



Delhi-Colombo Dialogue



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

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Environment**

***Workshop on Air Quality and
Environmentally Sustainable
Transport***

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Center (AirMAC), Ministry of
Environment,
Ministry of Transport and
Center for Science and
Environment, India
Colombo, April 28, 2011**





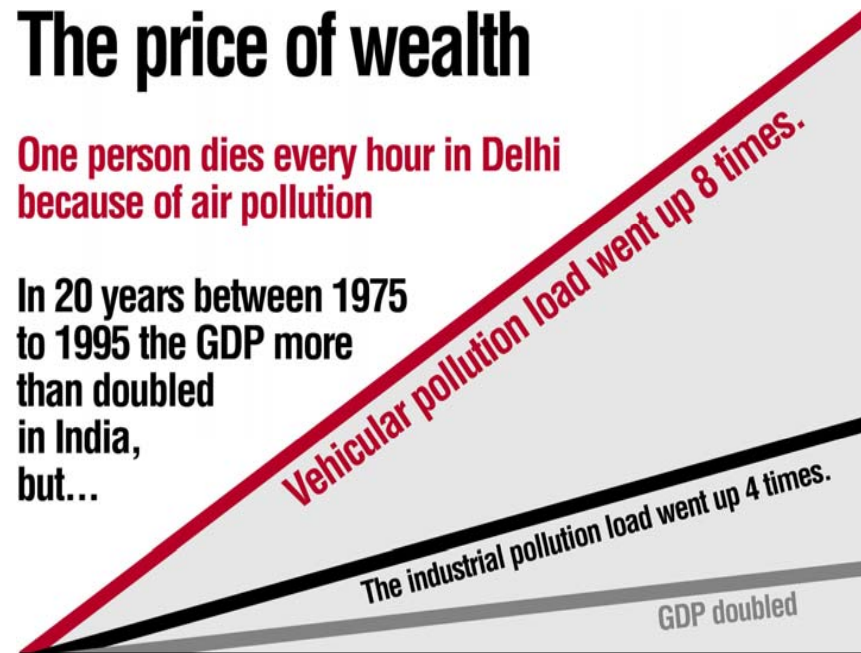
Growing pollution and toxification: new struggles in cities

- 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.

The price of wealth

One person dies every hour in Delhi because of air pollution

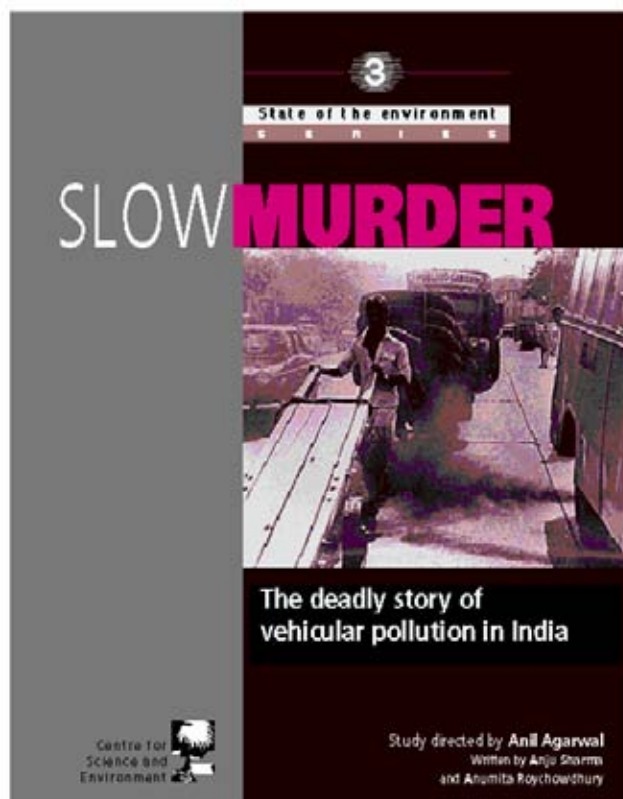
In 20 years between 1975 to 1995 the GDP more than doubled in India, but...



