



CENTRE FOR SCIENCE AND ENVIRONMENT

# Conclave of Champion Cities of Asia and Africa on Clean Air and Sustainable Mobility

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Gulmohar Hall  
India Habitat Centre, New Delhi

 #cseconclave

## BRIEFING NOTE

Traffic congestion and worsening air quality in cities of Africa and Asia is a cause for concern

But these cities also have the opportunity to plan differently and leapfrog emissions standards

- First Asia-Africa Dialogue on Air Quality and Mobility organized by Centre for Science and Environment (CSE), Delhi, India
- Dialogue focused on understanding the experiences of cities in Asia and Africa, explaining the science of air pollution and its control, and on what and how could the various agencies in Asia and Africa work on these issues
- Cities of Africa and Asia have an inherent advantage in their dominant commuting practices: use of public transport and non-motorized vehicles and walking. Leverage this strength to reduce automobile dependence that causes pollution and congestion
- Most of the cities in the Southern world need second generation action, including scaling up of public transport, integrated multi-modal transport options, car restraints and walking and leapfrogging emissions standards for clean air and congestion-free cities
- All cities have unique experiences and different lessons to offer to help strengthen action and also avoid mistakes

**New Delhi, April 9, 2015:** For cities in Africa and Asia, controlling traffic congestion, improving urban air quality, and protecting sustainable urban commuting practices are some of the toughest challenges. The cities in the region, while having made some significant strides in meeting air quality challenges, face newer challenges. Other cities in the South need second generation action, including technology leapfrog, scaling up of public transport, integrated multi-modal transport options, car restraints and walking for clean air.

This emerged out of the conference conducted by the New Delhi-based research and advocacy organization, Centre for Science and Environment (CSE), India today. This dialogue was organized to understand the emerging stories around the problem of air pollution and congestion and the solutions to the challenges facing our cities. This is part of an initiative by CSE to engage and share lessons from Southern cities to chart the future course of action.

The key highlights of the findings from the rapid assessment of issues, challenges and solutions in both the regions were presented by the Centre for Science and Environment today:

## PART I – INDIA AND AFRICA

### 1. The air we breathe

**Limited monitoring – limited knowledge:** In all our cities air pollution monitoring is limited and sometime non-existent. Only a few cities are better prepared. As a result, it is not always possible to understand the magnitude of the problem. India has close to 5000 cities and towns. But it monitors only about 247 cities. A mere 16 cities have online monitoring systems to generate real-time data. The monitoring grid in African Nations is still evolving. In the recently published database of outdoor air pollution in cities in 2013, the WHO has identified African countries in which particulate matter was monitored — Algeria, Botswana, Ghana, Madagascar, Mauritius, Nigeria, Senegal, South Africa, Tanzania, Ethiopia and Zimbabwe. In addition, Egypt, Madagascar, Tunisia, and Morocco have published reports of PM monitoring data. From the jigsaw of the limited data it is still possible to understand the nature of the crisis.

**Air quality trends in Indian cities:** In India half of the urban population breathes air laced with particulate pollution that has exceeded the standards. As much as one third of the population is exposed to critical levels of particulate pollution. Smaller and more obscure cities are amongst the most polluted. In cities of the African continent the problem, though not well assessed yet and not expected to be as bad as that of India, is showing assuming a growing significance. Indian cities are also facing multi-pollutant crisis. Nitrogen oxide levels have started to increase in several cities; even ozone levels are high in cities like Delhi. But there is also a mixed trend; several Indian cities have shown significant increase, some stabilization, and others improvement.

**Air quality trends in cities of the African Nations:** Most cities in Africa have not yet adopted air quality standards. The WHO guidelines are the key benchmarks. Though the reported particulate matter (PM10) levels in most cities in Africa are lower than some of the worst hit cities in India, their levels are still much higher than the stringent WHO guidelines. The WHO database of 2013 shows that while PM10 levels are 7.5 times the WHO standards in

Dakar, 5 times higher in Accra, 6 times higher in Lagos, and more than 3 times higher in Johannesburg and Tunis. But comparatively the levels in Delhi are 10 times higher.

Air pollution had hit the headlines way back in on October 12, 2005 when the first-ever smog in Lagos Nigeria occurred. This led LAMATA to facilitate the Lagos Air (vehicular emission) Quality Monitoring Study (LAQMS) in 2007. Delta State University examined ambient particulate pollution and its possible health implications in Nigerian cities. It found over 70 per cent of Nigerian cities had a high rate of daily mean/annual mean ambient PM10 of over 120µg/m<sup>3</sup>. Similarly, significant differences exist in PM10 concentrations across different land-use types, between the built-up areas and those of the surrounding rural areas. This is important evidence to inform policy action.

Even at the comparatively lower levels of pollution than those in Indian cities the African cities have a cause for concern. The Global Burden of Disease (GBD) estimates show that most of the health effects occur at even lower levels. There is no reason to think that the risk in these cities is less.

**Good air quality monitoring practices in the two regions to track air quality:** Good practices are evolving in both the regions. For example, the Senegalese Ministry of Environment and Sanitation has set up a Centre for Management of Air Quality. This has five fixed monitoring stations in Dakar and a laboratory. They also have a portable air quality monitoring van. The air quality data is communicated to the public through a simple air quality index. Similarly, Delhi has set up six online monitoring stations that report real time data in a properly laid out format for people to understand. There are over 10 monitoring stations in residential, industrial, commercial and road side locations in Accra, Ghana. Roadside and commercial sites recorded highest pollution levels.

Our cities need to bridge the gap in data availability to citizens and also assess personal exposure. It is important to invest in data generation to inform policy action on health protection.

## 2. Our health matters

Air quality has significant impact on public health in both the regions.

**Health risk in Indian cities has assumed scary proportions:** According to the Global Burden of Disease outdoor air pollution is the fifth largest killer in India. About 627,000 premature deaths occur every year in India. More than 18 million healthy life years are lost due to air pollution. Air pollution triggers stroke, cardiovascular and respiratory diseases, and cancer. Since 2000, at least one study a year has been published in Delhi, providing clinching evidence of smog's toxic risk. Many of these studies have been carried out by doctors from prominent hospital. They have widely reported prevalence of chronic respiratory symptoms; increase in emergency room visits during winter for asthma, chronic obstructive lung disease, and acute coronary event. The reports show the genotoxic effects of vehicular



fumes; vitamin D deficiency among Delhi children in polluted localities which increases the risk of developing rickets; and significant increase in eye disorder symptoms in polluted areas. Most extensive scary evidences have come from the 2012 epidemiological study on children in Delhi carried out by the CPCB and the Chittaranjan National Cancer Institute of Kolkata. This study had covered 11,628 school-going children from 36 schools in different parts of Delhi and in different seasons. It found that every third child has reduced lung function. There is evidence to show greater exposure to particulate pollution. Sputum of Delhi's children contains four times more iron-laden macrophages than those from cleaner environs, indicating pulmonary hemorrhage. The levels of these biomarkers in children have been found to be higher in areas with high PM10 levels.

**Health risk in the African region:** According to the GBD's estimates about 176,000 deaths occur every year due to outdoor air pollution in Africa. This is still less than Europe at 279,000 deaths. But this signals why Africa region needs to be preventive and precautionary.

There are several indicative results from studies that signal a serious public health risk. The UN Economic Commission of Africa has estimated that the cost of air pollution in a number of African cities can be as high as 2.7 per cent of GDP. A study finalized by the University of Nairobi shows that the economic loss per year in Kenya due to vehicle emissions and associated air pollution is 115 million KSh from related illnesses and deaths. In Ghana, acute respiratory illness is among the top 10 causes of out-patient hospital visit. An Addis Ababa study has identified that more than 18 air pollutant elements in the bio-monitor samples (lichen) in highly polluted area affected mainly by traffic air pollution. Africa is also reporting one of the highest death rates from non-communicable diseases. Air pollution can exacerbate this.

This is very serious in low income neighbourhoods located close to roads. The poor have a higher prevalence of some underlying diseases related to air pollution; proximity to roadways increases the potential health effects. Road users, public transport users, walkers and cyclists are the most exposed groups – they are also the urban majority.

There is enough evidence locally as well as globally to act urgently to reduce the public health risks to children, elderly, poor and all. Our cities do not have to reinvent the wheel but take action to reverse the trend of short-term effects as well as the long-term toxic effects. For toxic effects to surface there is a long latency period, therefore, exposure will have to be reduced today. Air pollution will damage the health of current as well as the future generation.

### 3. Motorization aggravates air pollution and health risk in all our cities

Cities have many sources of outdoor air pollution and all require mitigation action. But vehicles pose a special challenge. In the future cities will witness rapid increase in vehicular traffic. Cities are not expected to locate new industry or power plants inside the city. This means in terms of actual exposure people will be more vulnerable to vehicular fumes while traveling and in close proximity to roads. Vehicular emissions contribute to significant human exposure. Even though pollution comes from a variety of sources vehicles need special attention as they breathe in our breathing zone.

Pollution concentration in our breath is three to four times higher than what it is in the am-

bient air. People residing 500 metres from roads are the most exposed to vehicular fumes, says the Health Effects Institute of the US. For instance, about 55 per cent of Delhi's population lives within that zone; so it runs a serious risk of exposure. Air quality monitoring and studies conducted by the Centre for Science and Environment in New Delhi shows that the particulate levels that people are exposed to while traveling on the roads or while walking can be 2-4 times higher than the ambient concentration. Studies by University of California, Berkeley shows PM<sub>2.5</sub> concentration inside vehicles while travelling in Delhi can be 1.5 times the background levels.

