Air quality and sustainable transportation challenge in South Asian cities

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Workshop on Air quality and sustainable transportation challenge in South Asian cities

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Kathmandu, July 26, 2012
1950-2006: Urban population of the world has increased from 739 million to 3.2 billion.

By 2025 around 65 per cent of the world’s population is projected to live in cities.

By 2010 more than 75 per cent of the world’s urban population will live in poorer countries (State of the World 2007).

More than 40 per cent of the world children are estimated to be living in polluted cities of developing world (WHO).

A billion more will be added over the next three decades in Asia – almost adding a whole new India. More than half of them will be living in cities

What about South Asia?
Growing pollution and toxification: new struggles in cities

- Cities in grip of toxic model of growth: Intensive use of energy and materials leading to huge amounts of waste -- pollution.
- Major health impacts – toxic air causes one death per hour, ...
- High urban poverty
- This is a challenge for urban governance.
- How can cities reduce public health impacts, achieve low carbon and energy footprints, urban community wellbeing and improve liveability of cities.

The price of wealth

One person dies every hour in Delhi because of air pollution

In 20 years between 1975 to 1995 the GDP more than doubled in India, but...

Where will the future growth take us? It all depends on the choices we make
From its early stages, CSE’s Right to Clean Air campaign used a variety of communication tools — such as this poster — to put out its message to the public. It built support
Look at these black spots on the lung. The unfortunate owner lives in Delhi and has been breathing polluted air. Air full of carbon particles which accumulate in the lungs (black spots). What you can’t see is a cocktail of gases and tiny particles, even smaller than carbon that get into our bodies. Actually, you are getting polluted.

Scary? But those cars are so sexy!
Delhi has fought hard to get breathing space

On vehicles
- Introduced low sulphur fuels and petrol with 1 per cent benzene
- Mandated pre-mix petrol to two- and three-wheelers
- Moved from Euro I to Euro IV over the last decade
- Implemented largest ever CNG based public transport programme
- Capped the number of three-wheelers
- Phased out 15 year old commercial vehicles
- Strengthened vehicle inspection programme (PUC)
- Efforts made to divert transit traffic
- Set up independent fuel testing laboratories to check fuel adulteration

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

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

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

This now needs scale and stringent enforcement
Delhi got cleaner air: it avoided pollution

CPCB reported 24% drop in PM10 levels in 2002 compared to 1996 levels.
Evidence of action: Health Benefits

Downward PM10 trend in some cities* have led to 13,000 less premature deaths and reduction in respiratory illness¹

Lives saved:

- Delhi: 3,629
- Hyderabad: 125
- Kolkata: 3,293
- Mumbai: 5,308
- Chennai: 484

Source: CSE: based on NAMP data, CPCB, and World Bank 2004
India: Proliferating pollution hotspots

Half of the cities are critically polluted due to high PM10, even NO2 is rising in many of them – a twin trouble

Source: Estimated based on CPCB data, comparison with residential area standard
Delhi has lost its gains. After a short respite pollution curve turns upward.

Source: Based on CPCB data
First generation action in Kathmandu

Kathmandu has already initiated series of action to clean up its air:

- Introduced Nepal Vehicle Mass Emission Standard,
- Ban on import of second-hand and reconditioned vehicles, two-stroke engine vehicles
- Phase out of three-wheeler diesel tempos (1999), three wheeler two-stroke engine vehicles, and 20 years old taxis from Kathmandu valley (2004)
- Introduction of electric and LPG three-wheelers
- Introduction of Vehicle Emission Standards for in-use vehicles. Green stickers for vehicles meeting emission standards. In-use emission standards further improved after 1998 to include HC- and gas-operated vehicles such as LPG in 2000
- Ban on trucks and other heavy goods carrying vehicles during night (1999/2000)
- Ban on new registration of Bull’s Trench Kiln brick manufacturing industries in the valley. Others changed to cleaner technology (2004)
- Emission standards for brick kilns of 900 mg/m³ by Industrial Promotion Board in 2004
- National Indoor Air Quality Standard and Implementation Guidelines 2009
- Implemented Polluter Pay Principle in Kathmandu valley by placing Rs. 0.5 per liter petrol and diesel to reduce air pollution Kathmandu valley
Air quality in Kathmandu?

Annual average PM10 levels in Kathmandu (2003 - 2007)

Air quality data until 2007 shows mixed trend in particulate matter and also a dip.
Monthly average PM10 levels in 2007 show high winter pollution.
Kathmandu: More threats

PM2.5 concentration in hospitals

Benzene concentration in Kathmandu (2002-03)
## National Ambient Air Quality Standards

<table>
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<tr>
<th>Pollutant</th>
<th>Time weighted average</th>
<th>NAAQS, Nepal</th>
<th>NAAQS, India Industrial, residential, rural and other areas</th>
<th>Ecologically sensitive area (notified by Central Government)</th>
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<td>Total suspended particulates (TSP)</td>
<td>Annual, 24 hours</td>
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<td>Particulate matter (size less than 10um3) or PM10 ug/m3</td>
<td>Annual, 24 hours</td>
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<td>Particulate matter (size less than 2.5 um) or PM2.5 ug/m3</td>
<td>Annual, 24 hours</td>
<td>50</td>
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<td>Sulphur dioxide (SO2), ug/m3</td>
<td>Annual, 24 hours</td>
<td>70**</td>
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<td>Nitrogen dioxide (NO2),ug/m3</td>
<td>Annual, 24 hours</td>
<td>40</td>
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<td>Carbon monoxide (CO) mg/m3</td>
<td>8 hours, 1 hour, 15 minute</td>
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<td>Ozone (O3) ug/m3</td>
<td>8 hours, 1 hour</td>
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<td>Lead (Pb) ug/m3</td>
<td>Annual, 24 hours</td>
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<td>Benzene (C6H6) ug/m3</td>
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<td>Benzo(a)Pyrene (BaP) - particulate phase only, ng/m3</td>
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<td>Nickel (Ni), ng/m3</td>
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As the bar of health protection is raised more locations show up on the critical and highly polluted list

- **India has tightened the national ambient air quality standards**
  Focus on PM2.5 and ozone
  Uniform health based standards for all land use classes
  New standards have changed the air quality status of locations in India
  - The new PM10 standards have increased the total number of critically polluted locations from 123 to 176
  - After the new nitrogen dioxides overall 17 locations are in critical rank now as opposed to 6 earlier; highly polluted locations have increased from 13 to 41. and highly polluted industrial locations have increased from 3 to 19.
  - Critically polluted residential locations for NO2 have increased from none to 8, and highly polluted from 8 to 20.
In India no punitive action on state governments for not meeting the ambient air quality norms.

Abatement plans are not designed to meet local air quality targets.

Emissions regulations are kept weaker for most of India.

- In the US the air quality standards are federally enforceable. EPA impose sanctions if states fail to meet the air quality targets -- such as cut highway funds.
- Civil society can sue the state governments.
- “Citizen Court Suits” allowed against EPA for failure to promulgate NAAQS, emissions standards or implement state implementation plans.

