cars. Delhi is most privileged to have more than 21 per cent of its geographical area under road space. Delhi has built the maximum roads and flyovers. Yet its roads are totally gridlocked. Peak hour traffic has even slumped to below 15 km/hour. Cars and two-wheelers in Delhi occupy 90 per cent of the road space but meet less than 20 per cent of the travel demand. More roads are not the answer. Evidence in Delhi is clear. Because of its pro-car policies Delhi could not protect its initial strength -- 60 per cent ridership of its buses during the early part of this decade. By 2008 the bus ridership share has fallen to 43 per cent and it will reduce further if urgent public transport policies and infrastructure for bicycles and walk are not implemented. Delhi is also now focusing on building public transport and policies for pedestrians and cyclists.

We must not repeat the mistake of following pro car policies. Our cities still have the chance to plan its future growth differently and avoid the path of pollution, congestion and energy guzzling. More road space is not the answer. Cities need to redesign their existing space and travel pattern to provide the majority of the people affordable and efficient mode of transport that can be an alternative to personal vehicles. We must build on this strength.

Dhaka contemplating car restrain:

The government of Bangladesh is planning to restrict the movement of private cars in Dhaka to reduce nagging traffic jam. “Private cars with less than four or five passengers will not be allowed to ply the city streets,” Finance Minister AMA Muhith told reporters at his Secretariat office yesterday. The minister said the government is thinking about restricting private cars to make public transport system more efficient. But he did not say when this decision would come into effect. He admitted the government's failure in controlling the traffic situation in Dhaka. Former director of UN ESCAP and a transport expert Dr Rahamatullah welcomed the government move but not without reservations. “It [restriction] is very much in system. But you cannot do it unless you develop your public transport system,” he said. He opposed the disallowing of cars on streets carrying less than four to five passengers. “You can impose penalties instead of stopping cars,” he said. The restriction should be imposed on certain areas, not on all roads, he added. [52]

He cited examples of Bangkok, Singapore and the US. In Singapore, a car with four passengers does not have to pay congestion charge while in the US a car with more than two passengers is allowed to use the carpool lane. Bangkok encourages carpooling too. He suggested that the government introduces luxury air-conditioned bus services, like Bangkok has done, to get the wealthy more interested in using public transport. Not letting cars on Dhaka streets, unless it is packed with passengers, could be a first. Many cities impose hefty fees on vehicles jamming up city centres but they are never prevented from plying. In London a stiff congestion charge is levied on private vehicles for using roads in certain parts of the British capital. Almost all major cities in Europe, the US and Asia apply some kind of similar restrictions.[53]

The Delhi High Court in early 2010 made a decisive intervention into regulating movement of vehicles in the Indian capital. The court suggested imposition of congestion fee on cars entering certain parts of the city to reduce severe traffic congestion. Meanwhile, Muhith said the cabinet approved a proposal to buy 255 buses to make the public transport system more effective. The buses will be purchased from Korea at Tk 212 crore for the state-run Bangladesh Road Transport Corporation. He criticised the public transport operators saying that the way they are running now cannot be called public transport. “A few people are creating anarchy in the sector and looting public money,” he said. Dhaka, the capital city of Bangladesh, has got numerous problems. But the most irritating one is the ever-increasing travel-time due to clogging up of roads by vehicles. Quite often, vehicles need to wait for half an hour or more at a single set of lights. Even though the government assumed power promising to ease traffic congestions, the city dwellers have not seen any significant progress in two years. Muhith said, “Traffic jam is the biggest allegation against this government and the other allegations raised by the opposition BNP are bogus and baseless."[54]

Agenda for action. The future in our hands

If cities do not want to wheeze choke and sneeze then it has to act now. Its work with gaseous fuel programme shows that it can make a difference. It is time to set new terms of action. The rapidly rising vehicular fleet must emit as little as possible and therefore, technological improvements must take place as fast as possible. But technical measures alone cannot achieve the desired target for emissions reduction if the increasing number of vehicles is not checked. Sheer volume of vehicles threatens to destroy the gains of pollution control.

1. Strengthen the CNG initiative and improve technology roadmap: Efforts to clean up the vehicle technology must be accelerated. The CNG programme has been the first opportunity to leapfrog beyond the polluting diesel technologies and two-stroke engines. The environment benefit of this programme has been further enhanced because this is linked with a public transport augmentation plan. CNG buses and CNG autos are an important part of this programme.

In Dhaka and Delhi the CNG programme has the potential to reduce highly toxic particulate pollution. A diesel bus emits 46 times higher particulates than a CNG bus as tests conducted in India have indicated. CNG programme will help to prevent highly toxic diesel emissions. Diesel vehicles are known to emit higher particles and NOx than their petrol counterparts. According to WHO and other international regulatory and scientific agencies, diesel particulates are carcinogens.

Few countries worldwide have attained an NGV penetration rate higher than 1%. Bangladesh has by far the highest market share of NGVs, albeit with a very limited number of NGVs, almost 180 000 as of 2009..