Vehicular fumes are extremely toxic. This can be further aggravated by rapid increase in use of diesel in cars and expansion of freight traffic. In June 2012, WHO reclassified diesel emissions as class I carcinogen, putting it in the same bracket as tobacco smoking for its strong link with lung cancer. Diesel also has short-term respiratory and cardiac effects. International studies, including one carried out in London, show diesel emissions have worsened the lung function in people with asthma. Given the poor quality of diesel in India, this is of special concern.

In cities of Africa, the rudimentary data from sporadic studies show high exposure. A specific medical study of patients and their exposure to the pollution level was done in Addis Ababa. Out of the top 20 leading causes of out-patient visit by region in all health centers and hospitals of Addis Ababa, the occurrence of acute respiratory infections was of prime concern. The study concluded that this may be largely attributed to the noxious emissions of the vehicle transportation. Data shows that cases of acute respiratory infection were about 148,000 in 2006-07, which reached up to 207,000 in 2007-08.

Air pollution is expected to worsen with increased dependence on personal vehicles and erosion of pollution neutral modes. Studies by the Asian Development Bank show if a city like Bengaluru in India succeeds in increasing bus ridership share to 80 per cent, it can save equal to 21 per cent of fuel consumed in a "business-as-usual" scenario. This can lead to 23 per cent reduction in total vehicles; it will free-up road space equivalent to taking off nearly 418,210 cars. This can also bring down particulate matter in the ambient air by 29 percent and nitrogen oxide by six per cent.

#### 4. Road injuries add to health impacts of motorization

Recent estimates of the GBD have changed the way health impacts of motorization are conventionally understood. This has included deaths and illness from both accident risk as well as air pollution risks linked with motorization. This GBD ranks road injuries as the world's eighth-leading cause of death and the number-one killer of young people aged 15 to 24. If deaths due to road injuries and air pollution from vehicles are combined then motorized road transport deaths exceed those from HIV, tuberculosis, and malaria. The World Health Organization now classifies disability, unproductive life years, and premature deaths related to road injuries as a significant health impact of motorization.





**Road injury impact very high in India:** There is already very high death and injury impact of vehicle bulge in Delhi and other Indian cities. A rate of 16 deaths per hour and 58 injuries in India is equivalent to wiping out about 40 per cent of population of Maldives in a year. Despite the nominal reduction in total number of accidents over the last two decades, the share of fatal road accidents have increased phenomenally as the Indian cities are prioritizing high speed roads for vehicles over ensuring safe access for all.

India is framing a Road Safety Bill for more stringent action.

**High road injury risk in African cities:** It is said that Africa has less than three per cent of the world's motor vehicles, but more than 11 per cent of global road fatalities. This real numbers might be even higher than this estimate. Both India and African nations face the problem of under-reporting of accidents. Countries in Sub-Saharan Africa are estimated to under-report road crashes by over 500 per cent. Reported data in African region is only 7.2 per 100,000 people. But the modelled data shows it is as high as 32.2 per 100,000 people – a five time increase. The 2009 WHO Global Status Report on Road Safety suggested significant under-reporting of the problem. It was found in 2013, India under reported road death estimates by 78 per cent when official estimates were compared with death registry data.

Kenyan Statistics - 2012 shows that motor cycles and 3-wheelers cause 55 per cent of road deaths and buses/mini buses about 1 per cent. Pedestrians are the biggest victims of road accidents – more than half.

Several steps are being taken now to address road safety risk. This needs to gather momentum. In Kenya, National Transportation Safety Authority established to manage road safety; in Uganda the non-motorized transport policy is expected to address this; Gambia is developing an inter-ministerial committee on road safety but does not have funding to implement anything yet; Tunisia has set up a road safety observatory which brings together many parties; Senegal has put in place an inter-ministerial committee to look at the issue and is working with driving schools; and Nigeria has initiated a road safety programme

## 5. Mobility crisis in cities of Asian and African countries

Mobility crisis begins to build up when an increasing share of our daily trips are being made by cars that occupy more road space, carry fewer people, pollute more, guzzle more fuel. They edge out pedestrians, bicycles, and public transport. This is now happening across all cities of Africa and India/Asia.

**Explosive numbers:** Vehicle numbers are growing rapidly in both Indian cities as well as in the cities of Africa. Although the levels in Asia and Africa remain comparatively low compared to other regions, the growth rate is high. However, it is also said that if the estimates of personal vehicles include two-wheeled motorcycles then the rate of motorization is more than that of the developed countries.

**In Indian cities** like Delhi vehicle numbers have crossed eight million and the city is adding 1400 vehicles a day. This trend is dramatically reducing the share of public transport in Indian cities. In India the Indian Institute of Technology, Kanpur has estimated that between 2011 and 2030, daily travel trips will double; but the share of public transport trips would

fall from 26 per cent to 16 per cent; the share of personal vehicle trips might increase from 34 per cent to 51 per cent; and peak traffic might crawl at eight km per hour, compared to 16 kmph right now. Cities are losing the battle of car-bulge. Unfortunately, most cities are losing their inherited strength in high-usage of sustainable modes. The loss is most stark in Delhi, where buses catered to 60 per cent of the transport needs in 2000, but have now dropped to 40 per cent.

**Comparatively, the vehicle numbers are lower in most cities of African countries** but they are recording faster growth rate. For instance, in Addis Ababa, car ownership is still very low. In Ethiopia just last year, a total of 30,128 cars were imported, showing an increment of more than 7,000 cars compared to the previous year. In June 2014, the total stock of registered cars in the country was 519,816. But this motorization based on uncontrolled and aged vehicles, poor maintenance practice, poor fuel quality, and inefficient public transport are affecting public health and the environment.

Most African and Asian cities were originally designed on a human scale – with small block sizes and high street density; short travel distances that made cities more walkable and accessible. But car-centric street design and urban sprawl are increasing travel distances, severing neighbourhoods, removing people and activities from streets. This is discouraging walking, cycling and public transport usage by design. CSE's assessment of signal free roads in Delhi has shown how short walking distances are getting steadily converted to longer motorized trips within neighbourhoods, locking up enormous pollution in the road infrastructure.

**Congestion impacts:** Cities are paying a very high price for congestion. Traffic jams lead to fuel wastage, more pollution and serious economic losses. Normal commuting time has increased significantly during peak hours. On many arterial roads the traffic volume has exceeded the designed capacity and the service level of the road. A quick glance at the city development plans and other sources bring out the nature of mobility crisis in the cities.

Traffic congestion is of growing concern in many cities. Transport policies in sub-Saharan African tend to favour automobiles. Kenya imports around 200,000 vehicles every year in the country. Kenya allows import of vehicles less than eight year old. As of 2013, Kenya has a registered vehicle fleet of 2.25 million comprising of saloons, station wagons, vans, pick-ups, mini-buses, buses, lorries, trailers, motorcycles, three-wheelers, wheeled tractors and other vehicles. Of these nearly 30 per cent vehicles are in Nairobi. Motorcycles are much higher than the car numbers. Rapid urbanization is projected to double Nairobi's car fleet in just six years.

Traffic jams cost the Nairobi City County approximately KSh 50 million daily in fuel consumption, manpower time wasted and cancelled business appointments. The county is estimated to lose 37 billion shillings annually in terms of productivity, pollution and fuel. On a Monday morning it takes two to three hours to reach central business district (CBD) in Nairobi. Same is the case with other cities. These jams have had an effect on business. Com-



panies are now moving out of the CBD to less congested locations such as Upper Hill, Kilimani, Ngong road, Westlands and Gigiri, citing ease of access as the main reason for moving out. It is thus expected that with this trend of heavy traffic, there will be decreased demand and pricing in potentially prime areas in the CBD which have the highest concentration of new buildings.

In Lagos it is estimated that if ownership rates grow from 0.05 per capita to 0.06 over the period from 2010 to 2025 then there will be an 80 per cent increase in the numbers of vehicles owned to around 850,000. A study conducted by the Lagos Metropolitan Transport Management Authority (LAMATA) on air quality between 2003 and 2007 indicated that vehicles contribute approximately 43 per cent ambient air pollution in Lagos.

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**Learn from Delhi's dilemma — only more roads and flyovers are not the answer.** We need mobility transition: Learn from Delhi's mistake. 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 70 flyovers. Yet its roads are gridlocked. Peak hour traffic has even slumped to below 15 kmph. Cars and two-wheelers in Delhi occupy 90 per cent of the road space, though they meet less than 20 per cent of the travel demand.

More roads are not the answer. The limited urban space used for parking can have other, more important uses. Newly registered cars increase the demand for land for parking each year. This requires land equivalent to 310 football fields.

Cities need to improve the capacity of roads to carry people by influencing travel choices. Even during peak hours, a car carries only 1.5 persons as opposed to a bus carrying at least 40-50 people. Two cars occupy same space as one bus, but carry 20 times less people. If this trend continues, the capacity of roads to carry more people will reduce drastically. The planning challenge is to improve modes of mass transit and the people-carrying capacity of roads, as per the principle of the National Urban Transport Policy that states “plan for people, not vehicles”.

## 6. Cities in Asian and African countries have begun to act

It is not that Indian cities or cities in African countries have not done anything to control air pollution. Air pollution management has taken root but they are at different stages of progress showing different results.

**First generation action to control air pollution in Indian cities:** Delhi is the most notable example. Delhi got rid of its polluting industry, shut and replaced two coal-based power plants, brought in force one of the largest public transport systems based on cleaner natural gas, capped the age of commercial vehicles and improved vehicular emissions standards. It resulted in stabilizing Delhi's air pollution trend between 2003 and 2008. Nearly all the big Indian cities that have initiated pollution control measures show respite and stabilization, followed by a rising trend.