Where will the future growth take us?
It all depends on the choices we make



The Delhi story.....




cough wheeze suffocate

it's time you
TAKE A STAND
PUT YOUR HEALTH ON THE POLITICAL AGENDA

3.30 pm • June 5, 1999 • Silver Oak, India Habitat Centre, Lodi Road, New Delhi 110003

People for Clean Air

CSE  **CENTRE FOR SCIENCE AND ENVIRONMENT**
2995 5124, 2995 6110, 2995 6399, 2995 6394

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

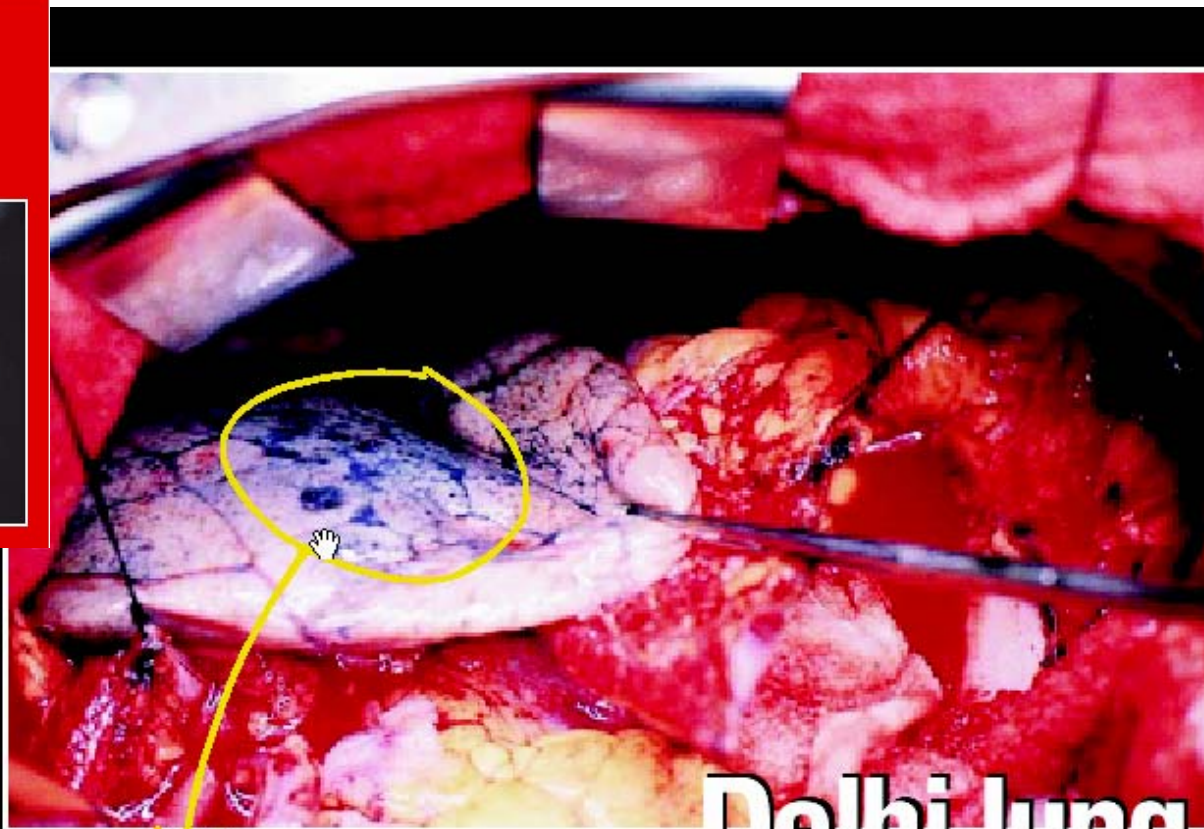
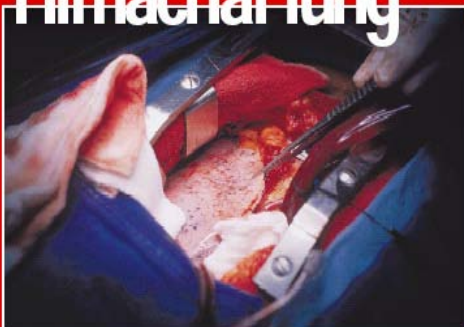


Bad air. We all know about it. But the fact that it gets into our bodies and inflicts fatal injuries is unknown to most of us. Surgeons who have the privilege of seeing inside us have a funny story to tell. They can tell, just by looking at the colour of the lungs, whether the person is from a dirty big city or not.

