“Air Pollution, Health and Congestion in South Asian Cities: Seeking solutions”

Anumita Roychowdhury

Centre for Science and Environment

Workshop on Air Quality and Environmentally Sustainable Transport

Air Resource Management Center (AirMAC), Ministry of Environment, Ministry of Transport and Center for Science and Environment, India Colombo, April 28, 2011
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.

Where will the future growth take us?
It all depends on the choices we make
The Delhi story……

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
Imprint of growth
Our lungs at risk

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.

But those cars are so sexy!
51,779 DEAD BY BREATHING

Air Pollution Toll Rises from 40,351 in 1991-92

30% More Deaths

In 1995! In Some Indian Cities Deaths Have Doubled

The Government Is In Control.

So It Thinks.

A DELUSION!

Gas chambers?

Pollution is killing more people in Indian cities

<table>
<thead>
<tr>
<th>Year</th>
<th>Delhi</th>
<th>Mumbai</th>
<th>Kanpur</th>
<th>Chennai</th>
<th>Calcutta</th>
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</thead>
<tbody>
<tr>
<td>1991-92</td>
<td>7,491</td>
<td>4,477</td>
<td>1,884</td>
<td>893</td>
<td>5,728</td>
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<td>1995</td>
<td>9,869</td>
<td>7,023</td>
<td>3,039</td>
<td>1,291</td>
<td>10,647</td>
</tr>
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</table>

More illness

Rising pollution-related sicknesses and hospitalisation

<table>
<thead>
<tr>
<th>Year</th>
<th>Delhi</th>
<th>Mumbai</th>
<th>Kanpur</th>
<th>Chennai</th>
<th>Calcutta</th>
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<tr>
<td>1991-92</td>
<td>39.5 lakh</td>
<td>25.5 lakh</td>
<td>8.03 lakh</td>
<td>4.5 lakh</td>
<td>29.3 lakh</td>
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<tr>
<td>1995</td>
<td>60.0 lakh</td>
<td>40.0 lakh</td>
<td>15.4 lakh</td>
<td>8.8 lakh</td>
<td>54.5 lakh</td>
</tr>
</tbody>
</table>

1991-92 figures are of World Bank

1995 figures are generated by CSE

Ministry of Environment and Forests

No clear air quality reduction targets. No one knows when our air will really become cleaner.

Ministry of Petroleum and Natural Gas

Monopoly producer of very, very dirty fuel.

Ministry of Surface Transport

Does not even share with the public the data it collects on the emission of new vehicles. Who knows if the new vehicles have really improved their standards? Not only this, it has no plans to deal with growing urban transport crisis.

Ministry of Industries

Soft on polluting industries.

Ministry of Finance

Shying away from taxing the polluters.

Ministry of Health

Totally silent on health effects of air pollution.

Automobile Industry

Trading health for mobility and profit.

Pollution Control Boards

Neither can they control pollution nor do they develop effective control programmes.

Politicians in General

No interest in people's health.

You line up for a tailpipe test while real culprits go scot-free

One more year of slow murder

Centre for Science and Environment (CSE) is a public interest organisation engaged in research, and lobbying for and communicating the urgency of sustainable development. CSE's campaign against air pollution began on November 1, 1996 with a public meeting, an exhibition and the release of a first-time exposition on smoggy secrets. Slow Murder: The deadly story of vehicular pollution. Since then, we have focussed on gathering information to better nail the culprits. We are networking with interested people and institutions to appraise everyone of air pollution's clear and present dangers.

For health's sake, demand your right to clean air!