The first generation action has helped many of the cities to stabilize the air pollution problem. But cities are in danger of losing the gains as particulate pollution levels are once again rising and are elevated and newer pollutants like nitrogen dioxides are also rising steadily. The cities now face second generation challenges.

**First generation action in cities of African countries:** In sub-Saharan African countries about 27 countries have adopted Environment Protection Acts; they also specify vehicle fuel parameters, emission standards and air quality. Several countries in the region have operational routine air quality monitoring systems. Sixteen have set fuel specifications for gasoline and 14 for diesel. Several countries have sulphur content between 2,000 and 5,000 ppm, or even above 5,000 ppm. Only five have promulgated emission standards for vehicles, and only eight have set air quality standards (another two have proposed them). The phase-out of lead has now been essentially completed across the region. Air quality monitoring is used to test compliance with air quality standards. Only eight countries have operational routine monitoring systems: Botswana, Ethiopia, Ghana, Madagascar, South Africa, Tanzania, Zambia and Zimbabwe.

Air quality management is considered comprehensive in South Africa, and advancing in Ghana; it is at an intermediate stage in Botswana, Madagascar, Zambia and Zimbabwe, and either at an initial or early stage or entirely absent in the other countries.

In Kenya for instance the government has set the age limit for imported vehicles at eight years; reduced the standard limit of sulphur in fuel from 10,000ppm to 500 ppm. In 2014, air quality regulations draft to regulate vehicular emission limits as stipulated in the Kenya Standard (KS) 1515; completed construction of the Eastern, Northern and Western by-passes to decongest the city-centre; and rehabilitate and extend the commuter rail transport within the Nairobi city.

## 7. Vehicle technology and fuel quality roadmap to reduce vehicular emissions

India and countries in Africa are motorizing at a level of technology and fuel quality that are not so clean and can lock up enormous pollution in the vehicle stock and compound health risks.

**Concerns over technology and fuel quality roadmap of India:** India has implemented Euro III emissions standards in about 30 cities and Euro III in the rest of the country. This is 10 to 15 years behind Europe. If the rapidly growing number of new vehicles is not linked with the best available technology it can have serious pollution impact.

This also increases worries over the toxic impact of growing use of diesel in the transportation sector in India. The International Agency for Research on Cancer (IARC), a wing of the World Health Organization (WHO), have reclassified diesel emissions as class I carcinogen for strong link with lung cancer and put it in the same bracket as tobacco smoking. Evidence on diesel's toxicity has been mounting over the past 20 years, which has already



compelled stringent regulatory action on diesel quality and emission standards in other regions of the world. India and African countries need to respond to this science and accelerate the roadmap to get clean fuels and vehicle technologies.

**Emissions standards roadmaps in Africa:** One of the biggest success stories in Africa is the elimination of lead in petrol. The countries in the continent have also begun to reduce fuel sulphur levels to enable use of emission control technologies. In 2002, there was no country in Africa which had 50 ppm sulphur in diesel. Since January 2015, Kenya, Uganda, Rwanda, Burundi and Tanzania have moved to 50 ppm sulphur fuel within East Africa. South Africa and Nigeria have already implemented the Euro 2 standards. South Africa has passed the regulation to implement 10 ppm by 2017. Morocco, Tunisia and Mauritius have met 50 ppm or below target.

Now, these countries are looking at the future roadmap for the entire Africa to have unleaded & lead replacement petrol grades; diesel & petrol sulphur to be reduced to less than 10 ppm; Euro 5 vehicle emission, and the introduction of metal free petrol.

**Find fiscal strategies to clean up fuels and vehicles:** While some countries in Africa entirely import fuels, a few like South Africa and Nigeria produce their own fuels. India also produces its own fuels. Fuel producing and importing countries therefore need different strategies to accelerate the emission standards roadmap. But fiscal solution will be critical for the makeover. Thankfully, there are many good examples in the region.

Investment in fuel upgradation is justified based on the health benefits expected. For instance, available estimates show that while fuel quality improvement in Kenya is expected to cost USD six billion, the benefits from this is expected to be USD 43 billion – to be saved from the reduced health cost to its citizens. In fact, Kenya started by giving subsidy to its refinery to improve quality to 500 ppm sulphur fuels. But subsequently, along with other oil importing countries, it has decided to move to 50 ppm sulphur fuels from January this year. South Africa has also started by giving subsidy to the refinery to improve fuel quality.

In India as well, there is a proposal to find a fiscal strategy to move to 10 ppm sulphur fuel by 2020. An additional tax on fuels and diesel cars can bring additional revenue that can be used to create Clean Fuel Fund to meet the cost of refinery costs. Such incentive strategies are needed to prevent pollution disasters.

## 8. Fuel substitution strategy — the CNG initiative

As the mainstream fuels of diesel and petrol are taking time to improve, several cities in both the regions have leveraged availability of CNG to run vehicles to cut pollution. Fuel substitution is a unique opportunity in cities of Africa and India that have natural gas to step around the problem of toxic diesel. This is also an important strategy to leapfrog to move forward quickly.

**Delhi CNG programme:** Delhi has implemented one of the largest natural gas vehicle programme. Close to 6,000 buses, 60,000 three-wheelers and substantial numbers of taxis are running on CNG in the city. This has helped to curb the toxic diesel emissions. This had also helped Delhi to stabilize its pollution problem. Today, about 40 cities of India have access to

CNG and have implemented CNG programme of some scale. But the Delhi experience shows that for successful implementation of this programme it is important to set up appropriate emission and safety regulations, and introduce a fuel pricing policy that allows to maintain an effective price differential between CNG and diesel, to ensure people prefer to use CNG and not diesel.

**CNG programme in African cities:** The launch of the Clean Energy Transport Scheme in major cities across Nigeria has commenced. The scheme involves the introduction of Compressed Natural Gas (CNG) run vehicles and retrofitting of diesel engine to CNG. The Clean Energy transport scheme has Asiko Energy as the lead Partner in the gas flare down programme introducing CNG to Borno State, Kaduna. Nimco and the PPMC have already started operations in Benin City of Edo State with over 50 per cent of taxi operators converting to CNG. Tata Motors and Tower Group have delivered a new investment package to complement government's Green Entrepreneur Scheme, a scheme that empowers unemployed youths to run only CNG buses on a hire-purchase basis.

This drive resulted in significant infrastructure development within and around Benin City. Use of natural gas instead of petrol translated into significant savings for taxi drivers in the area, as Green Gas refuels over 4,000 taxis and cars with natural gas and this is growing on a daily basis. Policy and regulatory support from the government is needed to launch incentives similar to those of other fuels in the country as well as to speed up the construction of needed fueling infrastructure

## 9. Address the unique challenge of old second-hand vehicles

This is a special challenge of African cities where import of second-hand vehicles dominates. Second-hand vehicles from Japan, Europe and other countries are swamping the markets in these countries. Because of the high price of new vehicles, people prefer buying second hand vehicles. Very few vehicles are new. Some of them are locally assembled or manufactured as in South Africa or in General Motors assembling plant in Ethiopia.

For example, Addis Ababa faces a rapid increase in air pollution due to increasing number of automobiles which do not follow emission standards set by various environmental agencies. Lack of a retirement policy for the vehicles worsens the problem. It was found that 53.5 per cent vehicles are more than 20 years old, while 29.3 per cent were more than 30 years old. As much as 85 per cent of all taxis are 22 years old. This causes enormous emissions.

Several governments in the African region have begun to take steps to address this problem—by fixing the age of vehicles and putting higher taxes on the older vehicles, and also by introducing vehicle inspection programmes for in use vehicles:

- **Addis Ababa:** According to the Traffic Law owners of mass transport vehicles (e.g. taxis) that are greater than 20 years old are not eligible for operating licences. This programme was initiated as a voluntary programme in 2009. About 50,000 taxis are eligible for



replacement. Financial incentives are being provided to the fleet owners to purchase a new vehicle.

- **Angola:** Motor companies are not allowed to import used vehicles; individuals allowed to import regardless of age
- **Botswana:** Maximum of 100,000 kms on the vehicle
- **Burkina Faso, Mali, Malawi, Zambia, Ethiopia, Central African Republic, Democratic Republic of Congo, Cameroon:** No import restrictions on vehicle age basis
- **Chad:** Vehicle inspection upon import
- **Côte d'Ivoire:** A fine of FCFA 150 is imposed on vehicles older than 10 years and an additional FCFA 10 for every year after that.
- **Gabon:** Used vehicles must be less than four years old
- **Ghana:** Used vehicles over five years old pay graduated penalty according to year of manufacture and capacity
- **Seychelles:** Used vehicles must be less than five years old
- **Sudan:** Imported second-hand vehicles are illegal, except for immigrants, vintage and racing cars, vehicles adapted for physically disabled, and donated vehicles for welfare organizations
- **Gambia:** Import of second hand vehicles restricted through taxation – increases in vehicles exceeding 10 years. Roadworthiness must be proven before import
- **Mauritius:** Has a three year age restriction

Efforts are being made to organize the vehicle inspection centre to address the problem of in-use emissions. There are 19 vehicle inspection centres across Kenya including one at Likoni Road, Nairobi. Mainly public service vehicles and commercial vehicles – matatus, buses, tuk-tuks, taxis and trucks come for annual inspection. From January 2015, all private vehicles more than four year old will also have to undergo the inspection. At present only visual tests are done. It's basically seen if the vehicles are fitted with a speed governor and are in good mechanical condition. There are plans to do emission testing.