Actually a shocking tale!

Look at the spotless lung below. The fortunate owner comes from a relatively cleaner place.

Himachal lung



Delhi lung

Capital punishment

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? **CSE Poster** But those can be so sticky!



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

	Delhi	Mumbai	Kanpur	Chennai	Calcutta
1991-92	7,491	4,477	1,894	883	5,726
1995	9,868	7,023	3,639	1,291	10,647

More illness!

Rising pollution-related sicknesses and hospitalisation

	Delhi	Mumbai	Kanpur	Chennai	Calcutta
1991-92	39.5 lakh	25.5 lakh	8.03 lakh	4.5 lakh	29.3 lakh
1995	60.0 lakh	40.0 lakh	15.4 lakh	8.8 lakh	54.5 lakh

1991-92 figures are of World Bank

1995 figures are generated by CSE

All 1995 figures are based on a CSE study. We fed Central Pollution Control Board air pollution data for 1995 — the LATEST AVAILABLE! — to an epidemiological model developed by World Bank staffers to calculate pollution-related health and mortality costs. (The World Bank used 1991-92 pollution data.)

YOU LINE UP FOR A TAILPIPE TEST WHILE REAL CULPRITS GO SCOT-FREE

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 profits.

POLLUTION CONTROL BOARDS

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

POLITICIANS IN GENERAL

No interest in people's health.

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 exposé 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, Sonita Narain or Anamita Raychowdhary

CENTRE FOR SCIENCE AND ENVIRONMENT

41, Tughlakabad Institutional Area, New Delhi 110 062

Tel: 698 3394, 698 1110, 698 1124, 698 6399 Fax: 698 5879

Email: anumita@cse@vsnl.ernet.in



YES, I would like to join the campaign

☐ Donate money for the Campaign Against Air Pollution.

My contribution, Rs _____ In a Cheque (No _____)

☐ Money Order ☐ Demand Draft is enclosed

All donations are exempted from income tax under Income Tax Act 80C

Please keep me informed.

Name: _____

Occupation: _____

Address: _____

Telephone: _____ Fax: _____

Email: _____

Ad in newspaper



First generation reforms.....