Table 1: Market share of NGV in total fleet in countries with at least 1% NGV market sh

Country	NGV market share (%)	Country	NGV market s
Bangladesh	61	Tajikistan	5
Armenia	30	India	5
Pakistan	26	Egypt	5
Bolivia	26	Kyrgyzstan	3
Argentina	24	Ukraine	3
Colombia	24	Bulgaria	2
Iran	14	Italy	2
Malaysia	11	Moldova	1
Myanmar	8	Trinidad & Tobago	1
Peru	7	China	1

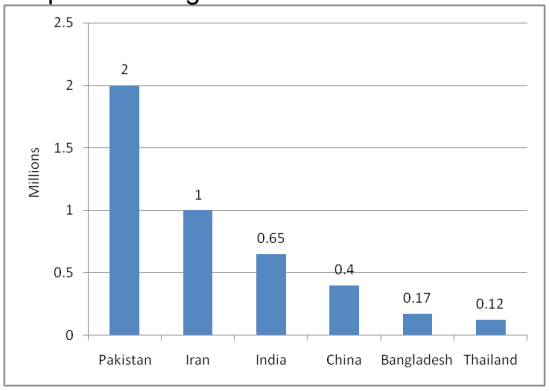
Source: IEA

According to International Association for Natural Gas Vehicles, the natural gas vehicle use in Asia is set to rise (10-15% growth in 2010) with the growth driven by increases in Pakistan, India, China, Iran, Bangladesh and Thailand. Asia is showing the strongest growth worldwide with total vehicle numbers increasing by more than 50% year on year in six out of the past eight years. [55]

The number of vehicles already on the road in Asia is substantial. There were 9.61 million NGVs worldwide at the end of 2008, of which 4.44 million were in Asia, according to statistics from the IANGV. Pakistan led the count with 2 million gas-powered vehicles on the road, while there were another million vehicles in Iran, 650,000 in India, 400,000 in China and 170,405 vehicles in Bangladesh. [56] The majority of Asian NGVs are cars, but buses account for much of the consumption and two- and three wheelers powered by CNG are prominent in Pakistan, India and some southeast Asian countries. [57] In terms of refilling stations also the cities are well equipped, for

instance there are 2600 stations in Pakistan, 1000 stations in China, India had 463 and Bangladesh has 468 stations, respectively.[58]

Graph: Natural gas vehicles in selected Asian countries



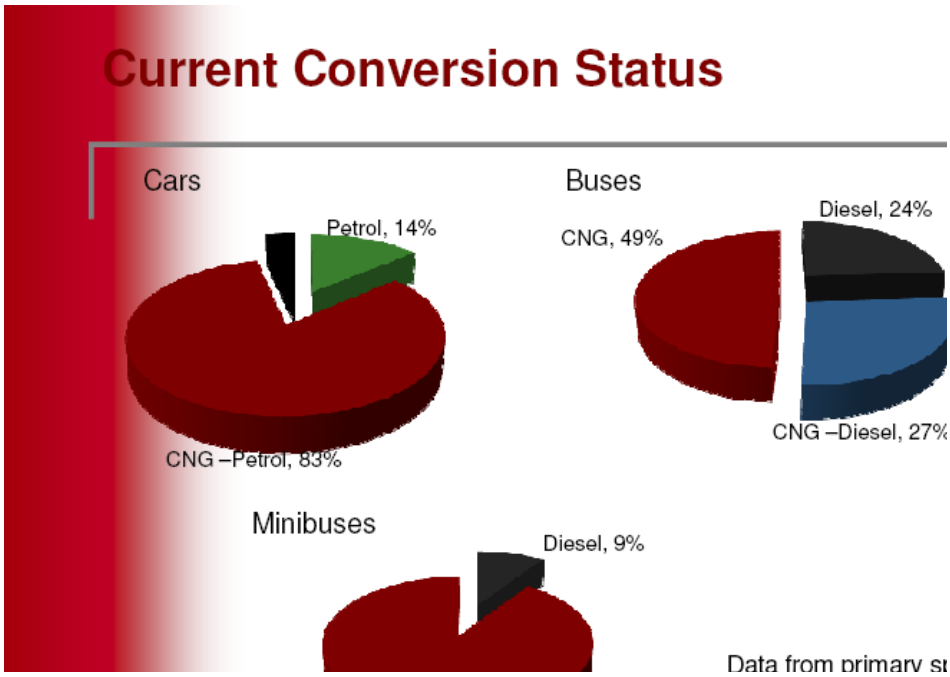
Source: IANGV and Petrobangla

Growth in CNG vehicle populations has been very rapid over the last 2 years in Bangladesh, PRC, Malaysia, Pakistan, and Thailand. Pakistan is the largest user of CNG in Asia, and the Thai Government is aiming to convert half a million vehicles to run on CNG by 2010 to help reduce the country's dependence on oil.[59]

ADB says, when strong governmental action is taken as in Delhi and Dhaka, the externalities of public transport can be substantially improved. Modern buses can generate orders-of-magnitude fewer emissions per passenger-km than private cars and substantially reduce congestion if car usage within the metropolitan areas is inhibited and modal shift is induced.[60] Substantial development gaseous fueled three wheeler in cities including Delhi and Dhaka have required their 3-wheelers to operate on compressed natural gas (CNG), yielding substantial advantages in local pollutants.[61]

In Dhaka the government undertook the step to convert petrol/ diesel-run vehicles into CNG. Of the total 550,000registered vehicles in Dhaka city (registered till 2009), many are already converted into CNG, yet there is a significant number of diesel or petrol-run vehicles play on the streets of Dhaka city. Studies conducted in 2010 in Dhaka reported that about 90 percent of the city vehicles (other than motorcycles), which total roughly 200,000, have switched to CNG already. This includes the more than 6,000 buses and 8,000 minibuses that used to run on diesel. Rising prices of auto fuels in the recent years have contributed to conversion of vehicle engines into CNG.[62]