## 10. Majority still walk, cycle and use public transport; they are part of the solution

Despite growing dependence on cars, walking, cycling and public transport share dominate travel in our cities. Among key big Indian cities walking, cycling, and public transport trips still make up 60-78 per cent of all trips. In several Indian cities the walking and cycling trips are still more than car and two wheeler trips.

In Nairobi, a 2007 survey of the Ministry of Roads and Public Works Report, Kenya showed that while private vehicles are 36 per cent of the vehicles on the roads and occupy more road space they carry only 15.3 per cent of commuters. Matatus, that are 27 per cent of the vehicles, carry 29 per cent of commuters. Another 47 per cent of the city residents walk to their work places. Commuters share of Matatus is stated to have increased substantially since then — it could be carrying as much as 70 per cent of the motorized trips in the city today.

This is the low polluting and low carbon mobility paradigm that the world is trying to achieve today to be more sustainable. All our cities must be made conscious of this strength. The cities have advantage because it has closely built, high density environment. This has reduced travel distances that foster low emissions and low carbon transport like walking, bicycling, para-transit and bus/metro-based transport.

All cities in the Asian and African regions need to retain their compact city design that has helped to reduce travel distances. The average travel distance in Indian cities is around 3-4 kms. This enables very high level of walking, cycling and public transport usage. Only in bigger cities the average distance is longer.

But, as noticed in Indian cities, the sizeable share of the transportation infrastructure is being spent to facilitate vehicle movement and not people's movement. All our cities need to transform the infrastructure for the walkers and public transport users to prevent dependence on cars.

## 11. Scale up comfortable and reliable public transport

Buses will play a crucial role in the mobility transition in the big and medium rung cities. Cities need well managed, well organized modern buses that deliver efficient public transport services at affordable rates. Cities need buses because these allow greater flexibility, greater geographical coverage, cost effectiveness, and space efficiency. New bus routes can flexibly and easily meet the needs of changes in demography and land use in cities. It can also cover areas with lower travel demand. A bus occupies twice the road space taken by a car but carries 40 times the number of passengers. A single bus can displace anywhere between 5 and 50 other vehicles and allow enormous oil and pollution savings.

However, bus reforms and investments are just not about buying new buses but about efficient deployment of reliable and attractive services. Cities require immediate improvement in service level of buses in terms of frequency, reliability, coverage, reliable information, ITS enabled passenger information service, improvement in ticketing system, bus priority, signaling, GPS enabled deployment strategy, among others. These service conditions will have to be fulfilled. This will also determine the costs. Some Indian cities have begun to move in this direction. For example Bengaluru in India has made considerable progress in improving bus operations.

**Dynamics of bus transport in Asian and African cities:** Bus service is still very inadequate in most cities in African region. According to the World Bank's Urban Transport Indicators database, the average number of bus seats per thousand urban residents of Latin America, Asia, the Middle East, and Eastern Europe is around 30–40. In Africa the average number is only six bus seats per thousand residents. The average cost of a one-way trip is about 0.30 USD, which is high in relation to the average household budget. These unaffordable fares are clearly linked to poor people's decision to walk in an environment with poor facilities for non-motorized transport.

**A step forward in Kigali city:** Kigali city has recently adopted a net cost contracting method to procure privately delivered bus services from three firms to serve four zones and its CBD. The restructured bus services have definitely improved service coverage and quality of vehicles, but service schedules, fares, and customer care are failing to meet the performance standards of the contracts. A recent reorganization of privately run public transport serv-



ices has improved service coverage, but the reliability and level of service remains inadequate due to the peak hour congestion, shortage of vehicles, and inadequate service provision by operators; furthermore, bus transport is still not affordable for all.

In most African cities the bus service is part of the unorganized sector that is not very amenable to proper regulations and service quality control. Only a few cities in India and African countries have begun to organize these services.

Delhi, for instance, has phased out the informal bus system and replaced it with corporate and centrally operated large fleets. This requires monitoring of service trips, penalty if there is any violation etc.

**BRT transition in Africa:** Cities in Africa are making more strident move towards introducing Bus Rapid Transit system. There are more success stories in BRT transition in African cities than in Indian cities.

**South Africa:** In South Africa, The National Land Transport (NLTA) Act, 2009 aims to improve public transport by establishing an integrated rapid public transport network that comprises of an integrated package of rapid rail and road corridors. Since the promulgation of the NLTA in 2009, the 12 largest municipalities have been made responsible for implementing new bus rapid transit services. The BRT systems are being implemented through PPP model, whereby cities build and maintain the infrastructure for the operation of the buses, stations, depots, control centres and fare collection system. Private operators, by contrast, own and manage the buses, maintain them, hire staff and provided services for long contracts.<sup>1</sup>

The main intention of NLTA has been to make metropolitan and larger city governments the key focus of responsibility for public transport, integrating it with their land use planning responsibilities. The idea of the BRT services in South Africa was to provide integrated rapid transit system in the cities aiming to significantly improve public transport in the cities. The first leg of this IRT system is primarily a “Bus Rapid Transit” system. It is designed in a way that emphasizes the need for integration with other modes, especially rail, the backbone of public transport in cities. The other major factor to push BRT service was to empower the existing informal sectors and taxi operators on that route and integrate them with the new system. The ultimate goal was to ensure that those who were operating or getting affected by the BRT be shareholders in the bus operating companies that will take over the BRT system. As the existing operators were involved for negotiations, the department had to give them loss of income allowance to get them to negotiate. In addition, technical support and independent facilitators were provided to facilitate during negotiations.<sup>2</sup>

**Cape Town:** Since 2007, the city has been working on the first phase of an Integrated Rapid Transit (IRT) system in Cape Town, aimed at significantly improving public transport in the city. MyCiTi is designed to be rolled out in four phases for completion within 15 to 20 years. In October 2009, Phase 1A was approved and the National Department of Transport allocated a total of 312 million USD for 2010-13 to Cape Town. By March 2013, Phase 1A, ‘a world-class BRT system in miniature’, was operational. The main feature of the system is that all 35 MyCiTi stations and 161 roadside bus stops are universally accessible and all 379 buses have levelled boarding, spaces for wheelchairs and an audio LED screen. It even includes 22.4 km of accessible and continuous walking and cycling pathways.



**Johannesburg:** Rea Vaya BRT is the first BRTS system in South Africa. By 2020, the city plans to roll out 122 kilometers of mainline BRT corridors served by 150 stations and 250 kilometers of formal feeder routes. The long-term objective is to provide a network of some 330 kilometers (of lanes that are easily accessible to more than 80 per cent of the people of Johannesburg).

**Lagos:** Nigeria's 2010 National Transport policy seeks to develop an efficient, self-sustaining and reliable public transport system. Lagos Metropolitan Area Transport Authority (LAMATA), along with World Bank, has provided the framework and infrastructure for the first BRT system in Nigeria called LagBus service in Lagos. The LAMATA comprised the responsibility of bus depot garage, three bus terminals, 65 per cent segregated bus-ways, 28 bus shelters, road markings and other traffic management measures while the selected private sector operator (First BRT Cooperative Limited) accepted regulatory enforcement, commitment to procurement of buses, operations and maintenance.

**Dar es Salaam** has made significant effort to sensitize people over a period of time to win public support for DART- Dar Rapid Transit. Dar es Salaam started its BRT initiative in 2003. The idea for DART was supported and advocated by Dar's then mayor Kleist Sykes along with the support of County Government. In 2003, DART was established which soon started working on strategizing for implementation and adoption of BRT. To address the concerns regarding multiplicity of stakeholders, an institution carved out of the City Council was placed directly under the Prime Minister's office. This allowed immense political buy. All concerned stakeholders were made part of the working group and quite interestingly the chairman of the BRT-opposing faction of Daladala operators was made the chairperson of the working group. This whole process generated a significant interest in the public towards the project and leveraged it to the level of a project for the larger public good. The first corridor of the project was constructed on the Morogoro Road in 2013, which is one of the main thoroughfares, penetrating straight into the city centre. The project is likely to reverse the congestion problems of Dar es Salaam making it difficult to access the city's downtown by car, thus encouraging sustainable mass public transport in Dar es Salaam.

The project now faces the challenge of establishing bus operating companies and attracting investors. DART is also trying to transform the mini-bus taxi industry into shareholders in BRT operating companies from other cities, including Johannesburg and Cape Town. The DART BRT is expected to reduce commute times for Dar es Salaam residents. This also includes high quality bicycle lanes in parallel to the BRT corridor as well as safe sidewalks and at-grade pedestrian crossings at the same level as the sidewalks.

These initiatives are critical for improving network of formal public transport systems.

## 12. Walk and cycle

In most of our cities in Asia and Africa, people who commute by walking outnumber those who use vehicles. Yet, there is continuous erosion and destruction of the space meant for



walkers. Our cities have inherited strength in their dominant walking and cycling practices. Cities in India, most of Asia and Africa were originally compact in urban design and high population density. This kept most trips within walking and cycling distance. Moreover, due to high incidence of urban poverty a large part of the urban population is too poor to pay for any other mode of transport. Also, any attempt to improve the share of public transport will lead to correspondent increase in walking. Even 50 per cent increase in kilometers travelled by public transport will lead to massive increases in the quantum of walking. Roads will have to be planned with more space for walking. This needs urgent intervention to meet the present and future demand for walking in the city.

Our cities still have the chance to plan their future growth differently and avoid the path of pollution, congestion and energy guzzling.

**The mega cities in India** have one of the highest walk and cycle trips. 34 per cent in Delhi and 53 per cent in Mumbai walk to work. Government should mandate pedestrian plans and make it conditional to infrastructure funding.