Soft options are now all exhausted



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

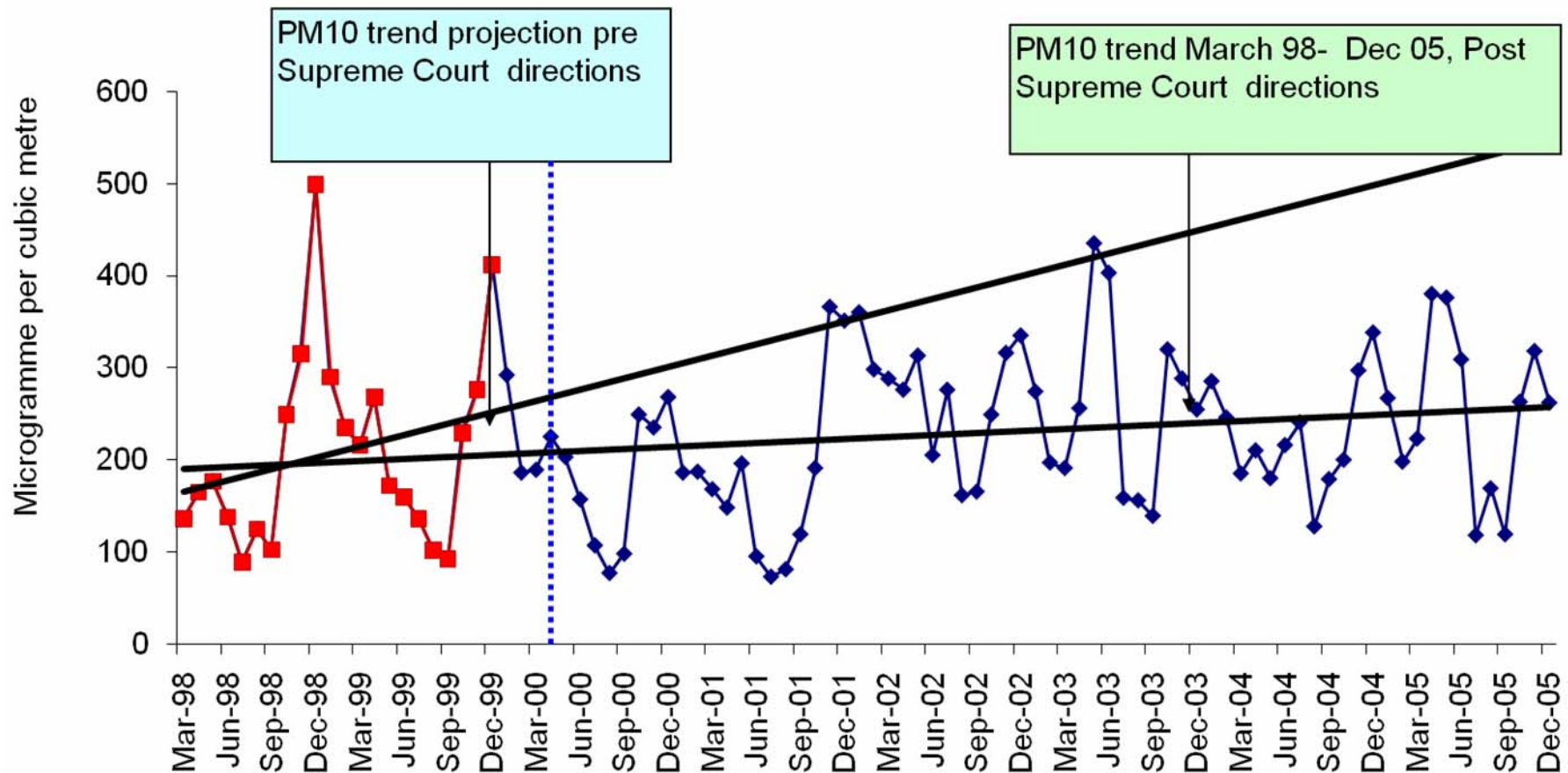
This now needs scale and stringent enforcement