In India the eleventh five year plan mandates the central government to set monitorable target of air quality -- achieve the standards of air quality in all major cities by 2011–12

Ensure enforcement of air quality standards, accountability and compliance.
Our health must matter.............
The myth of safe air

How far tiny particles penetrate our lungs

Ultrafine particles 0.65 microns
Magnified 200,000 times

Our health is at serious risk......

Particulate matter: Special worries:
Acute and chronic effects; Cause premature deaths. Studies show association of PM with mortality at much lower level (less than 50 microgramme per cum (HEI)

WHO says -- no safe level

Global evidences abound: Clinching evidences from American Cancer Society study that tracked effects in 600,000 people over 18 years.

Observed large effects....-- A mere increase of 10 microgramme per cum of PM2.5 can increase the risk of lung cancer by 8%, cardiopulmonary deaths by 6%, all deaths by 4%.

Other cocktail of pollutants -- A Killer mix:
Ozone, Nitrogen oxides, hydrocarbons, Carbon monoxide...Air toxics: -- Aldehydes, formaldehydes, acetedehydes, benzene, 1,3 butadiene, metals, PAH etc........Dangerous at trace levels
Scourge
Alveolar macrophage - biomarker of air pollution

Control area: Sundarbans

Exposed group: Kolkata taxi driver

Increase in AM number

Larger AM – particleladen

Source: CNCI
Emerging evidences in Kathmandu

- **An analysis of COPD patients in Patan Hospital** (April 1992 to 1994) -- COPD cases 1.96 times higher for Kathmandu valley compared to outside. Increase four folds. COPD - number one killer

- **The database of total OPD visits**, and the percentage of respiratory disease for two years reflects the increase in respiratory disease. (1996 - 1998) Number of ARI patient increased at the rate of 22.89 per cent per year. Share of ARI patient out of total OPD visit also increased from 9.99 to 10.11 per cent

- **A 1997 World Bank study** -- mortality and morbidity impacts due to PM10 levels -- Kathmandu’s PM10 resulted in 84 cases of excess mortality, 506 cases of chronic bronchitis, 4,847 cases of bronchitis in children and 18,863 asthma attacks per year

- **A study found the number of in-patients in three major hospitals in Kathmandu valley** suffering from COPD significantly increased between 1992 and 2003. Increase highest during winter

- **A study found that Kathmandu’s residents experienced over 1.5 million respiratory symptom days per year**

- **A survey done by Clean Energy Nepal and Environment and Public Health Organization in 2003** studied patients with respiratory illnesses in emergency departments of major hospitals in Kathmandu. Most of them are from Kathmandu valley and belong to the age group of 51 to 75

- **The Ministry of Environment, Science and Technology (MoEST) estimated in 2005** that the valley’s air pollution results in approximately 1,600 premature deaths per year

- **Estimate by the Clean Energy Nepal/Environment and Public Health Organization** the total benefit of reducing valley’s PM10 levels to 50 μg/m3 would amount to US$1.86 billion per year

- **Using the WHO unit risks for benzene and PAH the number of people expected to suffer from leukaemia due to benzene exposure amount to 1-8 persons per 100,000 and for PAH to 16-32 persons per 100,000**. Benefits of reducing benzene and PAH concentrations to half their current values would amount to US$ 30-70 million per year

- **A study in Atmospheric Pollution Research on Kathmandu** Feb 2008 to Jan 2009 in Kathmandu found high density traffic areas and road intersections of the valley severely polluted by PM10 and all the studied sites can be considered as “hazardous” in comparison with the MoPE’s benchmark of 425 μg m⁻³
South Asia’s unique public health challenge

- The Asia-wide review of existing studies show that the estimated health effects are similar to those found in the extensive studies in western countries.

- But the risk in India could be more serious. Science has yet to assess the unique risk factors in Asia.

- Extremely high levels of particulates and pollution cocktail -- the problem of exposure to multiple pollutants.

- Impact of poverty: Socio economic variables are not included in health studies to influence public policy. Sporadic studies elsewhere show poor are more susceptible.

- Understand risk transition.
Pollution comes from a variety of sources......
Why are we specially worried about vehicles?
People living close to roads are most exposed to vehicular fume

Evidence from Delhi....

The Traffic Impact Area in Delhi:
New HEI Analysis: 55% of the Population within 500 meters of a Freeway; 50 meters of a Major Road

Given the large number of people living within 300-500 meters of a major road, the Panel concluded that exposures to primary traffic generated pollutants are likely to be of public health concern and deserve attention.
Vehicles: Significant contributor amongst the combustion sources in Indian cities

If road dust is taken out from the PM10 inventory results – vehicles share increase dramatically to 83% in Chennai, 63% in Bangalore and 53% in Pune. Vehicles become the second major contributor in Delhi and Kanpur.

(CSE analysis)
Vehicles contribute overwhelmingly to the air pollution load in Kathmandu.

Vehicle emissions contribute 38% of the PM10 levels.
High exposure to vehicular fume

- Vehicular emissions contribute to significant human exposure. Pollution concentration in our breathe is 3-4 times higher than the ambient air concentration.

- In densely-populated cities more than 50 – 60% of the population lives or works near roadside where levels are much higher. This is very serious in low income neighborhoods located close to roads.

- Poor have a higher prevalence of some underlying diseases related to air pollution and proximity to roadways increases the potential health effects.

- In three cities World Bank review found vehicles contributing an average 50% of the direct PM emissions and 70% of PM exposure.

- The WHO report of 2005: Epidemiological evidences for the adverse health effects of exposure to transport related air pollution is increasing.

- Public transport users, walkers and cyclists are the most exposed groups – most of them are also poor.
What is the second generation challenge in South Asian cities?
Technology lag in South Asia

Status of emission standards in South Asia

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PRC = People’s Republic of China.

Notes: The level of adoption varies by country but most are based on the Euro emission standards. Italics indicate that they are under discussion.
a. Gasoline.
b. Diesel.
c. Entire country.
d. Agra, Ahmadabad, Bangalore, Chennai, Delhi, Hyderabad, Kanpur, Kolkata, Lucknow, Mumbai, Pune, Sholapur, and Surat. Other cities in India are in Euro 2.
2. Equivalent to Euro 4 emission standards.

Source: CAI-Asia, June 2010
# Fuel quality languishing in South Asia

## Current and proposed Sulfur Levels in Diesel in South Asia

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ppm = parts per million, PRC = People’s Republic of China.

1,000–10,000 ppm  | 400–500 ppm  | 100–350 ppm  | 50 ppm  | 10–15 ppm  

Notes:
- Under consideration or discussion; uncertain.
- Nationwide supply of 50 ppm commenced in 2003 and for 10 ppm in 2005 due to voluntary goals set by the oil industry.
- Marketed.
- Mandatory.
- Voluntary standard of 500 ppm; however, the formal standard remains 2,000 ppm, and product in the market nationwide varies from 500 to 1,000 ppm.
- Various fuel quality available.
- Beijing, Guangdong, and Shanghai.

Source: CAI Asia, 2010
Technology–lag in India

Indian metros today (Euro IV). But rest of the country Euro III

Diesel Car (PM norm)

Gramme per km


Europe
Japan
USA

Diesel Car (NOx norm)

Gramme per km


EU
Japan
USA

Indian metros today (Euro IV).
But rest of the country Euro III.