**Walking in African cities:** In African cities where a majority of people (nearly 50 per cent of the population) walk, not much emphasis is given to these vulnerable road users. The share of walked trips in Kigali has reached 60-70 per cent. In Nairobi, 60-70 per cent commuters walk. People even walk large distances of 7 to 10 km.

Not enough and proper designated areas exist for pedestrians and other non-motorized traffic. Roads where people walk in large numbers do not either have sidewalks or, if they have, they are not adequate. City authorities are now making sidewalks and cycle tracks on new roads. According to the Nairobi city county official, the county is planning investment in public transport facilities to improve walking infrastructure. Their proposal involves improvement in traffic signals; construction of 11 foot-over bridges; every urban road to have a footpath; enable cycling, and preparation of a master plan to integrate land-use and transport.

Government of Uganda has framed a national policy for improving non-motorized travel. With the support of UNEP's Share the Road programme, the policy recommendations were designed to increase awareness of walking and cycling in transport planning, and supporting effective design and infrastructure provision at a national level. The policy recognizes walking and bicycling as non-polluting, sustainable, environmentally friendly and healthy transport options, and the promotion of these modes is part of its environmental policy. This recognizes universal accessibility principles for all transport infrastructure. Also, establishment of a National Road Safety Authority (NRSA) responsible for road safety, management and coordination has also been recommended.

**Need action:** All our cities need reform in engineering and environmental guidelines for walkways and make them mandatory. We need to ensure these guidelines are incorporated by all road building agencies. We need a comprehensive road users act for targeted pedestrianization; segregation of space by users; system of penalty to prevent encroachment in pedestrian space; prevent usurpation of pedestrian space for motorized traffic without proper justification. Urban local bodies must implement walkability audits of pedestrian ways. Public transport plans must include pedestrian plans for multimodal integration. Zero tolerance policy for accidents.

Street design guidelines must give priority to the comfort of the movement of people. Increasingly, cities are trying to remove people from the roads by barricading medians and putting foot over-bridges to minimize conflict between people and vehicles. This will be counterproductive. If people cannot cross at frequent distance, or are forced to climb foot over bridge it will discourage walking and public transport usage. A survey in Nairobi showed that the most common reasons cited for not using the pedestrian crossings and foot bridges were ignorance of traffic regulations (26 per cent), people being in a hurry and laziness (23 per cent) and lack of road safety awareness (11 per cent). Other reasons cited were that footbridges are not strategically placed. But as the experience in India has shown foot over bridges are very inconvenient for people and this force people to walk on the roads and get exposed to safety risk. People must always remain on surface and be given safe crossings.

### 13. Intermediate public transport system

**Cities of India and African countries must not make the mistake of destroying the intermediate public transport system – Matatus, Boda Bodas, auto rickshaws, cycle rickshaws:** In most cities of India and Africa intermediate public transport system are the most important form of transportation system.

In Nairobi for example, *Matatus* or mini-buses are the only form of public transport operating in Nairobi. This today meets nearly 70 per cent of the travel demand. These are very important for last mile connectivity and as feeders to public transport. These systems should be reorganized well to improve efficiency and deployment.

A good example is the effort to reorganize them and their routes as cooperatives and manage them well. 87 cooperatives or *Saacos* have been formed in Nairobi. Across Nairobi, Matatu routes were organized into eight major corridors used to codify clear routes and bus stops. This structure was used to develop a coding system based on branching and rotation to give each stop and route a unique, logical identifier. The initiative of Digital Matatus is an important one. This transit data is over the publicly accessible GTFS exchange.

In Delhi similar efforts are being made to reorganize the auto-rickshaws with GPS systems, permit rationalization etc. to integrate them with the overall transportation system.

### 14. Get the taxes right

The scale of transition that is needed will require enormous investment. This demands innovative fiscal strategies. Implement polluter pays principles. Motorists should pay the full external costs that include congestion, pollution, ill health, and climate change. This can bring additional revenue to pay for the alternatives like public transport, walking and cycling infrastructure

It is ironical that across our regions – India and several African countries buses are made to



pay more taxes than cars. Almost all state governments tax the buses higher than cars. This will have to be reversed. Currently bus operations are treated as commercial operations and taxed high. But cars will have to be taxed higher than buses. In Delhi for instance, cars pay a miniscule amount of one-time road tax when they are purchased. But buses are made to pay much higher taxes annually. This increases bus fares.

Similarly, in Kenya for instance, vehicles have to pay a varied range of taxes when they are imported into Kenya. But mini-buses up to 29-seater have to pay all taxes as applicable on cars. Buses with more than 30 seats are required to pay import duty and VAT, like cars. This should be rationalized. Public transport services are for public good and should pay lower taxes. Cars that are part of unsustainable modes should pay higher taxes.

If bus fares increase, people will easily move to motorcycles that have much lower operational costs than even the bus fares in most of our cities. This will aggravate the problem of motorization and pollution.

## 15. Parking restraints

Globally, governments are adopting measures to restrain use of cars. This is being done either through tax policies, road pricing or parking policy. The first generation restraint measures include parking policy as a demand management tool to reduce parking demand and also use of personal cars. This is easier to implement in developing cities.

Conventional parking policies in most of our cities have aimed at increasing parking provisions to meet the growing demand for parking by earmarking as much public land as possible; by constructing multi-level car parks; and by mandating all buildings to provide minimum parking spaces. The underlying assumption has been that demand for parking will continue to grow with motorization and therefore the local governments should set aside adequate parking spaces to meet this demand. But this policy assumption is now under attack.

Decades of experience across the world has shown that parking demand is insatiable that only locks up valuable urban land that have more important usages. Moreover, uncontrolled parking supply incites more driving, more car ownership and defeats the purpose of reducing automobile dependence, pollution and congestion. This has led to serious policy rethink. Parking policy can be redesigned in such a way that instead of encouraging unlimited parking supply and car usage it can be leveraged to restrain parking demand and thereby personal vehicle usage.

But there is very little policy or public understanding of the key elements and principles of parking policy that can make it a tool for reducing parking demand and car usage to cut decongestion and pollution in cities.

Unlimited parking supply lead to more automobile dependence and congestion. This increases pressure on public land. For as much as 95 per cent of the vehicle lifetime these vehicles remain parked somewhere. This creates enormous demand for urban land which is limited, valuable and is needed for more important usage. Depending on the size of the cities and rate of motorization, the annual demand for additional parking spaces can be equivalent to as much as 310 football fields in Delhi.

The number of vehicles that are registered in Nairobi annually can create additional demand for land areas as big as 100 football fields. Cheap and free parking is a subsidy to rich car owners and loss to the local government exchequer. The costs of using valuable urban land for parking of personal vehicles are not recovered through proper taxes and pricing. Parking rates, even in expensive parking structures, are minimal and not adequate to recover the cost of investment. This is a subsidy. This subsidy amount will work out to be much larger if the rental or the land cost is taken into account. Increased investment in expensive and prime areas of the city further enhances this subsidy as the parking rates are not expected to recover this cost.

**A step forward in Nairobi:** Nairobi has taken the lead to introduce priced parking to reduce demand for parking and car usage. Parking in Nairobi is managed by the Nairobi City County. The city has 13,000 on-street and 460 off-street parking lots. Off-street parking lots are mainly in the CBD area. Entire Nairobi has priced parking though unauthorized parking lots also coexist. Parking charges vary — cars have to pay 300 KSh for an entire day in an on-street parking whereas in case of off-street parking, one has to pay 50 KSh for entry and thereafter 30 KSh every 30 minutes. This comes to 12.5 KSh every hour in case of on-street parking and 110 KSh for an hour in an off-street parking lot. Nairobi City County has initiated a pilot project of cashless parking pricing system. One has to pay the parking fee using phone. The system asks for details such as parking duration and zone and also the type of vehicle. The parking fee will be deducted and the car owner/driver will receive SMS notification. People who do not pay for parking, their cars are clamped and a penalty of 2000 KSh is charged which is to be paid within 2 hours of clamping the vehicle. Thereafter, the car is towed and impounded for which the car owner has to shell out 2500 KSh for towing and 3500 KSh for impounding. On successful implementation, there are plans to go for hourly charging. Aimed to increase the parking revenue, this system was not favoured by the cars owners and drivers initially.

This is an important learning curve in the region. Indian cities can also learn from this strategy. A combination of restraint measures like this and improved public transport system can help to reduce congestion on roads.

**A few steps forward in Indian cities:** Indian cities are also framing several strategies. These include variable and increased parking pricing; parking district management plan, no car without proof of parking; barring parking on green areas, etc.



## PART II – INITIATIVES IN CHINA AND INDONESIA

### 1. The air we breathe

**Air quality monitoring in Chinese cities:** Public pressure started to build for the release of data on air quality in Chinese cities after the United States Embassy in Beijing began to collect and publish their own data ahead of the 2008 Olympic Games. The US data, which measured the levels of the pollutant PM<sub>2.5</sub> and published it through Twitter, showed that the air quality was much more hazardous to human health than what was indicated by the data released by official Chinese sources (which did not include PM<sub>2.5</sub>). Interest in the matter increased further throughout 2011 and 2012, through the distribution of personal air quality monitoring devices by NGOs and through campaigns by prominent citizens on social media, particularly the microblog Weibo, China's version of Twitter.