Delhi got cleaner air: it avoided pollution



PM10 at ITO Traffic Intersection



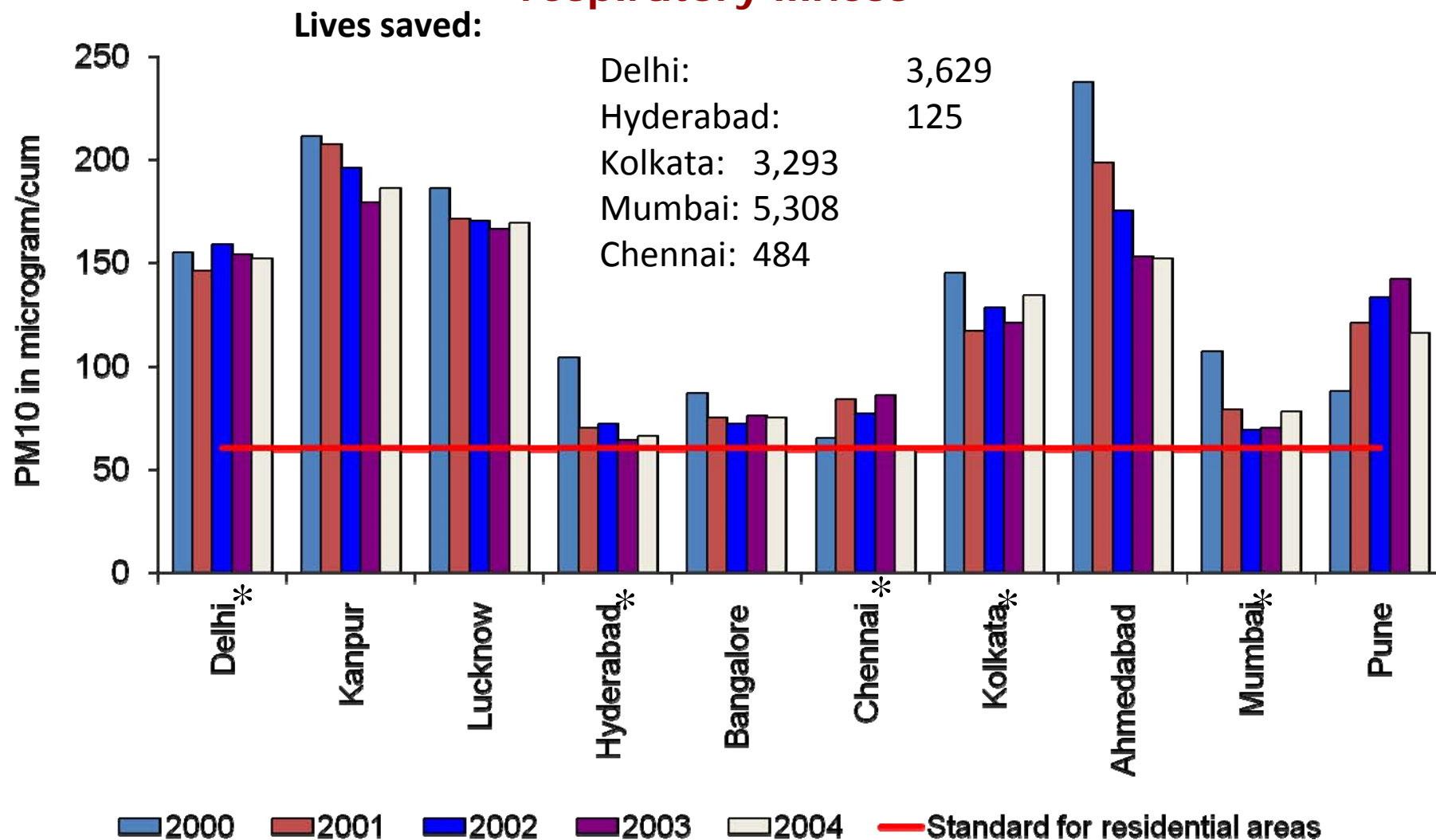
CPCB reported 24% drop in PM10 levels in 2002 compared to 1996 levels.