Join our campaign against air pollution before you become another victim

Donate to enable research and raise a fuss

Write to: Anil Agarwal, Satish Ninan or Anumita Roy Chowdhury
CENTRE FOR SCIENCE AND ENVIRONMENT
41, Tughlakabad Institutional Area, New Delhi 110 062
Tel: 011-2394, 698 1110, 698 1124, 698 6599 Fax: 011-5879
Email: anumita@cse@dacl earning.in

Yes, I would like to:

<table>
<thead>
<tr>
<th>u</th>
<th>Donate money for the Campaign Against Air Pollution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>u</td>
<td>My contribution, Rs ___________ in a Cheque (No ___________)</td>
</tr>
<tr>
<td>u</td>
<td>Money Order u Demand Draft is enclosed.</td>
</tr>
<tr>
<td>u</td>
<td>All donations are exempted from Income tax under Income Tax Act 80D.</td>
</tr>
</tbody>
</table>

Name:
Occupation:
Address:
Telephone:
Fax:
Email:
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
### Pollution hotspots:

#### Cities with high NO2 levels in 2009

(Annual average concentrations in micrograms per cubic meter)

<table>
<thead>
<tr>
<th>Cities Name</th>
<th>Annual average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Howrah</td>
</tr>
<tr>
<td>2</td>
<td>Asansol</td>
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<tr>
<td>3</td>
<td>Kolkata</td>
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<td>4</td>
<td>Delhi</td>
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<td>5</td>
<td>Jamshedpur</td>
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<td>6</td>
<td>Raipur</td>
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<td>7</td>
<td>Mumbai</td>
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<td>8</td>
<td>Navi Mumbai</td>
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<tr>
<td>9</td>
<td>Jharia</td>
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</table>

**Safe level 40 microgramme/cum**

#### Cities with high PM10 levels in 2009

(Annual average concentrations in micrograms per cubic meter)

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Jharia</td>
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<td>2</td>
<td>Ludhiana</td>
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<td>3</td>
<td>Khanna</td>
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<td>4</td>
<td>Delhi</td>
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<td>5</td>
<td>Ghaziabad</td>
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<td>6</td>
<td>Kanpur</td>
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<td>7</td>
<td>Gobindgarh</td>
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<td>8</td>
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<td>Amritsar</td>
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<td>10</td>
<td>Gwalior</td>
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<td>11</td>
<td>Firozabad</td>
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<td>12</td>
<td>Kolkata</td>
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</tbody>
</table>

**Safe level 60 microgramme/cum**

Source: Based on “Most Polluted Cities, Government Of India, Ministry Of Environment And Forests, Lok Sabha, Unstarred Question No 1644, Answered On 04.08.2010”
Delhi has lost its gains. After a short respite pollution curve turns upward.

Source: Based on CPCB data
Most locations in Delhi have Unhealthy levels of PM10, PM2.5 and NO2.

CO level is also unhealthy for sensitive groups

Ozone levels are moderately high in 5 locations

<table>
<thead>
<tr>
<th>Location</th>
<th>CO</th>
<th>O₃</th>
<th>PM₁₀</th>
<th>PM₂.₅</th>
<th>SO₂</th>
<th>NO₂</th>
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<td>36</td>
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<td>Velodrome Stadium</td>
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<td>166</td>
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First generation action in Colombo

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

• Introduced Euro I standards for vehicles

• Mandatory annual vehicle emission testing programme launched in 2008. (5% of vehicles failed and removed from fleet)

• Importation of 2-stroke vehicles banned.

• Conversion of 3-wheelers to LPG/CNG/electric

• Construction of refinery that can produce Euro IV diesel by 2012. Feasibility study being done for expansion of refineries.

• Plans to introduce Euro 4 in 2012
Air quality in Colombo?

Annual average PM10 levels in Colombo Fort station (1998-2009)


Limited monitoring shows mixed trends in particulate matter and a dip

But continue to show exceedance
Nitrogen dioxide (Fort Station, 1997-2001)

NOx problem is expected to grow. Reported to be high in high traffic areas already. More recent data also indicate a rise.

Source: Sunil Chandrasiri, 2006, Health Impact Of Diesel Vehicle Emissions: The Case Of Colombo City University of Colombo
Other cities are vulnerable too
Kandy: Valley effect

Pollutants concentration in Kandy, 7-13 July 2010

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Maximum Permissible Level (national standards)</th>
<th>Average Concentration</th>
<th>Recorded Maximum Average Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>0.08 ppm (1 hour)</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>26 ppm (1 hour)</td>
<td>1.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>0.13 ppm (1 hour)</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>100 μg/Nm$^3$ (24 hours)</td>
<td>87</td>
<td>103</td>
</tr>
</tbody>
</table>

Stringent air quality benchmark change the air quality status of cities ..... Make targets more difficult......