Guangzhou Environmental Protection Bureau became the first agency to start publishing air quality monitoring data, which included PM 2.5, on their website in March 2012. In July 2012, the national Ministry of Environmental Protection made it mandatory for all city Environmental Protection Bureaus to monitor and release this data on their websites. By the end of the year, 74 cities had begun doing so. In 2013, this number increased to 180 and as of the end of 2014, 380 cities in China have fixed air quality monitoring stations and are publishing the results on their websites, often with a few hours delay. This data is also widely disseminated to the public through the use of mobile apps.<sup>3</sup>

However, the Air Quality Index (AQI) used in China is still less stringent than the one used by the US EPA for the lower levels of pollution.

Though getting the air quality monitoring and release of data in place was a major achievement, there are still concerns raised that the monitoring stations do not properly reflect the quality of the air people actually breathe, as they are all outdoor and for the most part placed on top of buildings. NGOs, such as Qing Qi Tuan in Guangzhou, advocate for the use of more decentralized air quality monitoring and encourage people to buy their own monitoring device to check their indoor air.<sup>4</sup>

**Emergency pollution control measures:** In November 2014, China hosted the annual APEC summit in its capital city of Beijing. In an effort to manage air pollution during the event, the city instituted a set of air pollution emergency measures which included the closing of 10 per cent of factories in Beijing and the surrounding province, an odd-even registration plate measure whereby half of the vehicles were banned on the roads each day, and the closing of government offices. The latter meant that 800,000 people got a holiday and many left the city.<sup>5</sup>

A similar package of measures is supposed to go into force if the air pollution is forecasted to be above AQI 300 (meaning a PM 2.5 level above 250) for a consecutive three days. However, this has so far never been used.<sup>6</sup>

**Air quality monitoring and emission inventories in Indonesia:** Cities are required to monitor their air quality at least once every 6 months. Only 15 cities nationwide have fixed monitoring stations, the rest use mobile devices for monitoring. The data from the monitoring



is not published on a regular basis, so a person interested in it must request it from the relevant city Environment Protection Agency.<sup>7</sup>

In 2012, a pilot project to conduct emission inventories (EIs) started in the cities of Palembang and Surakarta. The EIs, which assess the source, magnitude and distribution of different pollutants, were conducted by local universities, with support from the local governments, the “Clean Air for Smaller Cities in The ASEAN Region (CASC)” of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Indonesia Ministry of Environment and Forestry (MoEF).<sup>8</sup> Following the start of the EIs in these two cities, the MoEF decided to support EIs in an additional eight cities across Indonesia. As of March 2015, the results were still being analyzed for most of the cities involved. These findings will then be used to develop Clean Air Action Plans for the cities.<sup>9</sup>

In **Surakarta**, the EI was conducted by a team from Sebelas Maret University. Emissions of the pollutants NO<sub>x</sub>, Sox, NMVOC, PM 10, CO and CO<sub>2</sub> were measured at source in the entire city (but not in the surrounding cities which are part of the Greater Surakarta Area). As a major transportation hub on central Java, the preliminary findings show that more than 70 per cent of emissions of all pollutants except for PM 10 came from the transportation sector. For PM 10, transportation accounted for 56 per cent.<sup>10</sup>

## 2. Initiative to reduce road injuries

**Education for road safety in Surakarta:** The Traffic Management Agency of the city of Surakarta is taking an active part in promoting road safety in the city. The agency has so far worked with 200 schools from the pre-school to the university level, with different programs depending on the age of the students. For younger students, they have games to teach them safety as pedestrians and for older students they hold lectures. They also bring different schools to a place outside their office every week where they have a “special safety school” with traffic signs and crossings to show students safe behaviour. They also have a life-sized road safety version of the board game “snakes and ladders” which they put out every car-free day on Sunday mornings.<sup>11</sup>

## 3. Vehicle technology and fuel quality roadmap to reduce vehicular emissions

**Working towards the Euro 4 standard:** The Euro 2 standard was implemented in Indonesia in 2002 and is still in place. The country is now working towards the adoption of the Euro 4 fuel economy standard. In 2014, there was a draft government decree on the implementation of Euro IV in 2016. All new vehicle models produced would need to comply with the standard at this time, but existing models would be allowed to continue being manufactured until 2018.<sup>12</sup> The decree has been delayed and the new timeline is to implement Euro IV by 2017 with existing models allowed to be sold until 2019. However, the decree has still not been approved.<sup>13</sup>

The main challenge for improving the fuel economy standard is the high sulphur content in



diesel. The diesel produced domestically has a sulphur content of 1,000 ppm, while the Euro 4 standard mandates a maximum of 50 ppm. The main producer is the state-owned-company Pertamina. Pertamina already has several refineries capable of producing Euro 4-compliant fuel, but it will take until 2019 for it to make all of its production compliant with the standard and it is reluctant to make this investment unless it is sure that the decree will be passed.<sup>14</sup> Furthermore, due to increased domestic energy demand, Indonesia became a net oil importer in 2004.<sup>15</sup> Much of this fuel is very low-quality and cheap diesel imported from Singapore which contains up to 5,000 ppm. The mix actually used in Indonesia therefore often has a sulphur content of around 2,000-3,000 ppm.<sup>16</sup>

There is also resistance to the Euro 4 standard from sections of the auto manufacturing industry. According to their calculations, raising the standards will make private vehicles unaffordable to a large enough segment of the society to decrease the companies' overall revenues.<sup>17</sup>

#### 4. Scale up comfortable and reliable public transport

**Multi-modal connectivity in Guangzhou:** Several steps have been implemented to achieve good multi-modal connectivity in Guangzhou, both in terms of physical features and soft features such as tickets and signage. The metro in Guangzhou began operation in 1997 and serves as the backbone of public transportation in Guangzhou. It currently consists of 9 lines and 164 stations, covering 260 km. An additional five lines are under construction and the full system will extend for 500 km in 2020. In 2014, the metro had a daily ridership of 6,130,000, which was an increase by 9.3 per cent from 2013. When a new metro station is opened, the bus lines in the surrounding area are rerouted to complement the metro system instead of competing with it.<sup>18</sup>

Guangzhou's award winning BRT system was constructed in close collaboration between the Guangzhou Municipal Engineering Design and Research Institute and ITDP and opened in 2010. It is physically integrated with the metro at several stations. It cost USD 4.4 million/km to construct, which was financed by the city government. In comparison, Guangzhou metro line five (the line running closest to the BRT) cost nearly 10 times as much to construct per kilometre.<sup>19</sup> While the system and infrastructure is regulated by the Public Transport Management Office, the BRT Management Co. oversees the operational delivery of the private companies. The buses are operated by seven companies, which are organized into three large corporate groups. The operators are paid per vehicle kilometre travelled within the BRT lane, instead of per passenger and the operational costs are covered through revenues.<sup>20</sup> With a peak capacity of 27,400 passengers per hour per direction and a daily ridership of 850 000 passengers per day, it has the highest capacity of any BRT system in the world as well as a higher ridership than most metro systems in China.<sup>21</sup> It is estimated to contribute to a 10-15 per cent modal shift from private vehicles.<sup>22</sup> Though there is only one corridor of 22.5 km, the BRT is a so called direct service system, meaning that buses continue on routes outside of the BRT lanes, which reduces the need for transfers. Multiple lanes per direction allow for buses overtaking each other at stations and both the length of the stations and the distance between them are planned based on passenger demand. Preliminary results show that 32 million passenger hours and approximately USD 77.3 million are saved each year due to reduced travel time and congestion.<sup>23</sup>

Bicycle parking and bike lanes were constructed along the entire BRT corridor.<sup>24</sup> A bike-share system with 5,000 bikes at 109 stations has also been opened along the route and covers the area within a one kilometre radius of the corridor. The system cost USD 4.5 million in capital cost and an additional 4.5 million in annual operational costs, which is paid entirely by the city government.<sup>25</sup> There are plans to expand the bike-share system to cover a larger part of the city, with 50,000 bikes by the end of 2016 and 100,000 bikes in the future.<sup>26</sup> As part of this, there are plans to expand the bike-share in suburban areas in the hope that it will be used as a feeder to the metro instead of motorcycles and electric bicycles. However, due to safety concerns, NMT infrastructure would also need to be expanded. In an effort to promote sustainability, 1,000 km of greenways have been built around Guangzhou with the stated purpose of improving the conditions for pedestrians and cyclists, but many of these actually prohibit cyclists and can only be used by pedestrians.<sup>27</sup>

Public ferries also operate in Guangzhou, along the Pearl River, which runs through the city. There are 61 ferries running each day, which is an increase of 24 per cent from 2013. However, though there are bus connections, the ferry is not well-connected with the metro and bike-share systems. This is mainly due to land-use issues as it is difficult to get permission to construct near the ferry stations. There is an overall lack of coordination between transportation planning and urban planning in Guangzhou with the result that it has proven difficult to get the transit oriented development (TOD) concept implemented around transit stations.<sup>28</sup>

Guangzhou's first 7.7 km electric tram line with 11 stations was opened in 2014, connecting three of the metro lines. It is meant to function as a kind of test run before building more tram lines around the city. It is expected to carry 26 000 passengers per day.<sup>29</sup> However, the tram has been criticized by the media and the public for being more of a show for visitors than a system providing good public transportation. It connects the central landmark Canton Tower with the area where the Canton Trade Fair is held for two weeks, twice a year. The argument is that there is not enough passenger demand year-round to warrant the investment cost. Furthermore, the tram runs along the riverfront and has thereby significantly reduced the pedestrian and NMT area there.<sup>30</sup>

All modes of public transport, i.e. metro, BRT, bus, tram, ferry and bike-share, in Guangzhou uses an integrated electronic ticket system, the Yang Cheng Tong Card. If the same card is used 15 times in the same month, the user receives a 40 per cent discount on all subsequent rides. Clear signage is also used to make connections easier for travelers. For example, all metro stations have signs showing which bus lines stop at each of its exits and the bus stops have signs showing the routes of each of its bus lines and which stops have nearby metro stations.