Technology–lag in India
Future roadmap?

- India has enforced Euro IV in 13 cities and Euro III in the rest of the country. As of now there is no emissions standards roadmap.

- Nepal plans to adopt the Euro III/IV quality fuel.

- Both countries need to tighten the in-use emission norm regime and in-use compliance to reduce in-use emissions.
Threat of dieselisation

- **Indian cities:**
  - Nationally, 30% of new car sales are on diesel. Nearly 65% of the Kolkata’s vehicular population and nearly 99% of commercial vehicles are diesel-run.
  - Contribution of diesel fuel combustion to ambient PM2.5 can be as high as 23% in Delhi, 25% in Mumbai to an astounding 61% in Kolkata (World Bank).

- **Kathmandu**
  - Diesel vehicles plying in the valley
  - Fuel price policy responsible for growing dieselisation: Transport sector uses 96% of diesel.
  - The share of diesel in overall consumption of petroleum products is the highest at 67.1 per cent followed by petrol at 17.7 per cent. This is imported.
  - Distorted import policy also aiding dieselisation: Age limit for imported petrol cars is 3 years but that for diesel is 5 years. Effective tax paid for diesel vehicles lower than petrol vehicles.
  - Import and use of reconditioned vehicles and improper management of vehicle engines lead to bad air quality.
Why are we worried about dieselisation?
License to Pollute

Diesel cars are legally allowed to emit three times more NOx than petrol cars under the Euro norms.

One diesel car emits as much NOx as 3 to 5 petrol cars. PM is several times higher.

Toxicity of diesel emissions
WHO/IARC has branded diesel emissions as class I carcinogen

Source: MP Walsh
Diesel cars can also make us more energy and climate insecure. How?

- Cheaper diesel fuel encourages bigger and more powerful cars. Eg, --
  - Due to higher gasoline prices 85% of the gasoline cars sold in India have less than 1200 cc engines
  - But 64% of diesel cars are just under 1500 cc and the rest above.
- Diesel fuel has higher carbon content than petrol. If more diesel is burnt encouraged by its cheaper prices and more driving, more heat-trapping CO2 will escape.
- Black carbon emissions from diesel vehicles are several times more heat trapping than CO2 and this nullifies fuel efficiency gains.
- Europe has found that with increased demand for diesel energy consuming refining process will expand to increase the share of diesel from each unit of oil refined. CO2 emissions from the upstream refining process will increase. This negates the benefit of shift from petrol to diesel cars.
- European Commission has calculated the difference in lifetime pollution costs of Euro IV compliant diesel car and petrol car. Total pollution cost of a Euro IV diesel car is 1195 Euros vis a vis 846 Euros for a petrol car. This nullifies the marginal greenhouse gas reduction benefit of diesel car and costs higher to the society.
Countries are moving towards Clean diesel technology to reduce harmful diesel emissions drastically. But India is dieselising without clean diesel.

What experts say?
Do not replace a new petrol car with a diesel, unless they meet:

- US Tier 2 or Euro 5 Standards

And ULSD is Available.

Source: ICCT
CNG helped Delhi to leapfrog and fight poor quality diesel

Euro II diesel bus emits nearly 46 times higher PM than Euro II CNG bus in India.

CNG Bus Emissions in 2004

Source: Teri

Euro II diesel bus emits nearly 46 times higher PM than Euro II CNG bus in India.
Other governments are taking active fiscal measures

• Fiscal measures to discourage conventional diesel.

  – In **Brazil** diesel cars are actively discouraged because of the policy to keep taxes lower on diesel.
  – In **Denmark**, diesel cars are taxed higher to offset the lower prices of diesel fuel.
  – In **China**, taxes do not differentiate between petrol and diesel.
  – **European Commission** has calculated the difference in lifetime pollution costs of Euro IV compliant diesel car and petrol car. The total pollution cost of a Euro IV diesel car is 1195 Euros vis a vis 846 Euros for a petrol car. This nullifies the marginal greenhouse gas reduction benefit of diesel car and costs higher to the society.
Sri Lanka has turned the market around with tax measures

Sri Lanka imposes close to 436.90% import duties on diesel cars as opposed to 244.47% on petrol cars. With that they have changed the market trends.

### Change of fuel consumption in Sri Lanka (in litres)

![Graph showing change in fuel consumption](image)

Transition to electric vehicles in India

High powered committee in India has set a roadmap for transition to electric and electric hybrids. Rs 1300 crore to be spent until 2020 for tax incentives and R&D

Proposed tax incentives to promote electric drive

State governments in India have begun to incentivise the electric vehicle programmes

Challenges remain in terms of battery technology, charging facility, costs, battery disposal systems etc.

Kathmandu has taken the lead in the region
Action on in-use vehicles.....

Move to upgrade in-use vehicle inspection in Delhi

- System upgrades and norms revisions
- Lambda implemented
- Audits networking
- Specially designed inspection of CNG buses
- High volume centralised test centres for commercial vehicles
- Check malpractices
- Diesel vehicle testing needs upgradation

Kathmandu has taken the lead in improving in use emissions inspection regime

- Construction of a high-tech vehicle fitness test centre for scientific check pass of vehicles, embossing number plates of vehicles, implement the concept of third party insurance and maintaining transparency in service delivery have been taken ahead
Vehicles make us more energy insecure.... Climate insecure....... Resolve efficiency vs emissions trade-off
Car centric growth encourage fuel guzzling

Very high fuel guzzling in the transport sector of big cities. These also have high concentration of personal vehicles – cars and two-wheelers.

Urban car travel consumes nearly twice as energy on average as average urban bus travel on a per passenger basis. By 2030-31 on an average Indians will travel thrice as many kilometers as they traveled during 2000-01.

Personal vehicles can account for about 65 – 90% of the total carbon-dioxide emissions in transport sector.

Fuel consumption per day in different classes of cities

Source: Based on Wilbur Smith 2008
Fuel guzzler cities – Cities with more vehicles guzzle more fuel, emit more CO2

CO2 emissions strongly correlate with vehicle numbers

Cities with high walking and cycling have low CO2 emissions
Nepal, dependent on fuel import
Today two-wheelers are more polluting than cars

But they have the smallest carbon and energy footprints

Need to make them clean for a win-win

Motorized two-wheelers have the smallest energy footprint (60-70 km/litre).

Source: CSE/ARAI
Cities are losing battle of car-bulge: The rapid increase in vehicles is destroying all gains of air pollution and health.
It took 30 years to reach the first million mark for personal vehicles in 1971.