• Sri Lanka has set national ambient air quality standards

• India has revised tightened the national ambient air quality standards in 2010. Introduced standards for PM2.5, ozone and air toxics
  – New standards, new benchmark – This has 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 standards are notified under the Air Act. But no accountability. No punitive action on state governments if the ambient air quality standards are not met.

Abatement plans are not designed to meet local mandatory 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.
In India Courts uphold our rights to clean air and health

Evokes principles underlying environmental governance

- Right to Life
- The precautionary principle
- The polluter pay principle

Basis of the court rulings

Article 21: The right to wholesome environment incorporated into a fundamental right to life under article 21 of the Constitution.

Article 39: The state shall direct its policy towards securing health ...

Article 47: Duty of the state to raise the level of nutrition and standard of living to protect public health...

Article 48: protection and improvement of environment...
Our health must matter............
The myth of safe air

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 – particle laden

Source: CNCI
Emerging evidences in Colombo

- Study by NBRO and the Faculty of Medicine, University of Colombo: Found a significant association between ambient air pollution (SO2 and NOx) and acute childhood wheezing episodes in Colombo. Children experiencing wheezing (and requiring nebulization) were observed and found to be statistically significant (Senanayake et al. 1999).

- Field observations indicate that children require more frequent medical visits than in the past. School absenteeism has become common especially among children.

- Senior citizens often experience difficulties in breathing, coughing and chest tightness. These illnesses become prominent during certain seasons when pollution accumulation takes place in Colombo.

- The application of WHO health impact assessment shows that nearly 20% of Asthma cases recorded at LRH could be attributed to PM10. 4% of total cases for hospital admissions for respiratory diseases and respiratory mortality in general could be attributed to PM10 pollution in Colombo (2005).

- Studies attribute Rs 22-17 billion to health damage cost owing to auto diesel emissions in Colombo. Diesel vehicles are responsible for 96%-89% of SO2 and PM10 from the transportation sector (Sunil Chandrasiri 2006).
India’s unique public health challenge

- The Asiawide 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.
• Vehicles contribute overwhelmingly to the air pollution load in Colombo --- Transport sector contributes about 60% to air pollution

• More than industries and power plants emissions

• Air pollution problems have also been reported in other Sri Lanka cities such as Kandy
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.
Technology challenge..........

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.

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
Diesel Car (PM norm)

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

Diesel Car (NOx norm)

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 do emissions standards roadmap.

- Sri Lanka plans to achieve the Euro IV quality fuel with 50 ppm sulfur from 2012 onwards.

- 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).

- Colombo
  - Diesel vehicles are 45% of total fleet now.
  - Fuel price policy responsible for growing dieselisation: Transport sector uses 96% of diesel.
  - Taxes on diesel cars have increased but the cheaper fuel continue to remain an incentive.
  - Import and use of reconditioned vehicles and improper management of vehicle engines lead to bad air quality.
Check dieselisation of car segment

Number of cars (by fuel type) in different weight categories in India

![Bar chart showing the number of petrol and diesel models in different weight categories in India.](chart.png)
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.

Source: MP Walsh
Toxic risk of diesel emissions

Emissions vs efficiency remains unresolved in India………………

Source ARAI
Very high contribution of diesel combustion to PM2.5 in Indian cities

- In three cities among six cities reviewed by the World Bank shows that vehicles contribute an average 50 percent of the direct PM emissions but 70 per cent of PM exposure.

- Nearly 65% of the Kolkata’s vehicular population. Nearly 99% of commercial vehicles are diesel-run

- Nationally, 30% of new car sales are on diesel

Diesel’s contribution to ambient PM2.5 levels in Kolkata, Mumbai and Kolkata
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
Diesel cars can also make South Asia 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.
Who will bear the burden of diesel costs and health costs

• The government is incurring huge revenue losses as it earns much less from excise on a litre of diesel used by cars, as opposed to petrol. Only in Delhi the loss is as high as Rs 300 crore. This will be mammoth on a nation-wide scale.