According to estimations by Zia Wadud & Tanzila Khan from Department of Civil Engineering, Bangladesh University of Engineering and Technology, Due to CNG Dhaka avoided around 4260 premature deaths in 2009. Around BDT 55 billion (USD 0.8 billion) saving which is around 0.9% of GDP.[63]



Source: Zia Wadud & Tanzila Khan 2010, CNG conversion of motor vehicles in Dhaka: Valuation of Co-Benefits, Department of Civil Engineering, Bangladesh University of Engineering and Technology, 9 November 2010, Better Air Quality (BAQ) 2010 Conference, 9-11 November 2010, Singapore

Speed up technology roadmap: Simultaneously, cities must fasten the introduction of more advanced and cleaner vehicle technologies and fuels and tighter standards. Also devise strategies for in-use vehicles – their regular effective emissions inspection and renewal of the old fleet.

2. Reinvent mobility

The cities need to prevent increased dependence on personal vehicles and provide affordable, comfortable and attractive alternatives for mobility to the majority of the city dwellers. Redistribute road space according to the users not vehicles,

Need city transportation and mobility plan: In India the cities are already required to prepare a comprehensive mobility plan that will include the key strategies for sustainable mobility.

In India the Central government funds are available under the reform based Jawaharlal Nehru National Urban Renewal Mission (JNNURM) for urban transportation. This one time JNNURM bus scheme is tied to conditional reforms in the transport sector. To access this fund the city government will have to initiate institutional reforms for public transport management and implementation, create dedicated funds from revenues from a variety of heads including higher taxes on personal vehicles and diesel cars, implement parking policy as a car restraint measure, use advertisement policy for revenue, reform bus sector for more efficient delivery, make land-use changes among others. There is a perceptive shift in the focus in the government funding in India, from road based projects and flyovers to public transport.

If the infrastructure investments and schemes are leveraged based on the city mobility plan the transport sector of the city can be transformed substantially and made sustainable. This can influence the way people travel. The cities can gain substantially if the priority areas for sustainable mobility can be identified at the early stages of its mobility planning.

Build integrated public transport:

Expand bus fleet-- it helps in reducing emissions and energy demand:

Asian Development Bank in 2006 studied three South Asian cities—Bangalore, Dhaka, and Colombo—to analyze the transportation, energy demand, and emissions scenarios over the next 15 years (up to 2020).

In Bangalore the study found that an increase in public transport share from 62 percent to 80 percent leads to a fuel saving of 765,320 tons of oil equivalent, which is equivalent to about 21 percent of the fuel consumed in the baseline case. The other advantages that ensue are a 23 percent reduction in total vehicles (642,328), road space creation (equivalent to removing 418,210 cars from the road), and less traffic congestion. Air pollution in the city drops significantly: a 40 percent drop in carbon monoxide (CO), 46 percent in hydrocarbons (HC), 6 percent in nitrogen oxides (NOx), and 29 percent in particulate matter (PM). The total carbon dioxide (CO2) mitigation potential over the 15-year period is 13 percent.[64]

In Dhaka An increase in public transport share from 24% to 60% leads to a fuel saving of 106,360 tons of oil equivalent, which is equivalent to about 15% of the fuel consumed in the baseline case. The other advantages that ensue are a 39% reduction in total vehicles (99,294), road space creation (equivalent to removing 78,718 cars from the road), and reduced traffic congestion. Air pollution in the city drops significantly: a 24% drop in CO, 26% in HC, <1% in NOx, and 13% in PM. The total CO2 mitigation potential over the 15-year period is 9%.

In Colombo a marginal increase in public transport share from 76% to 80% in Colombo leads to a fuel saving of 104,720 tons of oil equivalent, which is equivalent to about 3% of the fuel consumed in the baseline case.[65] The other advantages that ensue are a 5% reduction in total vehicles (47,716), road space creation (equivalent to removing 62,152 cars from the road), and reduced traffic congestion. However, air pollution in the city does not drop much, as the city already depends heavily on public transport and the CO2 mitigation potential is around 2%.[66]

Therefore cities that are in the process of building their bus fleet have advantages to avert the energy and air pollution impacts. However before introduction of buses, proper surveys and assessments needs to be carried out to ascertain the critical bus numbers that the city needs, as well there should be plans for rationalisations of the bus routes and integrations with train systems.

Reorganise bus sector for efficient delivery:
Only buying buses will not help. It will require route planning, fare policy, and efficient management model. Wherever possible consider giving traffic priority to the buses to improve their speed. The Transport Corporations in many cities suffer from mismanagement and inefficiencies. Private bus service may require a proper business model and also perhaps cost sharing arrangement. This may cost enormously. Bus reforms are much needed in Indian cities. This is already evident in Delhi that is in the process of revitalizing the bus system. The gap financing that the government is expected to bear can become unaffordable if there are no plans to mobilize revenue. While financial performance of the bus transit system will have to improve by lowering cost of capital, consumables, fuels and staff cost, cities will also have to look a the additional revenue to support the cost of transport.

Tax measure for buses: Public transport will have to be incentivised for public good and environmental benefit. This will require reduction in tax burden to reduce both capital and operational costs of buses. But unfortunately, in most of our Indian cities buses have to shoulder higher tax burden than cars. A cursory review of existing transportation taxes in most cities show severe distortions. While private cars pay a miniscule amount as road tax, buses pay several times more. But cars carry disproportionately lower number of daily commuting trips in comparison to higher road space they occupy, and cause more pollution per passenger. While tax burden on buses should be lowered that on personal cars should increased.