Another 20 years to add two more million

Then in 10 years (1981-91) increased by 14 million

Another 10 years (1991-2001) – jumped by 28 million

This decade just in four years (2001 to 2004) we have added 16 million

Vehicle registration in India: India’s urban population has grown 4.6 times, vehicle numbers have increased 158 times

Source: Computed on the basis of MOSRTH motor vehicle registration data
Explosive numbers in Nepal

Rapid motorization -- motor vehicle fleet in Nepal has increased by 11 times

- The vehicle numbers in the country increased from 0.1 million in 1994/95 to 0.7 million in 20007/08 and reached 1.1 million by mid March 2009/2010

Economic Survey, ‘1988/89--2009/10, number of vehicles totalled 1,015,271, while in the first eight months of the 2010/11, it increased by 11.06 per cent, i.e. by 112,320 reaching a total of 1,127,591.
Indian cities are paralyzed
The Crawling Traffic

The average journey speed in Delhi (16 km/hr), Mumbai (16 km/hr) and Kolkata (18 km/hr): Abysmally poor compared to smaller cities

Source: Anon 2008, Study on traffic and transportation policies and Strategies in Urban Areas in India, MOUD, p63
Peak hour traffic speed dips in Kathmandu

• Increase in vehicle numbers is leading to traffic congestion and choked roads in Kathmandu

• According to a study by DoTM, the number of vehicles in Kathmandu has already exceeded the valley’s carrying capacity by about 30,000 in 1999/2000 fiscal year.

• More than 50,000 vehicles have been added since then, while the road infrastructure has remained more or less the same
Can building more roads help? Delhi has failed to solve the problem of congestion by widening road network ...... We can never build enough roads

Source: On the basis of Economic Survey, Delhi Govt
Congestion grid of Delhi in 2021: Is this the kind of city we want?

Figure 4.2 Expected Peak Hour Traffic Volumes (in PCU’s) on Road Network in 2021 in BAU Scenario

Source: Based on RITES data
**Delhi records highest road accidents**

*We don’t protect our zero emitters*

**Shocking:** Delhi has highest road accidents in the country. Fatalities and injuries to walkers and cyclists are unacceptably high.

-- Cities with high numbers of walkers as well as vehicles show high injuries as more people are exposed to friction with motorised traffic.

**Pedestrian deaths and walk trips in some cities**

Delhi has highest pedestrian fatality.

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**Share of bicyclists and pedestrians in road accidents**

**Pedestrian deaths and walk trips in some cities**


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Source: Based on: MOUD 2008, Study on traffic and transportation policies and strategies in urban areas in India, Wilbur Smith Associates, Ministry of Urban Development, May.
How do we make the mobility transition?
Strength of our cities....

Urban Mobility
PT and NMV based, MTW majority personal vehicles

Source TRIPP, 2010
Transport modal share in Kathmandu (2001)

Bus is 19% of the vehicles km but carries 63.5% of the passenger km

Peak hour modal split in Kathmandu valley

- Motorcycle: 5.8%, 10.2%
- Passenger car & taxi: 16.3%, 5.1%
- Public transport: 63.5%, 56.5%
- Bicycle: 21.9%, 4.1%
- Pedestrian: 17.1%, 18.1%

Legend:
- Yellow: Percentage share of vehicle numbers
- Green: Percentage of passengers carried
- Light green: Percentage of daily passengers travel
Our cities are built differently
High density, mixed land use, and narrow streets -- an opportunity to plan mobility differently

-- In a typical city the core can just be 5 km across and easily walkable within a reasonable time.
-- Studies show more than 40 to 50% of the daily trips in many cities have distances less than 5 kilometers.
- These have enormous potential to convert to walking and non-motorised trips.

Source: Urban age

Delhi    Kolkata    Bangalore    Mumbai    London
This slide has already begun in Delhi.....

Public transport losing ground

Source: Anon 2008, transport demand forecast study, study and development of an integrated mass multi-modal public transport network for NCT of Delhi. RITES, MVA Asia Ltd, TERI, September
The Annual Average Growth in % in STU Bus Fleet (2000 to 2007)

- Mumbai: -0.8%
- Delhi: -7.7%
- Chennai: -1.7%
- Kolkata: -3.5%
- Ahmedabad: -0.5%
- Pune: 1.9%
- Bangalore: 9.4%

Source: Anon 2008, Study on traffic and transportation policies and Strategies in Urban Areas in India, MOUD
Shadow of things to come
Modal share trend 2007-2031

Private vehicle usage will increase.
Public transport will stay stable or decline

Source: Based on: MOUD 2008, Study on traffic and transportation policies and strategies in urban areas in India, Wilbur Smith Associates, Ministry of Urban Development, May
Challenges of rebuilding public transport

-- Delhi Master Plan has set the target of 80% public transport ridership by 2020........
Bus makes a difference......Evidence from our cities

Bus transport can make a big difference…

• **COLOMBO**: A increase in bus share from 76% to 80% can save 104,720 tonnes of oil equivalent, or 3% of the fuel consumed in the baseline case. This means 5% reduction in total vehicles and freeing up of roadspace equivalent to removing 62,152 cars.

• **BANGALORE**: An increase in bus share from 62% to 80% saves equal to 21% of the fuel consumed in the base case. Leads to 23 per cent reduction in total vehicles and frees-up road space equivalent to taking off nearly 418,210 cars from roads. CO2 emissions can drop by 13 per cent. PM can drop by 29 per cent and NOx 6 per cent.

• **DHAKA**: An increase in bus share to 60% saves fuel equal to 15 per cent of the fuel consumed in the base case. Frees up road space equivalent to removing 78,718 cars from the roads. CO2 emissions drops by 9 per cent. PM can drop by 13 per cent and NOx less than 1 per cent.
Transportation reforms have taken roots…………..driven by national and state level policies

……. but are we on track?
Let's look at the Urban renewal mission programme in India ……..

Transportation account for a quarter of total allocated funds

Source: CSE Based on data provided in http://jnnurm.nic.in/
Spending on roads overwhelms

70% of the projects are roads-and flyovers

Source: CSE Based on data provided in JNNURM website, available in http://jnnurm.nic.in/nurmudweb/Project/sector.pdf
Annual trends reflect changing priorities

Initially only roads.....other projects followed.....

Source: CSE Project analysis based on data provided in http://jnnurm.nic.in/
For the first time reform agenda with binding commitments:

-- Prepare city mobility plan for comprehensive planning
-- Form UMTA for integrated planning implementation
-- Form Urban Transport Fund (UTF)
-- Parking policy
-- Advertisement policy
-- Special purpose vehicles
-- Traffic management information centre
-- Bus priority lanes, revise bus fares
-- Waive off or reimburse state and local taxes
61 Mission cities got 15260 buses

Basis of allocation:
- 4 million population cities need 50 buses per lakh of population
- Cities with 0.5 – 4 million need 40 buses per lakh of population
- 20% of buses to be low floor buses

Many lessons from this experience......
Rolling stock arrived without deployment strategy
Cities without route planning, bus fare policy, or efficient management model. No plans for traffic priority to the buses; poor level of service.

Ministry of Urban Development review reveals lack of preparedness

Snapshots:

**Nagpur**: Buses dumped in open ground for a long time; caused damage; ITS not supplied in small and medium buses

**Bihar cities**: Buses sanctioned but not procured

**Jharkhand**: Buses sanctioned; but issues with selection of operators

**West Bengal cities**: City specific SPV not set up; buses not maintained; conditions violated

**In many cities reforms pending**
Constraints of supply....Huge captive market but manufacturers not prepared

- Tata and Ashok Leyland produce nearly 90% of the buses. But serious delays in delivery.
- As per contractual agreement between Tata and DTC there is delay penalty of 10 per cent per month. Tata has been fined for Rs 2 crore for this delay.