**Recognizing the importance of urban transport for development:** Overall national planning for development is done for five year periods in **Indonesia** through the National Medium Term Development Plan. It is a positive progress that the current one, valid for 2015-19, includes a chapter on urban transport for the first time, as this shows that the impact of urban transport on development is being recognized.<sup>31</sup>



**Commuter train as PSO:** Commuter trains are classified as a Public Service Obligation in **Indonesia**, meaning that fares are capped and subsidized by the national government. In the greater Jakarta area there are currently four lines, connecting the capital city of Jakarta with four other major cities: Serpong, Tangerang, Bogor and Bekasi. The infrastructure is owned and maintained by the government and the train services are operated by PT KAI Commuter Jakarta and carry around 400,000 passengers per day. The service was improved in 2007 with newer trains and AC.<sup>32</sup>

Issues include overcrowded trains during peak hours and a lack of connectivity with buses at many stations. The headway needs to be improved, but the main barrier is that there are at-grade crossings with roads which limits speed. There are currently six projects to build underpasses for grade separation in process and this should be finished within the next two years.<sup>33</sup> There are also plans on extending the railway to connect the city with the Soekarno-Hatta International Airport. A feasibility study is being conducted and if things go according to plan, the line will be finished within five years.<sup>34</sup>

## 5. Walk and cycle

**National policy and technical guidelines for Non-Motorised Transport in China:** In September, 2012, the Ministry of Housing and Urban-Rural Development (MoHURD), the National Development and Reform Commission and the Ministry of Finance released the “Guidance for Strengthening the Construction of Urban Non-motorized Transportation System”, which was the first national policy guidance document on pedestrian and cycling transport. The policy was based on lessons from the two first phases of the “National Urban Non-motorized Transport Pilot Project” which was carried out in six cities per phase, starting in 2010. It sets the goal of having a 45 per cent modal share of walking and cycling in all cities with a population above ten million and 50-70 per cent in all other cities, by 2015. The pilot project was initiated by Energy Foundation China Sustainable Cities Program (CSCP), in partnership with MoHURD and the ministry’s think tank, the China Academy of Urban Planning and Design.

In four of the original cities, Chongqing, Kunshan, Kunming, and Jinan, CSCP, China Sustainable Transportation Center and an international group of experts worked closely with the city governments to implement the project. Based on the experience there, China Sustainable Transportation Center and China Academy of Urban Planning and Design developed the “Technical Guideline for China Urban Non-motorized Transportation System Planning and Design”. In December 2013, these guidelines were officially issued by MoHURD, making them the first and only technical document promoting pedestrian and cycling networks by the national government.<sup>35</sup> Though the technical guidelines are voluntary, 100 cities have committed to following them.<sup>36</sup>

**Bike-share as a public service:** Cycling has historically been the predominant mode of transport in China, earning the country the nickname “Kingdom of Bicycles”. Though rapid motorisation has brought dismantlement of and encroachment on cycle tracks and other spaces previously used by cyclists, cycling is being actively promoted as a sustainable mode of transport in many cities. This is especially clear in the number of bike-share systems mushrooming up around the country. 102 cities currently have some type of bike sharing, with a current total of 680,000 bikes at 22,000 bikes and growing. This includes two of the largest

bike share systems in the world in the cities of Wuhan (90,000 bikes) and Hangzhou (78,000 bikes). Bike-share systems in Chinese cities are seen as a public service and as a mean towards reducing congestion and pollution. Therefore, bikes can be used free of charge for the first hour and then through a minimal charge for subsequent hours. Unlike many systems in Europe, there is no monthly or annual subscription fee, only a required deposit.<sup>37</sup>

Hangzhou was the first city in China to start a bike share system. It now has 78,000 bikes at more than 3,000 stations, with each bicycle being rented out 3.8 times per day on average.<sup>38</sup> The system is operated by the Hangzhou Public Bicycle Transportation Services Development Co., Ltd, with support from the city government. The placement of the stations, which includes all subway stations, was jointly decided by bus companies, the Traffic Police and the Urban Administration Office. This is guided by the “Hangzhou Public Bicycle Transportation System Development Plan”, issued by the Hangzhou Planning Bureau and the public can make suggestions on improvements through the internet, hotlines and other platforms. The city government is also actively promoting the city’s cycling culture with slogans such as “care for the environment, travel green” and “improve quality of life for our city” printed on the bikes, as well as through the tourism industry.<sup>39</sup> Hangzhou has also developed the *Hangzhou Non-Motorised Transport Development Strategic Plan*, which includes the completion of 125 bike corridors by 2020. The city has been divided into 47 NMT zones for NMT traffic planning and areas are also grouped into eight categories based on land use purposes, pedestrian traffic levels and citizen activities. Measures have been introduced based on the categorization of each area. It has also issued design guidelines for its NMT and pedestrian systems, to be used in future planning.<sup>40</sup>

**Bogor pedestrian advocacy:** The city of Bogor has adopted an NMT plan as part of its medium-term planning (5-year plan for the development of the city), which includes the improvement of pedestrian, and to a smaller extent cyclist, infrastructure. The plan is largely being implemented according to the time-line. However, there are still many areas waiting for improvement and encroachment on sidewalks by parked cars and street vendors is common. Koalisi Pejalan Kaki Bogor (KPK-B) is a local coalition of volunteers from business, school alumni and religious associations and other community groups who advocate for the improvement of their pedestrian environment. They have brought up issues of encroachment with the local government, including the mayor and through cooperation with the GIZ Sustainable Urban Transportation Improvement Project, they have been able to put forward their inputs for urban and transportation planning to the local agencies, which community groups have not been able to do before in Bogor.

Another project driven by KPK-B was the reopening of a pedestrian tunnel which was closed due to security concerns in 2005. It has been revitalized with an art exhibition on the pedestrian environment and music to encourage people to use it. The initial one-month opening of it has been extended by the city Tourism Agency. They also educate junior high students on the importance of using public spaces and arrange the car-free day on Sunday mornings.<sup>41</sup>



## 6. Intermediate public transport system

**Consolidating para-transit into the formal bus systems in Indonesia:** Public minivans, known as angkots, are a common sight on Indonesian roads. These are often not well organised, of varying legal status and difficult to manage. Some cities are initiating steps to make these part of the formal transportation network.

**Bogor** has a bus system called Transpakuan. Though this has some features of a BRT system, such as clearly defined stations, it does not have separate bus lanes. At present, it consists of three corridors, with an additional four in the planning stage. The plan is for the full system of seven corridors to function as the back-bone of public transportation with angkots serving as feeders. However, there are currently only 30 buses running in all three corridors of the TransPakuan, resulting in long headways and low ridership. At the same time, there are 3,412 angkots operating on 24 routes in Bogor, some of which compete with the TransPakuan corridors. The operators of these vary in size from a multitude of one-angkot companies to the largest company operating 1,000 angkots.

Negotiations are ongoing between the city government and Organda, the association of the angkot owners, to replace the angkots with medium-sized. The first step towards this is to get legal entity for the angkot owners, which was regulated in 2014 along with minimum service standards of angkots. Some already have this, but many, especially the smaller companies, still only have the older licenses which carry fewer requirements.

The next step is the actual replacement of the vehicles. According to the policy, three angkots can be exchanged for a TransPakuan bus or three angkots can be exchanged for two smaller buses, which should then in turn be replaced by one TransPakuan bus within five years. This has been approved by both Organda and the local government on paper in 2014, but as the city government was replaced later in that year following elections, implementation has been delayed.<sup>42</sup>

A similar process is ongoing in Surakarta, to consolidate existing bus and angkot operators into the Batik Solo Trans (BST) bus system, which opened in January 2014. There are currently two corridors in operation, with a third opening in June 2015 and another two by the end of the year if sufficient funds are allocated.

There used to be 17 bus operators in Surakarta, but as of 2014, these have been formalised into one company. Though this was a positive development, the bus operators were already quite few and relatively organised. There were also 300 angkot operators in the city and there were a lot of strikes from these when the second corridor opened as they feared losing passengers. Through negotiations between the various stakeholders, this issue has now hopefully been resolved. In February 2015, all angkot stakeholders were consolidated into one cooperative. They will mainly act as feeders to the BST, but some will also continue to drive along the corridors. In the long term, the BST will consist of 14 routes, with the current angkot operators transferring to some of these.<sup>43</sup>

## 7. Parking restraints

**Parking policy in Beijing:** Parking rates have been gradually increased since 2002. As part of the 28 specific measures announced in December 2010, non-residential areas have been di-



vided into three zones based on congestion levels and centrality of the location. Since April 2011, the rates for cars are between CNY 2 and 10 per hour for the first hour of on-street parking and then 50 per cent higher for subsequent hours. Off-street parking is slightly lower. The minimum time unit for parking was reduced to 15 minutes to increase turn-over. This measure was complemented by the construction of park-and-ride facilities to encourage modal shift to urban rail transport.<sup>44</sup>

The fine for illegal parking is CNY 200 (USD 32). However, enforcement is often weak as the traffic police have many other priorities.<sup>45</sup> Gao Yang, Assistant Director of the Beijing Institute of City Planning and Design, told China daily that “he had surveyed 23 residential communities across Beijing and found that more than 85 per cent of car owners “had never or seldom” been ticketed for parking illegally.”<sup>46</sup>