Implementation of fiscal measures to promote public transport should be publicized adequately to make the target groups aware and to encourage them to avail of the benefits. It is also important to monitor the impact from time to time to assess if the schemes are making the desired impact.

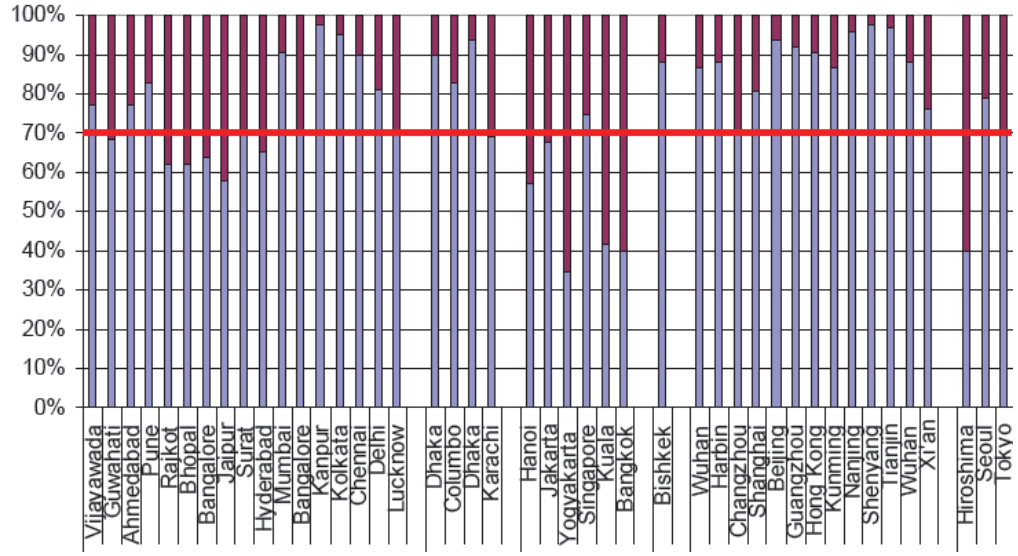
Build funds for public transport: At present there is barely any official scheme in Indian cities to stimulate investment in public transport. National Urban Transport Policy has proposed that the Government should encourage the levy of dedicated tax to be credited to an urban transport fund to exclusively meet urban transport needs. Cities need to look at the variety of measures to generate funds. Higher taxes on personal cars that can also help to lower their usage and hence the congestion, parking revenue, advertisement revenue, road pricing strategies etc. There are examples from other cities. Delhi has imposed an environment cess on diesel to create Air Ambience Fund to fund pollution control efforts in the city. Bangalore and Chennai have introduced higher taxes on older vehicles. Surat has already created a dedicated urban transport fund partly through budgetary allocation and the rest will come from parking revenue, property tax, etc.

Do not neglect NMT, IPT. Strengthen them for linkages to public transport systems:

It is more important to understand how people travel in Asia. Reviews by Asian Development Bank in 2009 shows that many Asian cities have 70 per cent modal share for public transport + non motorized transport. Formal bus system in Delhi actually carries just about 27 per cent of the daily trips and in Dhaka 30 per cent, but a lot more people – the majority – use the either walk (34% in Delhi, 19.8 per cent in Dhaka), or use informal intermediate public transport system such as cycle rixkshaws (in Delhi: cycle-rickshaw 6.36 per cent, auto-rickshaw 2.29 per cent; in Dhaka: cycle-rickshaws 38.3 per cent, auto-rickshaw 6.6 per cent). The combined modal share these systems together cater to a substantially higher travel demand in the city – as high as 94.8 per cent in Dhaka and in Delhi 77 per cent (including all types of public transport, auto & cycle rickshaws, walk, cycle etc.

Therefore, recognizing this strength is crucial for the future development of public transportation in the cities and especially non-motorised transportation which does not find much attention in planning and implementation needs strong policy recognition and support. The cities should focus on developing both its formal and informal mode of transportation including non-motorised transportation linkages in an integrated way and not one at the cost of the other.

Graph: Asia has favourable modal share



Source: Tim Chatterton 2010, Managing Transport Impacts in Asian Mega-Cities, University of the West of England, Bristol, UK, IUAPPA Regional Workshop, Tunis, North Africa

But the cities are already beginning to see the conflict between formal and informal public transport systems. The advent of the intermediate public transport systems is seen as eroding the space of the bus system. However the role of the intermediate public transport of autos should be reorganized as effective feeder for the bus transport and also to link all neighbourhoods efficiently. Routes of the buses will have to be rationalized.

In India concern of lack of integration of IPT with the formal bus transport is leading to competition between these two modes, studies have pointed out. It is also important to recognize that the majority of the trips in South Asian cities are between in the range 0-5 kms. This makes walking, cycling, cycle riskshaws and autos very convenient and appropriate. This will also perhaps help in improving the accessibility to services. But can we attain such high levels of public transport usage without supporting walking, cycling, NMT infrastructure and IPT connectivity?