Diverse bus specifications fragmented markets, increasing costs

- Case of bus procurement in Delhi and Ahmedabad -- Wide variation in design specs from operators, and near monopoly pushing up prices – Height of bus floor, manual or automatic transmission, type of suspension, standard vs monochoque body, CNG vs diesel..... High costs

- Cities asked --- should we go for cheaper standard buses to reduce capital costs? Get more buses to achieve high frequency?
Mandate for improved buses

• Follow standardised specs ......
  – Bus code of the Union Ministry of Shipping, Road Transport and Highways
  – Guidelines on bus specs of the Union Ministry of Urban Development
  – With standardisation cities can even do collective bargaining with bus industry to procure buses at reasonable standardised rates
  – Sale volumes should allow economy of scale and reduce prices further
  – Even the tendering process can be simplified
City expands bus fleet
1200 buses sanctioned for Kolkata under JNNURM stimulus package. Many are on the road

Kolkata Franchisee issues
Franchisee of JNNURM buses to private operators after Calcutta High Court banned pre-1993 vehicles.
Transport department entered into a PPP with private operators for 630 JNNURM buses.

Under the incentive scheme the bus owners who replaced their vehicles with JNNURM buses got Rs 50,000. Reduced monthly payment from Rs 26,000 to Rs 22,000.

Franchise operators were required to pay Rs 2 lakh as one-time security deposit and service tax as well as other taxes every month for eight years.

The state government is the guarantor of the loans secured by the franchisees. Nearly all of the 600 franchisees have stopped paying the monthly installments resulting in outstanding liabilities touched Rs 110 crore.
Reform process has begun in other cities......

- Bangalore Metropolitan Transport Corporation is modernising bus deployment and operations
- Delhi transport department is restructuring bus sector –
  - All city bus routes have been bunched into 17 clusters. Private bus agencies will bid and operate these clusters within defined performance parameters.
- Indore bus service reforms etc
- The Centre has approved the Bus Rapid Transport System in other cities as well
Build capacity for bus transport reforms

**Bus stimulus is only a beginning.** The MOUD high powered committee has estimated that in next 20 years 1.5 lakh buses costing Rs 60,000 crore will be needed for public transport in all cities and towns in India.....

**Only rolling stock will not help. This demands urgent and guided reforms in cities.......**

-- Technical planning for route reorganisation

-- Performance monitoring system

-- Innovative contracting and tendering

-- Application of technology for fleet management – GPS, central monitoring, electronic and integrated ticketing, etc

-- Policy for targeted subsidy

-- Ability of the bus industry to deliver clean and efficient buses............
Buses arrived ... but no users

- **Kanpur**: Around 300 buses inducted. Buses cater to 9% of the travel demand. Very few users

- **In smaller cities**: Congested cities with narrow streets – very small turning radius.....

- **Some mini/midi buses were allowed** in smaller cities (12% of all buses) – kanpur and other cities of UP, Nanded, Pune etc

Source CSE
**Para transit**: Small informal public transport -- autos, tempos, cycle rickshaws – Unique in South Asia ….Useful in closely built cities where most trips fall in 0 to 5 km range. Even big buses may not be convenient for such distances.

**Delhi is reorganising this sector:**
-- **Technology upgrades**: Replaced two-stroke engines with four-stroke engines; introduced CNG feet; Electric 3-wheelers

-- **Organisational changes**: All three-wheeler drivers to get public service vehicle badge and smart cards.
-- GPS connectivity to improve the meters and compliance.
-- In-use vehicle fitness and emission testing systems
-- Integrate with mass transit system.
-- Cycle rickshaw policy
-- Public transport and para-transit must integrate not compete

**Mixed traffic – cycle rickshaws, tempos, auto-rickshaws, buses ... but environmentally sustainable.**
But bus needs its space….. Bus caught in congestion is even more unattractive. You may ask – where is the space? But the current road space is used inefficiently. Look at Delhi. How much road space is wasted. Only one lane available to motorists.
Need equity in the usage of road space
Reorganise the road space according to road users

Bus Rapid Transport in Delhi:
Right of the way segregated according to users --- bus users, walkers, cyclists and motorised vehicles.

Bus speed increased from 11km/h to 19km/h. Benefits nearly 60% of road users.

Delhi working on the next phase of the network. Nearly 400 km of BRT lanes sanctioned.....
Who must get the priority – People or Vehicle?

Understand the BRT corridor in Delhi….
-- Buses are 2% of the fleet but carries 55% of the trips
-- Cars and two-wheelers are 75% of the fleet but carry 33% of the trip.
-- Important to take buses out of congestion

**Distribution of Vehicles - By Mode**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Vehicles</td>
<td>23%</td>
</tr>
<tr>
<td>Buses</td>
<td>2%</td>
</tr>
<tr>
<td>Cycle &amp; Cycle Rkshw</td>
<td>75%</td>
</tr>
</tbody>
</table>

**Chirag Delhi Junction**
Morning Peak Hour
AK to MC
4,916 Vehicles
11,480 People

**Distribution of People - By Mode**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Vehicles</td>
<td>33%</td>
</tr>
<tr>
<td>Buses</td>
<td>11%</td>
</tr>
<tr>
<td>Cycle &amp; Cycle Rkshw</td>
<td>55%</td>
</tr>
</tbody>
</table>

Source: Dario Hidalgo study for CSE, 2008 Mimeo
Funding of public transport......A challenge
The case of Delhi

Scale up efficient public transport system in the Capital

• 17 bus clusters
• 14 BRT corridors
• Reform DTC and overall bus operations
• Meet the target of 10,000 buses and the requisite infrastructure – parking, bus stations etc….
• Integration of transport systems – bus-metro-IPT-NMT
• Passenger information system etc

This will cost a lot of money

Transport department has estimated the desired investment requirement of Rs.5,444 crores for bus transport during in 2009-10, 2010-11.

-- This includes Rs.1713 crores, for 1500 A.C/Non-AC (excluding 35% assistance under JNNURM) low floor buses; Rs.660 crores for constructing depots; Rs.2666 crores for depots for private operators; Rs 105 crores for improvement of bus terminal and 15 new terminals; Rs.50 crores for Control Room for monitoring of private and DTC bus fleet; etc among others.................
Capital as well as operational costs are serious barriers.

The first cluster -- cost at Rs 55/km. Earning about Rs 30-35/km. The financial gap for all 17 clusters can be as high as Rs 600 - Rs 1000 crore annually in the future.....

The revenue expenditure gap can be an enormous burden on the government....

Raising bus fares is not the answer: This will make bus transport unaffordable for the urban majority. Transport cost is 15-25% of household income of urban poor

A substantial part of bus ridership can be lost to two wheelers: Lowest fare on a DTC bus is Rs.5 upto 4 km; Rs 10 between 4 - 10 km; and, maximum fare on ordinary buses is Rs.15 for 10km and above. Even for a km the minimum we pay is Rs 5

But the running cost of a two-wheeler is as low as Re 1/km..........