• Revenue losses per litre of diesel will compound with increased diesel car sales. But diesel car owners recover their premium within four years, given lower diesel prices.

• Revenue losses will compound not only with increased share of diesel cars and SUVs but also with greater penetration of diesel in the smaller car segments.

• Cheaper diesel fuel will encourage more diesel cars, more driving and more fuel guzzling in the rebound.
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

PM emissions from buses in grammes per kilometre

0.32

0.009

0.007

Bharat stage II Diesel Bus (500ppm max. sulfur)

Bharat stage II Diesel Bus + CRT (50ppm max. sulfur)

Bharat stage II CNG Bus + 3 way catalyst

Source: Teri
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.
Two-wheelers: Another trade off and a dilemma

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).

Fuel consumption of two wheeler models

Source: CSE/ARAI
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

Colombo has also taken the lead in improving in-use emissions inspection regime
Vehicles make us more energy insecure.... Climate insecure....... Resolve efficiency vs emissions trade-off
New generation challenge

Pollution, energy guzzling and warming...

- Indian cities show strong correlation between emissions of air pollutants and GHGs
- As cities grow in size, transport emissions increase
- Importance of catching cities early before they start to grow.

Source: KCAI ASIA 2008

Source: Analysis of MOUD- Study on Traffic and Transportation Policies and Strategies in Urban Area By CAI-Asia
The subtle link between local air pollution and warming.

- **Local pollution can enhance the warming effects...**Eg, HC + NOx lead to regional ozone but also to background hemispheric ozone; CO becomes CO2 but consumes OH radicals along the way increasing CH4; Diesel PM increases PM10 & PM2.5 & ultrafine PM but also black carbon

- **Warming can also enhance local public health impacts ...**Eg, each increase of 1 degree Celsius caused by carbon dioxide, can enhance PM and ozone build up. The resulting air pollution can lead thousands of additional deaths and many more cases of respiratory illness and asthma etc. (Mark Jacobson 2008)
Cars, trucks and buses will drive the future oil demand.....

Transport energy demand has grown at 1.2 times the GDP growth rate.

Fuel consumption by vehicles in 2035 could be six times that of the 2005 level. (ADB)

Shift of freight from railways to trucks: Railway share only 26%

Consumer interest in fuel efficiency: Monthly household expenditure budget shows that between 1993-94 and 2004-05 the share of expenses on transport has gone up from 11.3% to 17.1%. (NSSO)

Source IEA
Market shifting towards bigger and heavier vehicles that
guzzle more fuel...

Key Characteristics of New Vehicle Fleet in India (2006-2010)

<table>
<thead>
<tr>
<th></th>
<th>FY 2006-07</th>
<th>FY 2007-08</th>
<th>FY 2008-09</th>
<th>FY 2009-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Vehicle Mass (kg)</td>
<td>948</td>
<td>981</td>
<td>1000</td>
<td>1052</td>
</tr>
<tr>
<td>Average Vehicle Footprint (m²)</td>
<td>3.20</td>
<td>3.25</td>
<td>3.28</td>
<td>3.33</td>
</tr>
<tr>
<td>Average engine size (cc)</td>
<td>1202</td>
<td>1221</td>
<td>1226</td>
<td>1299</td>
</tr>
<tr>
<td>Average vehicle fuel consumption (l/100km)</td>
<td>6.06*</td>
<td>6.02*</td>
<td>5.93</td>
<td>6.00</td>
</tr>
<tr>
<td>Average vehicle fuel economy (km/l)</td>
<td>16.5*</td>
<td>16.6*</td>
<td>16.9</td>
<td>16.7</td>
</tr>
<tr>
<td>Sales</td>
<td>962,419#</td>
<td>1,245,504#</td>
<td>1,412,527</td>
<td>1,861,118</td>
</tr>
</tbody>
</table>

* 2006-07 and 2007-08 fuel economy data calculated based on other publically available information. May differ from ARAI test results.
# Sales information not available for many light-commercial vehicles (including MPVs) for 2006-07 and 2007-08 period, and may affect averages.
Source: Drive Inside, SegmentY, SIAM

Reality check...
Vehicle mass, and size increasing ---
6-10% increase in average mass,
-- 6% increase in engine size. This means increased guzzling......