The transport policy should integrate them with the bus routes, planned BRT and metro routes so that they can work as effective feeders. The cities therefore needs a public transport plan that designs deployment of buses in terms of rationalized routes, affordable fares, quick frequency, efficient organization of bus transport. Simultaneously it should plan how effectively the mass transport systems can be leveraged to further augment the total public transport share. Reorganizing and integrating autos and NMT (See *Box: Rickshaws in Dhaka and Delhi: bane or boon*). Improving their technology levels to increase the comfort levels for the drivers and users is also important. They also need deployment strategies. Do not remove them to create more space for cars. Cars will create more congestion and pollution for a small number of people they carry.

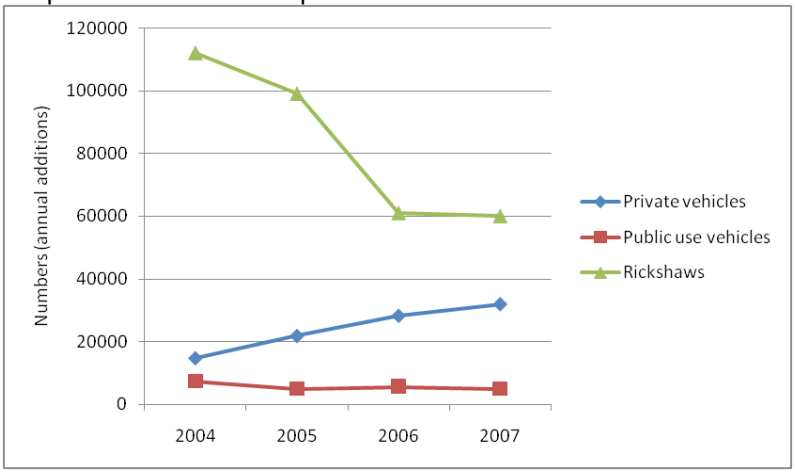
Box: Rickshaws in Dhaka and Delhi: bane or boon

Rickshaws are also often hailed as environmentally-friendly, inexpensive modes of mobility in the Bangladesh. A large number of people in Dhaka depend on this cheapest mode of transport as their only daily use of Vehicle.[67] However the National Land Transport Policy of Bangladesh sets a target that "Over the next 10 years, the target will be to reduce the number of trips made by rickshaw by half[68].

Estimates show that there is one rickshaw for every 25 residents in Dhaka. Dhaka city had only 37 rickshaws in 1941 and 181 rickshaws in 1947. The 'official' rickshaw population of Dhaka in 1972-73 had increased to 14,667 which then doubled to 28,703 in 1982-83, and thereafter increased rapidly to reach more than 88,000 by the end of 1986-87. Rickshaw numbers in Dhaka have continued to grow very rapidly. According to the Institute for Transportation and Development Policy (ITDP) and Strategic Transport Plan of Bangladesh (2005), the total cycle rickshaw population is now estimated at around 500,000.[69]

However now there is reverse trend. Bangladesh which has a great strength in terms of having non-motorised green modes of commuting and for haulage of goods, is putting restrictions on the rickshaws. However still the non-motorised vehicles outnumber the motorized vehicles in the city, as there are about 500,000 non motorized vehicles in the city which is about 1.3 times higher than the motorized vehicles. The growth now favors private vehicles rather rickshaws.

Graph: Vehicle additions per annum



Source: Based on Sunil Kanti Bose and Nojibur Rahman 2009, Country presentation on EST Bangladesh, Government of Bangladesh, 4th Est Forum

Some areas of the Dhaka city have already banned or restricted rickshaws. They are often prohibited in congested areas of major Dhaka city. For example, they were banned in some roads in the Dhaka as not fitting the modern image of the city being promoted by the government. In Dhaka they are no longer permitted on major roads crowded areas of Dhaka, but are still used to provide mobility within individual urban neighborhoods, while they have been criticized for causing congestion. [70]

The ban story started with Dhaka Transport Coordination Board's (DTCB) identification of ten major corridors in Dhaka city and in which the board decided to free all ten corridors from Non-Motorized Transport (NMT, which includes Cycles Rickshaws, Rickshaws, Vans, Bicycles etc.). The project was aimed to demonstrate the impact of NMT withdrawal on the road environment through achieving congestion free traffic movement in arterial corridors and ensuring speed. [71]

Of the ten corridors identified for this purpose, Mirpur Road was chosen as the target area for a Demonstration Project. In addition to other improvement works, this demonstration corridor was prepared NMT free in two phases. At first stage, NMT movement was banned from Amin Bazar to Asad Gate in December 2002, and in the second phase this banning was extended from Asad Gate to Azimpur, in December 2004. However various post-project reviews found that this NMT banning did not yield any major improvement to the transportation system, and in some aspects it caused huge economic burdens to a major portion of road users. [72]

In the study "Quantifying the Impacts of Banning Non Motorized Vehicles from a Major Arterial: Socio-Economic and Safety Evidence" (2010) the researchers assessed the socio-economic and safety impact after banning of NMT in Mirpur Road as a representative of major arterial roads. While the rickshaw ban was intended to improve the transport but this review notes that all survey participants complained that it takes longer now to go to a destination because they have to use multiple modes of transport. The survey showed that "It now takes 2 to 3 times more than the previous period and the travel expenses are also increased almost 1.5 to 2 times previous fare. Moreover, the present situation is not user friendly".[73]

In Dhaka the road traffic security rules require rickshaw to be registered by their owners with the police before they can be legally driven on public roads. Their drivers must carry the police registration documents on road otherwise police sees the rickshaw as the illegal rickshaw, but no driver license is required. The administrative fines are based on the punishment of violation of road traffic regulations. Police in Bangladesh have begun a campaign to remove unlicensed cycle rickshaws from the capital, Dhaka. The authorities say the long-term aim is to halve the city's cycle rickshaws. In major road of Dhaka city, most rickshaws have been replaced by auto-rickshaw, but they can still be found at limited places.