Need financial strategy to overcome cost constraints and make bus transport affordable
Funding approaches – There is no one silver bullet

i) Conventional sources:

-- Rationalize budgetary allocation
-- Reform transport related taxes
-- Advertisement and parking revenue

ii) Innovative non-conventional financing:

-- Land value gain capture/ land monetisation
-- Tax measures based on TDM principle
-- Tax measures based on polluter pay principle
Correct tax distortions...
Buses bear high tax burden than cars and two-wheelers.

If lifetime tax is amortised then car pays roughly Rs 300 per year. But buses pay about Rs 13,000 per year – 43 times more than cars.

Bus is perversely penalised for carrying more passengers…

Delhi with nearly the highest per capita income and car ownership pays the lowest taxes on cars.
Vehicle taxation in Nepal: Ahead in the region

- Annual tax for all vehicles including personal vehicles
- Higher taxes on bigger cars. Less taxes on buses

<table>
<thead>
<tr>
<th>Types of Vehicles</th>
<th>Yearly Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Car, Jeep, Van, Micro bus</td>
<td></td>
</tr>
<tr>
<td>- For 1000cc</td>
<td>NRs. 16,500/-</td>
</tr>
<tr>
<td>- From 1001cc to 1500cc</td>
<td>NRs. 18,000/-</td>
</tr>
<tr>
<td>- From 1501cc to 2000cc</td>
<td>NRs. 20,000/-</td>
</tr>
<tr>
<td>- From 2001cc to 2300cc</td>
<td>NRs. 27,500/-</td>
</tr>
<tr>
<td>- From 2901cc to above all</td>
<td>NRs. 44,000/-</td>
</tr>
<tr>
<td>b. (1) Machinery equipments like Dozer, Excavator, Loader, Roller, Tipper, Crane</td>
<td></td>
</tr>
<tr>
<td>(2) Minitipper</td>
<td></td>
</tr>
<tr>
<td>c. Auto rickshaw, Three wheeler, Tempo, Tractor and Power tiller</td>
<td></td>
</tr>
<tr>
<td>- Auto rickshaw, Three wheeler and Tempo</td>
<td>NRs. 4,400/-</td>
</tr>
<tr>
<td>- Tractor</td>
<td>NRs. 2,600/-</td>
</tr>
<tr>
<td>- Power Tiller</td>
<td>NRs. 2,300/-</td>
</tr>
<tr>
<td>- Minitruck/Minibus</td>
<td>NRs. 14,300/-</td>
</tr>
<tr>
<td>- Truck/Bus</td>
<td>NRs. 22,000/-</td>
</tr>
<tr>
<td>d. Motor Cycle</td>
<td></td>
</tr>
<tr>
<td>- For 125cc</td>
<td>NRs. 2,000/-</td>
</tr>
<tr>
<td>- From 126cc to 150cc</td>
<td>NRs. 3,500/-</td>
</tr>
<tr>
<td>- From 251cc to above all</td>
<td>NRs. 5,000/-</td>
</tr>
</tbody>
</table>
The mandate of urban transport fund

**JNNURM mandates urban transport fund with dedicated resource streams**

Identifies the following strategies:

- Waive off/reimburse all its taxes on urban buses and city bus service
- Need advertisement policy to tap newer source of revenues
- Parking policy
- Additional cess on automotive fuels
- Additional registration fees on cars especially diesel cars and two-wheelers
- Annual renewal fee on driving license, vehicle registration
- Congestion tax

**There is no one silver bullet. Need a package of fiscal strategy to make the difference**
Delhi has taken nascent steps: Build on this

**Air Ambience Fund**

Air Ambience fee of 40 paise per litre on sale of diesel fuel has been implemented.

Revenue from this cess is used to create Air Ambience fund to meet the cost of Delhi's clean air action plan.

This fund is used to subsidise battery operated vehicles and conversion of old commercial LCVs.

*Fund* from the penalty on diesel buses deposited with Supreme Court.
The beginning:

Urban transport fund in Ahmedabad, Surat, Pune-Chinchwad, Jaipur, Asansol and Kolkata. Proposed in 33 more cities..........

• **Surat takes the lead:** Operational since 2011. Created through budgetary allocation. Its revenue components to include -- vehicle tax amounting to Rs 8 crore, pay and park charges of Rs. 2 crore and license fee for advertisement rights of all kinds amounting to Rs. 5 crore. There are plans to collect revenue from floating F.S.I. along the BRTS corridor.

• **Kolkata:** Kolkata has Transport Infrastructure Development Fund created in the state by statute for funding various Kolkata city related transport infrastructure projects. Say no urban transport fund in required.

**Bangalore** has set up a dedicated urban transport fund through MRTS cess on petrol and diesel sold in Bangalore.
Build bus funding strategy

i) **Need targeted subsidies** to improve service quality (eg improve frequency to lower overcrowding etc); to keep bus fares low and support low income classes; provide financial incentive to bus companies to improve service levels. – But subsidies must not cover operational inefficiencies.

ii) **Need low fares and fare freeze** to improve bus ridership. London has followed this strategy with very good results.

iii) Need a finance plan for bus transport

-- Exempt buses from taxes in a revenue neutral manner

-- Create urban transport fund

  -- **Identify the revenue streams for the fund** (taxes on personal vehicles and fuels, advertisement and parking revenue, etc). Use **TDM measures**

  -- Assess revenue potential of commercial exploitation of land in bus depots/terminals etc and develop plan.

  -- Need policy for land based financing

-- **Bus transport projects need infrastructure status** like the metro and railway projects to take advantage of priority financing, and other fiscal incentives etc.

-- iv) Set up task force to come up with the finance plan for bus transport
Integrate, integrate integrate........
Delhi is developing guidelines for modal interchange location

**Bus stop, cycle rental**: within 50 meter level walk from station exit

**Cycle and two wheeler parking**: within 100 meter level walk from station exit

**Auto rickshaw stand**: within 150 meter level walk from station exit

**Private car/taxi/auto rickshaw “drop off”**: with barrier-free of exiting pedestrians and NMT

Pedestrian exits, bus-stops and Cycle-rickshaw stands must be closest to main pedestrian exits from station.

**Car parking** if provided, must be BEYOND 250 M distance of Station/ or PT interchange point

**Pairing of Origin-Destination (O-D) Nodes**: Provide cycle/ auto stands at nearby important destinations.

Signages at both end locations.

**Private car parking** only at Terminal Stations.

Discourage car parking at Stations within inner-city urbanized areas.
Public transport cannot work in isolation…..

Need walkways, intermediate public transport, and non-motorised transport….. Why?
We built walkable cities........Most people in our cities walk to work

Substantial number of people in our cities walk to work..... 16-58% in our cities. In Delhi nearly half of education and even business trips are walk trips

Walking and urban poor........ A great part of urban people live in low income localities and slums. Many of them are too poor to even take a bus....

Disability and walking......Survey in Delhi shows 58% of the disabled people find steps, ramps, difficult to negotiate; 45% of elderly find steps and ramps daunting; 20% find uneven, narrow sidewalks difficult. Engineering guidelines for disables are not implemented

Public transport can be successful only if our cities walkable:

Urbanity and life style......Co-relation between active transportation (walking and cycling) and obesity.