Evidence of action: Health Benefits



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



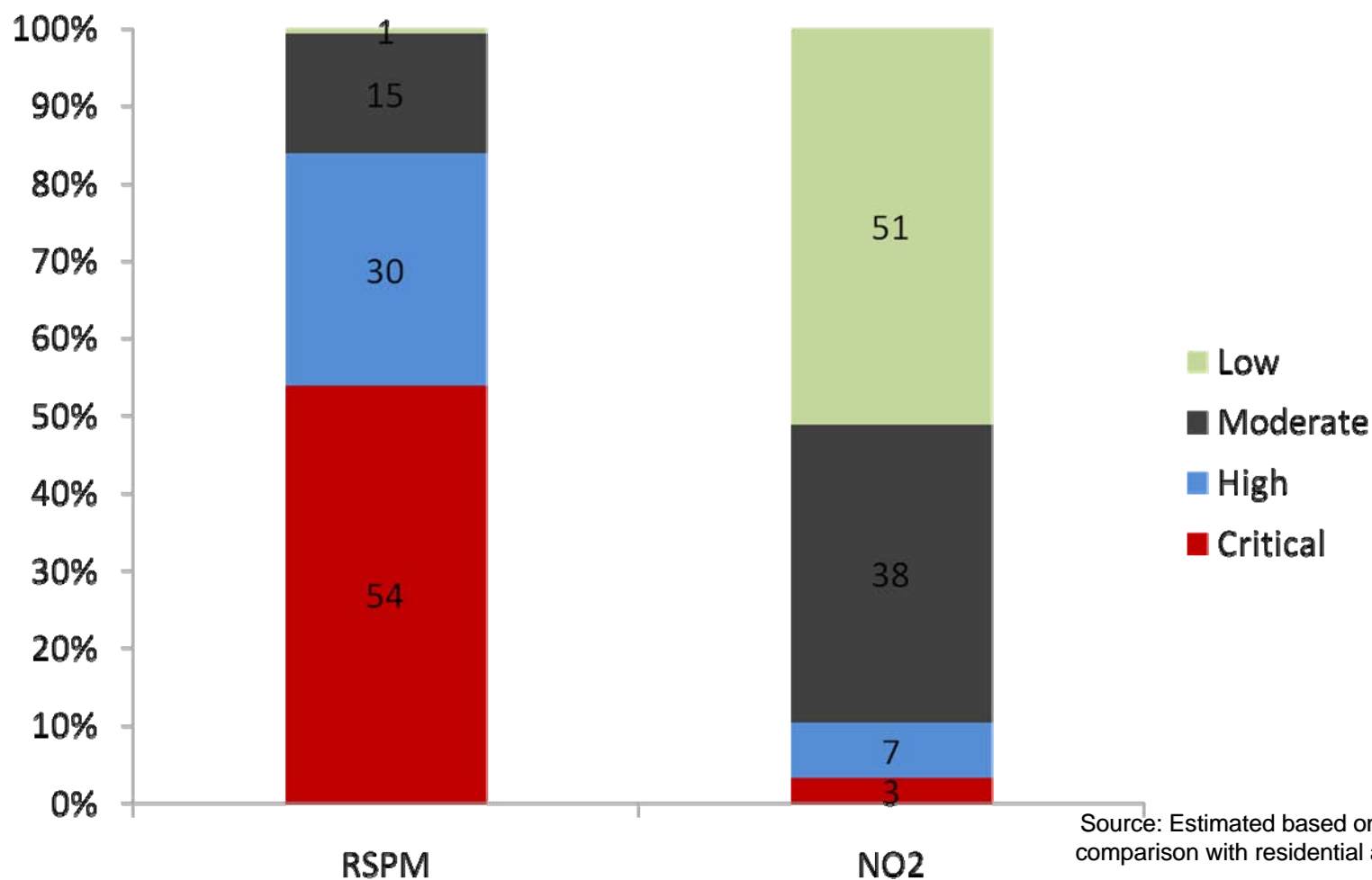
Source: CSE: based on NAMP data, CPCB, and World Bank 2004



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)

	Cities Name	Annual average
1	Howrah	81
2	Asansol	62
3	Kolkata	56
4	Delhi	49
5	Jamshedpur	49
6	Raipur	46
7	Mumbai	42
8	Navi Mumbai	42
9	Jharia	41
Safe level 40 microgramme/cum		