Experts says that the major criticism of the cycle rickshaw as a slow-speed congestion-generating vehicle is valid when considering longer trips on major roads, but for short trips, rickshaws can have a time advantage when walking time and transfer penalties (time consuming transfers to different modes) involved with motorized public transport (PT) vehicles are taken into account. In addition, rickshaws can operate on very narrow streets unsuitable for motorized vehicles; have reduced road space occupancy compared to private automobiles; are fuel-free with minimal environmental impact compared to motorized modes; and are an important source of employment for some of the poorest elements of the Dhaka community. Non motorized transport currently plays a key role in the transport system and urban fabric in cities such as Dhaka and this role is expected to continue for some considerable time into the future. [74]

Experts further say, "given the economic, social and cultural significance of NMT, its environmental benefits, and the magnitude of its role in sustaining the mobility needs of citizens in many Asian cities, it is timely to reconsider the future role of NMT in those cities where it is currently a major component of the transport market. *Rather than simply ignoring or pursuing policies to eliminate NMT, a better approach may be to integrate motorized and nonmotorized vehicles as complementary rather than competitive forces in meeting the comprehensive urban transport demands.* The priority should be to promote better integration of existing NMT into a multi-modal transport system." [75]

In Delhi MCD had capped the number of licenses to operate cycle rickshaws at 100,000. Additionally, it had limited the areas where cycle rickshaws could circulate, granted licenses only to cycle rickshaw owners, and allowed the confiscation and destruction of cycle rickshaws that violated the laws. But in 2010 the Supreme Court

refused to restrict number of rickshaws on Delhi roads. While hearing the appeal of MCD the Supreme Court refused to accept the proposal of Municipal Corporation of Delhi (MCD), which sought restriction on the number of cycle rickshaws plying on Delhi roads. Not only the Supreme Court refused to reverse the High Court verdict on MCD policy to restrict the rickshaws in the city to 99000, the Court even asked the MCD to first consider a cap on other forms of motorised vehicles — TSRs, taxis, two-wheelers, which are more hazardous, before restraining non-motorised cycle-rickshaws. The court sought to know whether there existed a similar cap on other vehicles and what mechanism was in place to identify whether the persons driving are the real owners. MCD, however, attracted the court's attention to the congestion woes of the city that forced the corporation to get cracking on rickshaws, mostly run without licences. But the MCD had no response when the Bench wished to know how many licences were issued to rickshaw-owners.

Build cities for people. Protect high pedestrian traffic:

Even today nearly 20 per cent of daily travel trips in Dhaka (much higher than the trips made by cars – 5.1 per cent), 34.3 per cent in Delhi, and more than half of Mumbai trips are "walk trips". In most Indian cities people who commute by walking outnumber those who use their vehicles. This is an enormous strength in our cities. Our cities were built to be walkable. High density, mixed land use, and narrow streets have made walking for work and recreation comfortable, feasible and popular in traditional Indian cities. More than 40 to 50 per cent of the daily trips in many of our cities have distances less than 5 kilometers.

Even in Dhaka non-motorized transport and pedestrian movements represent more than 50 percent of the total trips, and short trips constitute 76 percent of total trips in Dhaka City.[76] This has enormous potential to convert to non-motorised and especially walking trips. But wrong policies are leading to urban sprawl, increasing journey distances and making cities less walkable.

Even increase in public transport ridership will increase walking as all public transport trips begin and end with walk trips. Even 50 per cent increase in kilometer traveled by public transport would lead to massive increases in walking. Roads will have to be planned with more well designed sidewalks and safe cross walks. Therefore, the city has to plan the pedestrian infrastructure to cater to the present and future demand for walking in the city. Urban poor are too poor to even afford a bus ride for daily commuting. Often the only option for them is to walk.

The renewed interest in walking globally is also a fall out of the urgency to reduce energy, pollution and climate impacts and improve livability of cities. In the western world even health dynamics is playing an important role in reinforcing walking, as a measure to fight obesity.

All new roads must have well and appropriately designed pedetraisn ways that makes walking safe, comfortable and convenient. The pedestrian facilities need to provide the shortest direct route to destinations. Remember, road engineering interventions once made cannot be changed easily but it will permanently decide the design of the network and influence travel choices of people. It is imperative to ensure that road design does not increase dependence on and usage of personal vehicles. That is possible only if policy focus shifts to public transport, walking and cycling.

We need to adopt a pedestrian policy in South Asian cities that will integrate the following elements:

- Integration is the key in South Asian cities as many cities are planning to introduce (Dhaka) or already have (For instance Delhi, Kolkata) mass rapid transit system, bus rapid transit sustem, or have conventional bus network, therefore integrating these with pedestrian walkways is crucial for making mass transport a success.
- Governments should mandate pedestrian plans and make it conditional to infrastructure funding:
- Immediately reform engineering and environmental guidelines for walkways and make their implementation mandatory: Ensure these guidelines are incorporated by all road building agencies.
- Harmonise existing laws for effective implementation: While relevant laws will have to be harmonised it will have to be combined with more direct legal protection of pedestrian space and rights.