China – 1.8kg weigh gain after and twice as likely to get obese for a Chinese who acquired a car.

King County – people weigh 7 pounds less on an average in walkable neighbourhoods
Jay walking…asserting their right to cross where convenient
But car centric design does not allow safe, quick and shortest crossing

Seamless and signal free traffic is interrupting shortest direct route for pedestrians. This is inciting jay walking

Sai Chowk, Patparganj

Scindia House, CP

Source: CSE
Unusable infrastructure: Wasteful
Guidelines of Indian Road Congress are inadequate

Eg. In the absence of proper guidelines on height of pavements unacceptably high pavements without proper gradients are being made.....
Car infrastructure severing neighbourhoods and pedestrian routes

(All India Institute of Medical Sciences intersection)

Cloverleaf flyover disrupt at-grade continuity and direct shortest route, increase walking distance for the ailing visitors using public transport
At least in one direction use of subway is unavoidable

Source: CSE
Retrofitting changes…..

- Sidewalks are now being rebuilt in Delhi

Source: CSE
It is possible to change
Redesigned streets in a small town of Nanded in Maharashtra

Source: Pradeep Sachdeva
Walking needs policy strategy

Reform and enforce mandatory pedestrian guidelines for new roads as well as rebuild, beautification of existing roads – transform the entire city network. Delhi has adopted pedestrian guidelines. These are the basis of approval of road projects infrastructure funding.

Public transport plan needs linkage with pedestrian plan

Urban local bodies must conduct periodic walkability and safety audits

Legislate right to walk: Should we have comprehensive road users act?

Need zero tolerance policy for accidents

Involve communities on decisions on use of road space

Need pedestrian network plan

Adopt traffic volume reduction plan
Bicycles and cycle rickshaws – the ultimate zero emitters and feeders for multi-modal integration

Bicycles are personal feeders to public transport, cycle rickshaws are zero emissions intermediate transport. Momentous court order in Delhi recently to protect these vehicles.....

Enormous captive ridership of bicycles but declining in all Indian cities: 1980 - 2000: -- Bicycle ridership declined from 20% to 5% in Delhi; 45% to 35% in Nagpur; 33% to 18% in Indore; 3% to 16% in Ahmedabad.

Need well designed and safe NMT infrastructure under urban renewal missions programmes to induce NMT traffic

Bus-bike integration: Delhi experiment with BRT-rented bicycles as optional feeders

Need priority access to NMT. Eg. Delhi to implement bicycle master plan
Remove hidden subsidies to cars............
Free and discounted parking creates more incentive for car use for all kinds of travel….

Parking: wasteful use of cars: Out of 8760 hours/year the total steering time of an average car is 400 hours. For about 90 to 95% of the time a car is parked.

- Insatiable demand for land: If demand for land for an average car is computed based on average car size and multiple parking spaces per car -- the total cars already use up 10% city’s urbanised area. The forest cover in Delhi is 11.5 %.

- Daily registration of cars in Delhi is generating demand for land equivalent to 310 football fields! Land is expensive and has other opportunity costs.

- Inequitous use of land: A car is allotted 23 sq m for parking. Under low cost housing scheme only 18 sq m is allotted to poor families. Car owning minority using up more urban space.

- Cars are biggest encroachers in Kolkata: 30-40% of roads in Kolkata are taken up by parking; 50-70% of footpaths reduced due to on-street parking
Concern over parking crisis in South Asian cities.

Kathmandu

- Though KMC has designated 30 places for parking two-wheelers and small four-wheelers, there are mushrooming parking lots in the metropolis, many illegally run.
- The KMC has identified three long-term parking areas to ease traffic chaos in the capital. There is a proposal to construct new parking areas at Bhugol Park, Social Welfare Council and National Academy Hall which has been forwarded to the DoTM and Traffic Police. The existing parking spaces in New Road will be removed once the underground parking is constructed at Bhugol Park.
- KMC has also circulated a notice to all malls and shopping complexes to use their basement areas for parking in order to ease traffic pressure on roads.
- Directive from the Public Account Committee to remove parking from blacktopped roads. Acting on the direction, the KMC has been searching for wider spaces in the valley.
- Currently, there are 33 parking areas operated by private contractors of which 32 are near crowded roads. KMC has fixed Rs 5 and Rs 10 for two-wheelers and four-wheelers respectively for one hour parking. However, public complaints against the monopoly of contractors have been coming to the fore time and again.
- Kathmandu needs to formulate a parking policy as a travel demand management measure.
Use parking policy to reduce demand for parking and cars. Influence commuter choice

Should we keep supplying more parking? Is that the solution?

International experience shows just the opposite:
Tokyo has highest car ownership in Asia – 350 cars per 1000 people. But its parking standards in commercial areas is 0.5 parking slots per 100 sqm.

But Delhi with 84 cars per 1000 people provides 3 parking slots per 100 sqm.

Example from Delhi: Yawning gap between peak parking demand and supply and short fall

Source: CSE estimates based on CRRI report: (2006), New Delhi,
### Understanding cost of multi level parking

#### Example from Delhi

<table>
<thead>
<tr>
<th></th>
<th>BKM multi level parking</th>
<th>HT multi level parking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parking and commercial</td>
<td>Parking only</td>
</tr>
<tr>
<td>ECS</td>
<td>941</td>
<td>780</td>
</tr>
<tr>
<td>Cap. Cost Rs in lakh per ECS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total Cost in lakhs (including cap, working, taxes etc) (Net Present Value)</td>
<td>5,290 (Rs 1672 per sq feet)</td>
<td>3,849</td>
</tr>
<tr>
<td>Revenue in lakhs (NPV)</td>
<td>6,724</td>
<td>4,168</td>
</tr>
<tr>
<td>IRR in %</td>
<td>12.68</td>
<td>12.67</td>
</tr>
<tr>
<td>Parking charges</td>
<td>Rs 10/h</td>
<td>Rs 30.25/h</td>
</tr>
</tbody>
</table>

Delhi: the cost of providing multi level parking is nearly Rs 4 lakh to 6 lakh per car space. Accordingly parking fee should be **Rs 30-39 per hour**. But people are used to paying paltry sum. This is a hidden subsidy to rich car owners.
Lesson from Mumbai: Discrepancy in rates can lead to underutilisation of parking structure

INOX the multiplex in Nariman Point

**Before construction of MLP:**
- No. of surface parking spaces: 140, Utilisation: **100%** during office hours

**After:**
- No. of parking spaces: 540, Utilisation during office hours: **10%**
- Parking rates are Rs 5 per 30 minutes or Rs 10 per hour.