Cities with high PM₁₀ levels in 2009

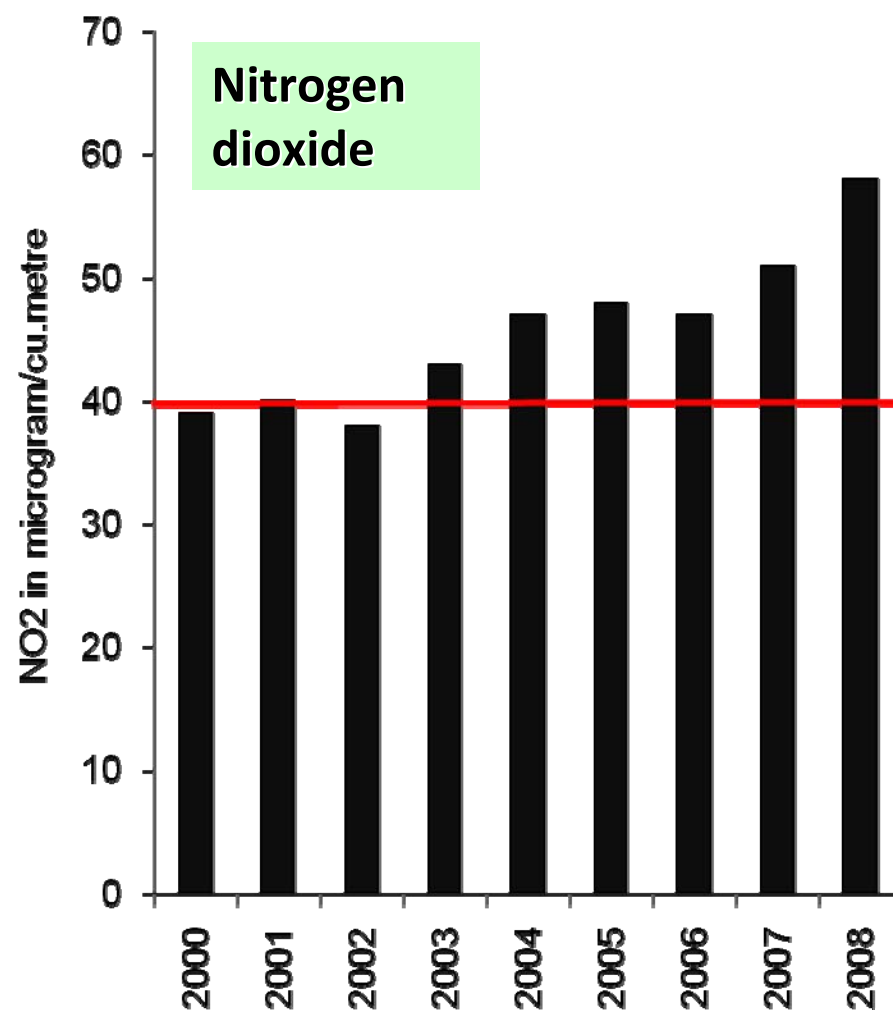
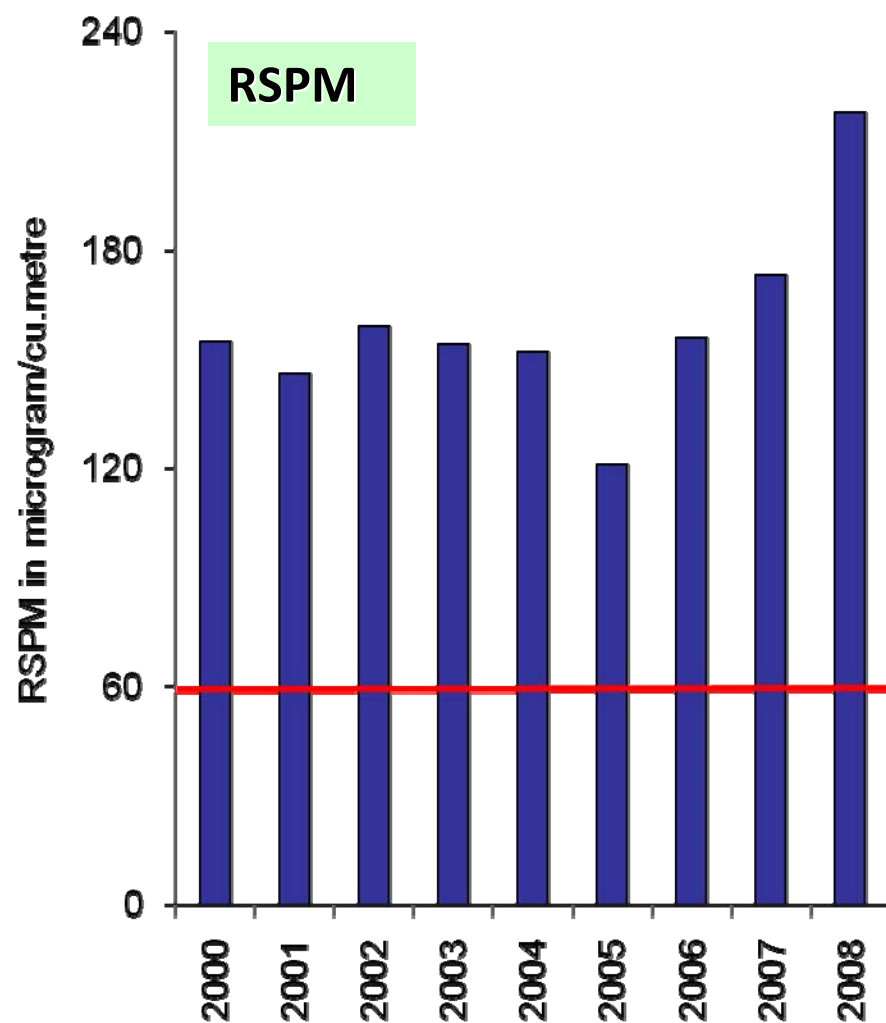
(Annual average concentrations in micrograms per cubic meter)