- Need a comprehensive Road users act for targeted pedestrianisation; segregation of space by users; system of penalty to prevent encroachment in pedestrian space; prevent usurpation of pedestrian space for motorised traffic without proper justification.
- Urban local bodies must implement walkability audits of pedestrian ways
- Public transport plans must include pedestrian plan for multimodal integration.
- Need zero tolerance policy for accidents

We need a parking policy that reduces congestion

Paul Barter of National University of Singapore in his study (2010) 'The parking Policies in Asian Cities' done for the Asian Development Bank has taken Ahmedabad and Dhaka as South Asian cities for the study. The report says that both cities (and other South Asian cities) face acute on-street parking problems as car ownership accelerates. They are trying to emphasize minimum parking requirements and local government-provided parking. Improving the weak management of on-street parking is crucial but elusive so far. Unrealistic expectations prevail that parking will be cheap for users.[77]

In Ahmedabad and Dhaka, low prices and continued saturation suggests that their pricing policies have not yet embraced pricing as a way to ration demand. However, Dhaka's newly adopted parking policy calls for higher parking prices in the busiest areas, where a "restrictive" parking policy is urged (Dhaka Transport Coordination Board 2009). [78]

Dhaka has chaotic on-street parking, including double and even triple-parking by chauffeurs, in key commercial areas and super saturation in key commercial areas is observed for long periods. The study also says that parking impacts on the pedestrian environment is "Severe" this is due to widespread parking across and on pavements, which are often ill-defined.[79]

The on street parking on the one hand is unorganized and causes congestion and severely limits pedestrian space. The review of parking rates in the study shows that Observed on-street parking prices were very low in Dhaka, Ahmedabad, Jakarta, Bangkok, and Kuala Lumpur. Conversely, Taipei city and Seoul stood out with relatively high on-street parking prices and with prices that vary from place to place. Hong Kong; Singapore; and Tokyo have surprisingly moderate on-street parking prices. However, Tokyo and Hong Kong complement their on-street pricing with time limits. If Beijing proceeds with its announced April 2010 doubling of city-center on-street parking prices, its rates will be comparable with those of these three rich cities. [80]

In this review city motorization rates have been classified according to population classes. By this criterion, the longer-motorizing group is Tokyo, Singapore, and Hong Kong; together with Taipei city, Kuala Lumpur, and Bangkok; and Seoul, Jakarta, and Manila. These cities might be expected to have well-established ways of handling parking. [81]

The second newly-motorizing group is Beijing and Guangzhou with Hanoi, Ahmedabad, and Dhaka (which are only now or very recently reaching this range of car ownership). (Dhaka has 27 cars 1000 persons and Ahmedabad has 55 cars per 1000 persons.) These have seen accelerating rates of car ownership within the last 10 years, so that it is only within the last few years that they have needed to grapple with parking problems at a scale that demands a significant policy response. Mass car ownership is a recent phenomenon in mainland Chinese cities, even though they now have car ownership higher than in Hong Kong or Manila. [82]

In Dhaka, it is proposed in the 2009 parking policy to impose a deficiency payment even on older buildings lacking parking up to newly increased standards. However, this is not really a sign of flexibility (Dhaka Transport Coordination Board 2009). In this city with only 30 cars per 1,000 persons, every residential building is expected to have some car parking space. [83]

Many cities in South Asia face difficulties enforcing their parking requirements, with developers and building managers often finding it tempting to divert planned parking space to other uses. In the South Asian cities for instance in Ahmedabad and Dhaka, this has led recently to dramatic enforcement action involving demolitions of basement shops. It is also allegedly a source of corruption of local government officials.[84] According to the

analysis of the views on parking supply Dhaka has "Concern over shortage. Commercial areas with chaotic on-street parking—to extreme extent in some areas. Buildings illegally diverting parking space to other uses. Architecture profession pushing for higher parking requirements. Frustration at slow progress of local government efforts to build off-street parking facilities." [85]

The on road parking takes away the effective carriage way is the normal practice in many cities in India. The demand for parking hurtles our cities towards congestion nightmare, it also devours scarce urban land, aggravates pollution and leads to social tension. Parking entails enormous cost. Normally, city governments focus only on creating more and more parking space. But it is also important to use parking policy to restrain usage of personal vehicles and encourage public transport. With the phenomenal increase in number of vehicle the city roads in several places gets choked with parked vehicles. In India an assessment of the Union Ministry of Urban Development shows that the problem of on-street parking is turning out to be a major problem. Close to 29 per cent of road length in Hyderabad is used for parking whereas the same in Delhi, Kolkata and Mumbai is 14 per cent, 19 per cent and 16 per cent respectively.

Parking supply and demand presents a very grim picture in many Indian cities. Lack of or misuse of parking spaces for other purposes in commercial areas lead to vehicle spillovers and on street and free parking also leads to haphazard parking and slow traffic movement therefore it must be recognized that only increasing parking spaces will not help to solve the problem. The parking policy must integrate the following principles to reduce demand for parking and also use parking to promote other sustainable modes of travel:

Use multilevel parking as much as possible for integrating public transport modes (buses, trains etc) and pedestrianisation of city centres. People can park their personal vehicles in these parking structures and use public transport or walk.