Result....Average fuel economy of new cars stagnating for the last four years (~ 1% improvement in average fuel economy)

Fleet weight increase by 2% a year can lead to a cumulative loss of 6.5 mtoe between 2010 and 2020. This nearly equals the fuel use of all four-wheeled passenger vehicles in 2006 -- around 6.6 mtoe.

Source ICCT
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

Source Based on Wilbur Smith 2008
Dependence on imported oil high in Sri Lanka
Oil demand is also galloping

Sri Lanka imports 85% of its energy demand (oil and products).

Sri Lanka - road sector petrol fuel consumption (kt of oil equivalent)

Source: Source: International Road Federation, World Road Statistics and electronic file and IEA
In Sri Lanka transport CO2 emissions dominate.
Sri Lanka has a chance to be preventive.
Requires fuel efficiency standards for vehicles and other measures.
We need fuel economy regulations.

Cities are losing battle of car-bulge: The rapid increase in vehicles is destroying all gains of air pollution and health
Vehicle registration in India: India’s urban population has grown 4.6 times, vehicle numbers have increased 158 times

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

Source: Computed on the basis of MOSRTH motor vehicle registration data
Personal vehicles will skew motorisation in Sri Lanka as well

Rapid motorization -- motor vehicle fleet has doubled in one decade (1991 to 2000) in Sri Lanka. The trend in recent years shows an even steeper growth.

Source: Department of Motor Traffic, Colombo
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 Colombo

Car journey time survey results

- Sri Lanka incurs a massive financial and man-hour loss due to traffic congestion.

- In Greater Colombo this loss was estimated to be as high as Rs 32 billion per annum in 2009.

- Sri Lanka is losing 1.5% of the GDP due to traffic congestion.

The country’s road network in the city is not capable of handling increasing traffic flows increasing at around 10% per year.

Source: Country Report, Sri Lanka, Regional Expert Group Meeting, Bangkok, 1-3 November 2010
Other costs in Colombo

- Road safety compromised: Fatality: 1 in 50 deaths are due to road accidents

- Cost of Accidents: estimated Rs 30 billion per annum (USD 260Mn)

- Cost of Congestion: estimated Rs 35 billion per annum (USD 304Mn)

- Cost of Lost Time in Public Transport: estimated Rs 20 billion per annum (USD 174Mn)
Congestion leads to more pollution

<table>
<thead>
<tr>
<th>Speed (kilometer per hour)</th>
<th>Autos Change in emissions with speed (gm/km)</th>
<th>Buses Change in emissions with speed (gm/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO</td>
<td>HC</td>
</tr>
<tr>
<td>10 km/hr</td>
<td>33.02</td>
<td>4.47</td>
</tr>
<tr>
<td>25 km/hr</td>
<td>21.20</td>
<td>2.60</td>
</tr>
<tr>
<td>50 km/hr</td>
<td>9.80</td>
<td>1.30</td>
</tr>
<tr>
<td>75 km/hr</td>
<td>6.40</td>
<td>0.93</td>
</tr>
</tbody>
</table>


Vehicle Emissions vis-à-vis Speed
Colombo shaping transportation strategies....

- 4 lane highway being constructed
- Flyovers being constructed (8 already done)
- In Western province, electric railway (metro) being constructed
- Transportation plans to 2020 include BRT system for Colombo and surrounding areas
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
The second generation challenge
Understand the advantage of South Asia

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

Urban Mobility

PT and NMV based, MTW majority personal vehicles

Modal share

60-30% carbon neutral trips
Increase in PT will increase carbon!

City population (million)

walk  Cycle  Rick-shaw  Three  Public Transport  Cars  MTW

Source TRIPP, 2010
Bus is less than 10% of the vehicles kms but carries 60% of the passenger km.

This strength is reflected at the global level
Modal split for passenger transport in selected countries

*India Note 1: automobile include cars, two wheelers, IPT. Note 2: Passenger mobility in India relies heavily on rail and road. Passenger travel by air and water is negligible in comparison to rail and road.