**Parking policy in Guangzhou:** A parking reform went into effect on August 1, 2014 which made all parking in the city fall under the same policy and included zonal parking rates and raised fees. The city has been divided into three zones, out of which the central areas are in the first zone. There, on-street parking is charged at CNY 4/15 min (USD 0.65/15 min) between 8am-10pm. Zone 3 and parking in all areas at night charge CNY 1 per 15 minutes. Off-street parking in commercial buildings will have these rates as a maximum, but owners can choose to charge lower rates.<sup>47</sup> When the policy was announced, it was said that the extra revenue from these rates fees has been earmarked for investment in public transport and park-and-ride facilities in the outskirts of the city. However, a lot of the parking spaces are managed by private companies and it is not clear how much of the increased revenue actually goes back to the government and how much of that is reinvested in public transport.<sup>48</sup> The potential of implementing incremental parking fees (raising the per hour rate for subsequent hours of parking) is being studied.<sup>49</sup>

In 2013, the total number of vehicles registered in Guangzhou was 1,820,000, while there were only 640,000 parking spaces. Due to this, there is a lot of illegal parking and there is a lack of enforcement. However, when the parking fees were raised, the auction price for a registration plate went down, showing that the policy did decrease the will to buy a car.<sup>50</sup>

**Parking meters in Jakarta:** On-street parking is officially restricted in areas known as KPP (parking control areas), but there is a lot of illegal parking, encroachment on sidewalks and revenue disappearing from the system. Electronic parking machines were recently (as of October 2014) put into use on a central road in Jakarta. The collected revenue has so far been 12 times higher than manually collected fares.<sup>51</sup>

**Zonal parking in Surakarta:** The city is making an effort to reduce motor vehicle usage through the introduction of increased rates and highly restrictive parking within its city, along with park-and-ride facilities along the cities fringes. A policy is being developed to remove all on-street parking from the main street, Slamet Riyadhi, and create off-street parking instead. Implementation of this on some segments will begin during 2015.<sup>52</sup> However, it is difficult to find space for off-street parking as most land is privately owned.<sup>53</sup> The pre-



vious parking fee was IDR 2,000 (USD 0.17) per day. Instead, the city will be divided into different parking zones A-E, with different rates according to the land use of the area. So far only zones C-E have been imposed. In zone C, cars are charged IDR 3,000 and motorcycles IDR 2,000 for the first hour with each subsequent hour at IDR 1,000. In zone A, cars will be charged IDR 5,000 for the first hour. This can be compared with the regular fare for buses of IDR 4,000.<sup>54</sup> However, not all parking attendants enforce the time-based parking fees and instead charge a flat fee as per the old system as this requires less administration.<sup>55</sup>

## 8. Innovative solutions for reducing dependency on private motorized vehicles

**Registration plates caps in Beijing, Shanghai and Guangzhou:** Caps on the sale of registration plates are used in several cities of China to reduce the number of motorized vehicles. However, the method of implementation varies between the cities.

**Shanghai** was the first city to use a vehicle quota system, starting in 1994. The first policy was linked with estate and automobile industry policies and was used more to protect the local auto manufacturing industry than to restrict vehicle numbers. The connection with the real estate policy was removed in 2001 and the differentiation between local and imported vehicles was removed in 2003.<sup>56</sup>

Around 100,000 plates are sold each year through an auction. To enter the auction, a person needs a permanent living place in Shanghai and a job. The price of a number plate rose from CNY 14,000 to almost CNY 50,000 between 2000 and 2007 (USD 8 000). Revenue from this has been used (at least partially) for public transport, which has increased public acceptance of the measure. Because of this, the city has less than a third of the number of personal cars in Beijing, despite the fact that Shanghai has a larger population and per capita income. However, the number of cars used in Shanghai is likely larger than official numbers, as some residents register their cars in nearby cities, though car use is still lower than what it would have been without the quota.<sup>57</sup>

**Beijing** introduced the registration plate quota which was distributed through a free lottery system in 2011. 240,000 plates were issued that year, compared with the 700,000 plates issued in 2010. From 2014, the number of license plates was reduced to 150,000 and 20,000 of these are reserved for New Electric Vehicles (NEVs).<sup>58</sup> Only residents of Beijing were eligible for the lottery. Other efforts to reduce dependency on private motorized vehicles in Beijing include the “odd-even licence plate system” which was introduced ahead of the 2008 Olympics, restricting cars from entering the city on certain days based on the last number of the licence plate. This was later revised to banning two end-plate numbers per weekday (that is, 20 per cent of the cars each day) between 7 am and 8 pm. Cars registered outside of Beijing are also forbidden to enter the city past the 5<sup>th</sup> Ring Road during peak hours (7-9 am and 5-8 pm) and motorcycles are forbidden on some major roads between 7 am and 8 pm.<sup>59</sup>

Restrictions are also implemented to reduce the number of official vehicles as these account for 15 per cent of total car-ownership in Beijing.<sup>60</sup> In 2011 it was announced that Beijing government agencies and institutions totally funded by the government were prohibited from buying new cars for five years.<sup>61</sup>

**Guangzhou** uses a mix of the systems seen in Beijing and Shanghai. The policy went into

force in 2012 and allows 120,000 registration plates to be sold annually. The license plates are distributed as follows:

- 50 per cent through lotteries: 68 per cent of businesses and 96 per cent of private persons wanting to purchase a new vehicle enters the lottery, showing that most people are not willing to pay extra for the license plate. Only three per cent actually receives one. To deter people from entering the lottery if they are not actually planning on buying a vehicle at that time, someone who is awarded one must buy the vehicle within six months. Failure to do so will both mean that you lose the license plate and prohibit you from entering the lottery again for 12 months.
- 40 per cent are sold through auctions with a minimum price of CNY 10,000 (USD 1,600) and this is also the price most plates are currently actually sold for. About 95 per cent of the revenue from the auction goes back into public transport, subsidies for NEVs and investment in getting buses to run on LNG.
- Ten per cent are reserved for NEVs. So far the demand for NEVs has been low enough that whoever buys one will also be able to get a license plate.

According to calculations by the Guangzhou Transport Research Institute, the number of new vehicles was reduced by 695,000 between July 2012 and August 2014 compared to the Business-As-Usual scenario. However, there is also a rise noted in vehicles from outside of Guangzhou driving in the city. Before the policy was implemented, only 5.9 per cent of the vehicles on the road were not registered in Guangzhou. By the end of 2014, this had increased to 13.6 per cent.<sup>62</sup>

**Ban on students under the age of 17 coming to school by private motorized vehicles:** There is a national policy prohibiting students below the age of 17 from travelling to school by motor vehicles, but this is not enforced in most places. **Surakarta** is one of the few cities starting to try to enforce this as they are expanding the public transportation network. The Transportation Agency has signed MoUs with several schools for cooperating on this, as the schools have the main responsibility for enforcing the policy.<sup>63</sup>

**Taking the lead:** Since 2011, the **Indonesian** Ministry of Transport, located in Jakarta, has the third Wednesday of every month designated as a Public Transport Day where all employees are supposed to come to work using public transport, cycling or walking. Parking of private vehicles at the office is prohibited and the Ministry provides its own feeder bus from the closest commuter train station on these days. There is also a BRT stop is right outside the Ministry Though evaluations show that this is largely followed on those days, no study has been made on whether this has made any employees shift their commuter mode permanently.

**Electronic road pricing in Jakarta:** An Electronic Road Pricing (ERP) trial is planned for certain main thoroughfares. Buses, taxis and emergency vehicles will be exempted from paying the tax.



Motorcycles will also be banned on some of the roads covered by the ERP at certain times of the day. The main stated objective of this is to improve road safety, with decreased congestion as a co-benefit. Parking will be provided outside the ERP zone and free shuttles are planned along that road. However, according to news reports, it seems that many people are not aware of the trial.<sup>64</sup> A trial of the ban on motorcycles was started on two roads in December 17, 2014 and was meant to go on until January 17, 2015. This was later extended and was still in place in March, 2015. During the first day of the trial news reports said that most motorcyclists seemed to be looking for alternative routes, rather than using one of the 20 free buses provided. No fines will be issued to transgressors during this trial period.<sup>65</sup>

## 9. The way forward

- **Strengthen air quality monitoring, and establish public information system with health advisory:** Cities should strengthen monitoring grid. Implement air quality index system and health advisory for informing people about ill effects of poor air quality.
- **Tighten fuel quality and emissions roadmap:** Tighter emission norms have become the necessity to ensure that pollutants are cut at source. Accelerate upward harmonization of emissions standards and create schedule for introducing tighter emissions standards. Frame fiscal policies to enable the transition.
- **Scale up and accelerate bus transport reforms. Integrate public transport, and non-motorized transport.** Cities need to integrate bus, cycling, walking and para-transit systems.
- **Adopt street design guidelines to build pedestrian infrastructure:** Mandate pedestrian plans and make it conditional to infrastructure funding. Investments must be linked with explicit pedestrian and cycling plans. Implement walkability audits. Public transport plans must include pedestrian plan for multimodal integration. Need zero tolerance policy for accidents.
- **Develop parking policy and parking area management plan to reduce demand for parking and use of personal vehicles:** Organize legal parking, enforce high penalty for illegal parking; cap absolute supply of parking spaces; Parking plans need to account for the changes in parking demand with improvement in public transport in different zones; Parking should be public, shared and priced; Need good on-street parking management; protect walkways from car parks; design parking for multimodal integration and improving public transport usage; create “Park and Walk” facilities; do not allow free parking and link car purchase with proof of parking
- **Use tax measures to discourage personal vehicle usage and use of poor quality fuels and vehicles.** Additional revenue from these taxes can help to generate additional resources to improve public transport and fuel quality.

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