**Surface parking rates:** Rs 5 per hour and Rs 3 for every additional hour.

**Poor utilization of multi level lot**

Principles that must guide parking pricing

**Graded parking rates according to**
- Peak hour, duration of stay; commercial importance of areas; Weekdays when demand is high and weekends when low.
  -- Fix parking rates at a level to influence commuter choice
  -- Higher rates at convenient places than the inconvenient places
  -- Limit parking duration for short term users. This can lead to higher customer turnover
  -- Free parking for cycles and cycle rickshaws and reduced/free rates for battery operated vehicles and public transport vehicles.
  -- Parking rates should be higher for big cars and SUVs

Source: Mumbai Environmental Social Network
Parking policy: Guiding principles:

- Adopt flexible parking standards and review parking standards. Do not create oversupply. Account for improved public transport access and reduction in personal vehicle travel.
- Integrate parking design with multi-modal integration. Priority to NMT and public transport.
- More stringent parking controls and enforcement in areas well served by public transport. Phase out on-street parking in targeted areas.
- Parking pricing -- Minimise free parking, restrict on-street parking, use variable parking rates, avoid fixed annual payment, price parity between surface and multi-level parking.
- No parking on green spaces, pavement, NMT lanes, and service lanes. Non-negotiable.
- Need parking strategy for residential areas and mixed land use areas.
- Use parking revenue for other congestion reduction strategies and local amenities.
- Stringent penalty on parking violations.
- Develop parking strategy for special localities like hospitals, railway station, cinemas, shopping malls, schools, high impact events etc.
- Provide parking for public transport vehicles.
- Need innovative parking strategies for residential areas for demand management.

Policy opportunity: National Urban transport policy provides for parking as a restraint measure; JNNURM reform agenda; Supreme Court directives on parking and congestion.
Other countries are limiting and pricing parking supply

Portland, Oregon set an overall cap of 40,000 parking spaces downtown. This increased public transport usage from 20-25 per cent in the 1970s to 48 per cent in mid 1990s.

Seattle allows a maximum of one parking space per 100 square metres at downtown office

San Francisco limits parking to seven per cent of a downtown building’s floor area

New York: Very high parking fees and limited parking supply lowers car ownership far below the average rates in other US cities.

Boston has frozen parking requirements at 10 per cent higher than the 1973 levels. This has helped Boston to meet the federal clean air standards.

Bogota has removed limit on the fees that private parking companies can charge. The revenue is dedicated to road maintenance and public transit improvement.

Shenzhen: Hike in parking fees during peak hours leads to 30% drop in the parking demand.

Tokyo: Enforcement against parking violations cuts congestion drastically. Private firms allowed to issue tickets for parking violations. This makes on-street parking expensive.

Bremen: No free parking in city centre. Parking charges higher than public transport cost.

Globally, customers agree to pay high parking charges if they get good shopping and pedestrian environment. This also improves business.
Other governments calculate hidden Subsidies for Urban Car transportation and public funds for private transport

<table>
<thead>
<tr>
<th>City</th>
<th>Year</th>
<th>Inhabitants</th>
<th>Income from car transportation</th>
<th>Expenditure for car transportation</th>
<th>Difference</th>
<th>Subsidy per inhabitant</th>
<th>Cost-Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heidelberg</td>
<td>2004</td>
<td>142.500</td>
<td>13.137.822</td>
<td>30.634.581</td>
<td>17.496.759</td>
<td>122,8</td>
<td>42,9%</td>
</tr>
<tr>
<td>Rotenburg</td>
<td>2003</td>
<td>22.500</td>
<td>693.380</td>
<td>3.094.252</td>
<td>2.400.872</td>
<td>106,7</td>
<td>22,4%</td>
</tr>
<tr>
<td>Düsseldorf</td>
<td>2002</td>
<td>569.046</td>
<td>24.699.867</td>
<td>167.106.878</td>
<td>142.407.011</td>
<td>250,3</td>
<td>14,8%</td>
</tr>
<tr>
<td>Lüneburg</td>
<td>2000</td>
<td>70.000</td>
<td>3.411.848</td>
<td>9.194.623</td>
<td>5.782.775</td>
<td>82,6</td>
<td>37,1%</td>
</tr>
<tr>
<td>Augsburg</td>
<td>2000</td>
<td>254.867</td>
<td>21.046.353</td>
<td>47.766.056</td>
<td>26.719.703</td>
<td>104,8</td>
<td>44,1%</td>
</tr>
<tr>
<td>Aschaffenburg</td>
<td>2002</td>
<td>67.788</td>
<td>3.041.045</td>
<td>11.366.940</td>
<td>8.325.895</td>
<td>122,8</td>
<td>26,8%</td>
</tr>
<tr>
<td>Freiburg</td>
<td>2000</td>
<td>201.000</td>
<td>17.163.087</td>
<td>37.993.383</td>
<td>20.830.296</td>
<td>103,6</td>
<td>45,2%</td>
</tr>
<tr>
<td>Ingelheim</td>
<td>2003</td>
<td>26.000</td>
<td>1.264.617</td>
<td>6.985.282</td>
<td>5.720.665</td>
<td>220,0</td>
<td>18,1%</td>
</tr>
<tr>
<td>Bremen</td>
<td>2000</td>
<td>547.000</td>
<td>12.551.020</td>
<td>72.959.184</td>
<td>60.408.163</td>
<td>110,4</td>
<td>17,2%</td>
</tr>
<tr>
<td>Dresden</td>
<td>2000</td>
<td>459.000</td>
<td>9.132.653</td>
<td>65.306.122</td>
<td>56.173.469</td>
<td>122,4</td>
<td>14,0%</td>
</tr>
<tr>
<td>Stuttgart</td>
<td>2000</td>
<td>581.000</td>
<td>20.663.265</td>
<td>104.591.837</td>
<td>83.928.571</td>
<td>144,5</td>
<td>19,8%</td>
</tr>
<tr>
<td>Average Germany (based on inhabitant numbers)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>145,5</td>
<td>29,1%</td>
</tr>
<tr>
<td>Graz</td>
<td>2003</td>
<td>238.000</td>
<td>20.832.664</td>
<td>60.959.484</td>
<td>40.126.820</td>
<td>169,0</td>
<td>34,0%</td>
</tr>
<tr>
<td>Geneve</td>
<td>2002</td>
<td>182.560</td>
<td>13.944.143</td>
<td>40.038.362</td>
<td>26.094.219</td>
<td>142,0</td>
<td>34,8%</td>
</tr>
<tr>
<td>Ferrara</td>
<td>2002</td>
<td>130.000</td>
<td>3.553.267</td>
<td>9.310.289</td>
<td>5.757.022</td>
<td>440</td>
<td>38,2%</td>
</tr>
</tbody>
</table>

Source ICLEI, Hidden Subsidies for Urban Car Transportation
Other global cities are dismantling car centric infrastructure........

Before

After

Seoul’s Cheonggyecheon restoration project

Cities that have destroyed roadways

San Francisco
Milwaukee
New York
Portland
Toronto
Seoul
Our cities need upscaled transition
Avoid future emissions
Shift to sustainable modes of mobility

Leapfrog technology
  Accelerate emissions standards roadmap
  Set fuel economy standards

Opportunity to provide scaled up alternatives
  Upgrade and upscale public transport and integration
  Infrastructure for walking and cycling

Reduce demand for travel and vehicle usage
  Integrate transportation with land-use planning
  Road pricing
  Tax rationalisation
  Parking policy and charges

Fund the transition: Need tax measures to allocate resources efficiently and raise revenue. Taxes on public transport is 2.6 times higher.

This needs support. Must not be allowed to fail..

Otherwise what???
Thank You...