2. CO2 EMISSIONS FROM PASSENGER TRANSPORT IN INDIA: 1950-51 TO 2020-21 Sanjay Kumar Singh, IIM Lucknow
Even with fewer vehicles congestion is very high. Why?

Source: Compiled from SIM AIR, and MOUD report
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.
This slide has already begun in Delhi.....

Public transport losing ground

Source: Anon 2008, transport demand forecast study: study and development of an integrated corridor mixed mode public transport network for NCT of Delhi, RITES, MVA Asia Ltd, TERI, September
Challenges of rebuilding public transport

-- Delhi Master Plan has set the target of 80% public transport ridership by 2020........
The Annual Average Growth in % in STU Bus Fleet (2000 to 2007)

Source: Anon 2008, Study on traffic and transportation policies and Strategies in Urban Areas in India, MOUD
City bus corporations in India: In the red

<table>
<thead>
<tr>
<th>Bus company</th>
<th>Fleet size</th>
<th>Average (years)</th>
<th>Fuel efficiency</th>
<th>Staff/bus ratio</th>
<th>Vehicle productivity (km/bus/day)</th>
<th>Total revenue (Rs crore)</th>
<th>Total costs (Rs crore)</th>
<th>Net profit/loss (Rs crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td>1,144</td>
<td>6.4</td>
<td>3.70</td>
<td>6.65</td>
<td>124</td>
<td>72</td>
<td>177</td>
<td>-105</td>
</tr>
<tr>
<td>Mumbai BEST</td>
<td>3,391</td>
<td>5.56</td>
<td>3.31</td>
<td>10.11</td>
<td>194</td>
<td>850</td>
<td>1,088</td>
<td>-238</td>
</tr>
<tr>
<td>Chennai Metro</td>
<td>2,773</td>
<td>8.39</td>
<td>3.77</td>
<td>6.40</td>
<td>209</td>
<td>472</td>
<td>557</td>
<td>-85</td>
</tr>
<tr>
<td>Delhi DTC</td>
<td>3,467</td>
<td>4.70</td>
<td>2.99*</td>
<td>8.21</td>
<td>205</td>
<td>464</td>
<td>1,267</td>
<td>-803</td>
</tr>
<tr>
<td>Bangalore MTC</td>
<td>3,977</td>
<td>4.47</td>
<td>4.66</td>
<td>4.78</td>
<td>218</td>
<td>687</td>
<td>574</td>
<td>+113</td>
</tr>
<tr>
<td>Ahmedabad MTS</td>
<td>685</td>
<td>11</td>
<td>—</td>
<td>5.72</td>
<td>172</td>
<td>76</td>
<td>99</td>
<td>-23</td>
</tr>
</tbody>
</table>

What ails bus transport?
-- Unorganised – large number of small time operators
-- Obsolete and poorly maintained fleet
-- Routes not rationalised
-- Poor level of service
-- Lack of performance and service standards
-- Lack of coordination between operating agencies

All city governments are under pressure to reform the bus sector
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.

- This can also lead to 5% reduction in total vehicles (47,716), release road space (equivalent to removing 62,152 cars from the road).

- **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.
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

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

Source: Dario Hidalgo study for CSE, 2008 Mimeo
Other governments are doing this as well....... Taipei
Integrate, integrate integrate........
Delhi is developing guidelines for modal interchange location

Delhi-- UTTIPEC/DDA guidelines

**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.
**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

*Uniqueness of the public transport in South Asian cities...*

**Mixed traffic** – cycle rickshaws, tempos, auto-rickshaws, buses ... but environmentally sustainable.
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
Lessons from Delhi
Poor walking infrastructure in Delhi

Captive walker in poor neighbourhood (Govindpuri and Zaffrabad): Traffic and people on collision course.....

- Discontinuous, poorly paved footpaths, and not easily accessible
- Height and width of pavements violate norms
- Poor signages, no pedestrian refuge islands -- crosswalks are ordeal
- No kerbed ramps or blended crossings to access the crosswalk facilities
- Exposure to traffic very high.