- **Introduce variable parking rates** according to peak hour, duration of stay etc. The intelligent parking system through card readers which automatically note down the check-in and check-out timings of the vehicles at the parking lots and deduct the charges from the pre-paid cards cash balance for the used time has been found to be yielding good results and resultant parking discipline has considerably improved. However it should be coupled with high charges so that people prefer to visit commercial areas in public transport.

- **The parking charges in multilevel parking should be linked to the actual cost of providing the parking**. Car parking should not be subsidized. Estimates from Delhi show that the cost of providing parking in multi level parking is nearly Rs 4 lakh to 6 lakh per car space. This translates into a parking fee of at lest Rs 30-39 per hour. But people have got used to paying paltry for using high cost services. The existing policy perpetrates hidden subsidy to rich car owners as the cost of using up scarce and valuable urban space for parking are not recovered through proper pricing and taxes. Worldwide experience shows that appropriately priced parking can influence demand for parking and commuter choice for alternatives.

- **Free parking should not be allowed for cars but it must by free for non-motorised transport** (cycles and cycle rickshaws) and the parking rates should be higher for bigger cars and SUVs *and* roadside parking *should be controlled to p*rotect footpaths/ pavements from parked cars. Unorganized parking is another reason for traffic jam.

o Delhi Parking crisis

In Delhi car boom is aggressively encroaching upon the scarce urban commons. If on an average three car spaces are assumed per car per day -- at the residence, office, and shopping areas, then the current fleet occupies nearly 10 per cent of Delhi's urbanised area. The daily registration of cars (as on 2005) generates demand for 2.5 million sq m – roughly equivalent to 310 international football fields. At the current real estate value the land cost of providing parking of this magnitude is thus enormous. Transport planners consider 23 sq m of land as appropriate to park an average car. This means in a prime business district of Connaught Place the rent of such

an area can be as high as Rs 36,000 per month. But the municipal laws in Delhi make cars pay a miniscule as "misuse parking charge" of Rs 4000 once for lifetime – not even one rupee per hour. If cities continue to opt for more structured parking it will make parking more expensive. The true cost of providing parking is thus never factored into the car dependent infrastructure that has begun to dominate cityscapes.

- **Dhaka parking crisis:**

  In Dhaka almost every part of the city, road space, footpaths, playgrounds, parks, empty lots and so on are sacrificed to provide parking space for private cars at little or no charge. Policies like incorporation of car parking space in buildings and construction of separate parking facilities are ultimately attracting more private cars. Moreover, car parking facility has been made compulsory in the "Bangladesh National Building Code". Recently in "City Center" building at. Motijheel, 10 floors were allocated to car parking place to contain more than 500 cars. According to DCC, more than 4,000 cars are parked in the Motijheel-Dilkusha area daily. Unless the growth of car ownership can be controlled and alternative transport services can be developed, the congestion problem cannot be solved by increasing the parking facility.[86] This government-owned multi-storey public parking facility has been built in the Motijheel office district. Remains partially empty, despite continued super-saturation of the much cheaper on-street parking nearby. Office space is being added above to help make it viable. Local governments seeking private participation for more multi-storey facilities.[87]

  Dhaka's 2009 parking policy document calls for a distinction between areas with non-restrictive and restrictive parking policies, with the latter proposed to have deterrent prices. Indian national government guidance urges parking prices to reflect land prices of each vicinity and this is linked with a TDM rationale (Government of India 2006). The adoption of higher on-street parking prices in central areas of the Chinese cities is also a sign of TDM thinking, although it must be set against efforts to boost public-sector parking supply. [88]

  Paul Barter says, "Unfortunately, so long as enforcement of on-street parking remains weak and so long as parking pricing remains uncommon (as in Ahmedabad) or cheap (as in Dhaka) parking policy progress will be difficult. Better management of on-street parking is essential and should not wait until there is "enough" off-street parking. However, many South Asian cities seem poised in the early stages of a conventional parking policy with the potential to gradually spiral towards a costly and destructive auto-centric approach, as seen in parts of Southeast Asia." [89]

  Saifuddin Ahmed and Maruf Rahman in the paper 'Increase of Traffic Congestion and Private Cars in Dhaka through Planning against Public Interest: A Solution' published by WBB Trust say, "Determine the parking charge on an hourly basis, or fractions thereof in busy parts of the city, considering the location of parking place as well as the parking time to determine a fair market price for parking. Completely disallow all car parking on footpaths."[90]

- **Also limit car infrastructure and augment public transport:** Hong Kong and Tokyo have more restricted car infrastructure in terms of wide roads and parking facilities. Even though Tokyo has one of the highest car ownership in Asia – 350 cars per 1000 people the share of car trips in Tokyo is 29 per cent – much less than Singapore. The lowest share of car trips is in Hong Kong – only 11 per cent – even less than Delhi. Despite high car ownership Tokyo provides less parking slots – only 0.5 slots per 100 sq meters in commercial buildings. But Delhi with 85 cars per 1000 people provides 2-3 parking slots per 100 sq meters. Tokyo has also invested in public transport instead of car centric infrastructure. Let us learn too. The world over it is recognised that demand for parking is infinite and any amount of supply cannot meet this demand if additional measures are not implemented to control car growth and usage and also use parking lever itself to control the demand.

Integrate land-use plan with transportation plan.

South Asian cities already have dense mixed land use planning. This is an opportunity to keep our travel distances short and more amenable to using public transport, cycling, walking etc. Policies should continue to encourage mixed land-use growth and prevent sprawls that increase car dependence.

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