Source: CSE
Mismatch in demand and supply

Aurangzeb Road and Govindpuri

We have counted 3 persons per 10 minutes in Aurangzeb Road and 100 person per five minutes in Govindpuri

Urban planning does not keep people in focus

Source: CSE
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
Jay walking....asserting their right to cross where convenient
But car centric design does not allow safe, quick and shortest
 crossing

Sai Chowk, Patparganj

Scindia House, CP

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

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.....

Source: CSE
Retrofitting changes.....

- Sidewalks are now being rebuilt in Delhi

Connaught Place
It is possible to change
Redesigned streets in a small town of Nanded in Maharashtra

Source: Pradeep Sachdeva
Need to change the practice

While car owners resent expansion of walk space ..... public voice gets stronger for liveable walking city

Public protest against PWD road-widening for the Commonwealth Games at Siri Fort to save the footpaths

PROTESTS PERSIST: Locals says the government body doesn’t have necessary approval to undertake the work

Source: Times of India
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
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.
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.
The affordability challenges of mobility transition..............

Are we spending on sustainable options adequately?.....
Delhi: Do we see any inconsistency here?

Rationalise budgetary allocation

Percentage share of public transport in total transport allocation

Percentage allocation to Transport

Percentage share of allocation to transport

Budget Year (Annual Plans, Delhi)
In India National Urban Renewal Mission has a reform based funding scheme for transport. But.....

The investment so far is heavily biased towards road infrastructure.

More than 71% of the transport related projects are road related projects.

Little on public transport and barely any in cycling and walking infrastructure.
Indian style socialism

We tax our public transport more than cars...

Correct 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. Thus, penalised for carrying more passengers.

If bus fares are raised, a substantial public transport ridership can be lost to two wheelers with running cost of just Re 1/km.

For example -- Delhi with nearly the highest per capita income and car pays the lowest taxes.
India setting its reform agenda.....

JNNURM mandates dedicated urban transport fund

Identifies the following as the possible sources of funds that can act as a fiscal brake on car centric growth……

- Waive off/reimburse all its taxes on urban buses and city bus service
- Need advertisement policy to tap newer source of revenues
- Need parking policy as a car restraint measure
- 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
Indian cities have begun to apply fiscal instruments

**Delhi:** Air Ambience Fund from environment cess on diesel fuel:
Air Ambience fee of 25 paise per litre on sale of diesel fuel has been implemented. Air Ambience Fund used to subsidise battery operated vehicles from the 15 per cent subsidy and 12.5 per cent VAT reimbursement. Also subsidise conversion of old commercial LCVs.

**Surat:** Dedicated urban transport fund: 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.

**Bangalore:** Green tax: Bangalore has taken the lead to introduce Green tax that is imposed on the older vehicles.
- Fiscal incentive for LPG conversion
- Comprehensive parking Policy proposed

**Hyderabad:** Exemption of motor vehicles tax on vehicles running on CNG, battery and solar power.
Learn from global approaches to tax reforms

Annual registration or road fees on personal vehicles.

**US** – Cars pay more taxes and also differentiates the tax according to engine size – fuel inefficient bigger cars pay more.

**Singapore** – Road tax differentiated by engine size, fuel type

**Germany** – Cars complying with older emissions standards pay more than the current standards.

**China** has a range of taxes on vehicles –

- **On purchase**- Excise, VAT, Tariff, Vehicle acquisition tax
- **On ownership** – New car check out fee, License plate fee, Vehicle usage fee,

- **Vehicle use** – Insurance fee, Road maintenance fee, Consumption tax


**There is no one silver bullet. Need a package of fiscal strategy to make the difference**
Other governments calculate hidden Subsidies for Urban Car transportation and public funds for private transport

<table>
<thead>
<tr>
<th>Budget 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>
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<tbody>
<tr>
<td>Heidelberg</td>
<td>2004</td>
<td>142.500</td>
<td>13.137.822</td>
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<td>104.591.837</td>
<td>83.928.571</td>
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<tr>
<td>Average Germany (based on inhabitant numbers)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>145,5</td>
<td>29,1%</td>
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<td>440</td>
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</table>

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

Cities that have destroyed roadways

San Francisco
Milwaukee
New York
Portland
Toronto
Seoul

Before
After

Seoul’s Cheonggyecheon restoration project
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...