	Cities Name	Annual average
1	Jharia	261
2	Ludhiana	254
3	Khanna	249
4	Delhi	243
5	Ghaziabad	236
6	Kanpur	211
7	Gobindgarh	206
8	Lucknow	197
9	Amritsar	190
10	Gwalior	187
11	Firozabad	187
12	Kolkata	187
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



Daily dose of poison in Delhi...

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

AQI Range	
0 to 50	Healthy
50 to 100	Moderate
100 to 150	Unhealthy (Sensitive Groups)
150 to 200	Unhealthy
200 to 300	Very Unhealthy
> 300	Hazardous

		November 18, 2010					
Location		CO	O ₃	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
1	National Stadium	96	36	161	176	57	173
2	Nehru Stadium	91	40	163	179	59	173
3	Velodrome Stadium	92	29	168	181	63	174
4	Indira Gandhi Stadium	95	22	170	185	69	177
5	Games Village	82	39	161	174	53	171
6	Karni Shooting Range	67	54	152	163	58	166
7	Jamia Millia Islamia Univ	90	44	164	183	61	175
8	Talkatora Stadium	90	36	158	169	53	170
9	Yamuna Sports Complex	88	38	157	167	57	167
10	Thyagaraj Sports Complex	87	42	163	177	58	171
11	Siri Fort Sports Complex	88	48	164	180	56	171
12	Airport	71	50	142	155	49	161
13	AIIMS Hospital	100	40	172	186	61	175
14	India Gate	102	32	165	179	56	176
15	Connaught Place	106	31	166	179	61	177
16	Nizamuddin	104	23	198	215	62	192
17	ITO	97	28	162	177	64	175
18	Delhi College of Engg	77	27	135	152	51	166
19	Janakpuri	101	30	182	195	53	181
20	CPCB	92	41	159	171	54	168
21	NSIT Dwarka	73	50	152	160	46	163
22	DMS Shadipur	106	17	169	184	63	179
23	IHBAS Shadara	89	34	156	165	57	167
24	Punjabi Bagh	100	31	167	181	52	174
25	Anand Vihar	103	22	173	188	58	179
26	Dwarka Kuan Junction	101	25	177	187	52	178
27	Karol Bagh	97	31	159	170	55	171
28	GK2	100	44	182	199	58	181
29	Chanakyapuri	86	42	155	165	50	167
30	RK Puram	98	36	167	178	50	172
31	Pragati Maidan	96	36	161	176	57	173
32	Vasant Kunj	73	53	153	162	58	163
33	Mayur Vihar	88	51	162	174	53	169
34	Okhla IDE	90	24	165	184	72	182
35	Gurgaon	79	58	154	162	48	165
36	Faridabad	68	43	154	169	58	174
37	Badarpur	68	61	156	171	59	166



First generation action in Colombo



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

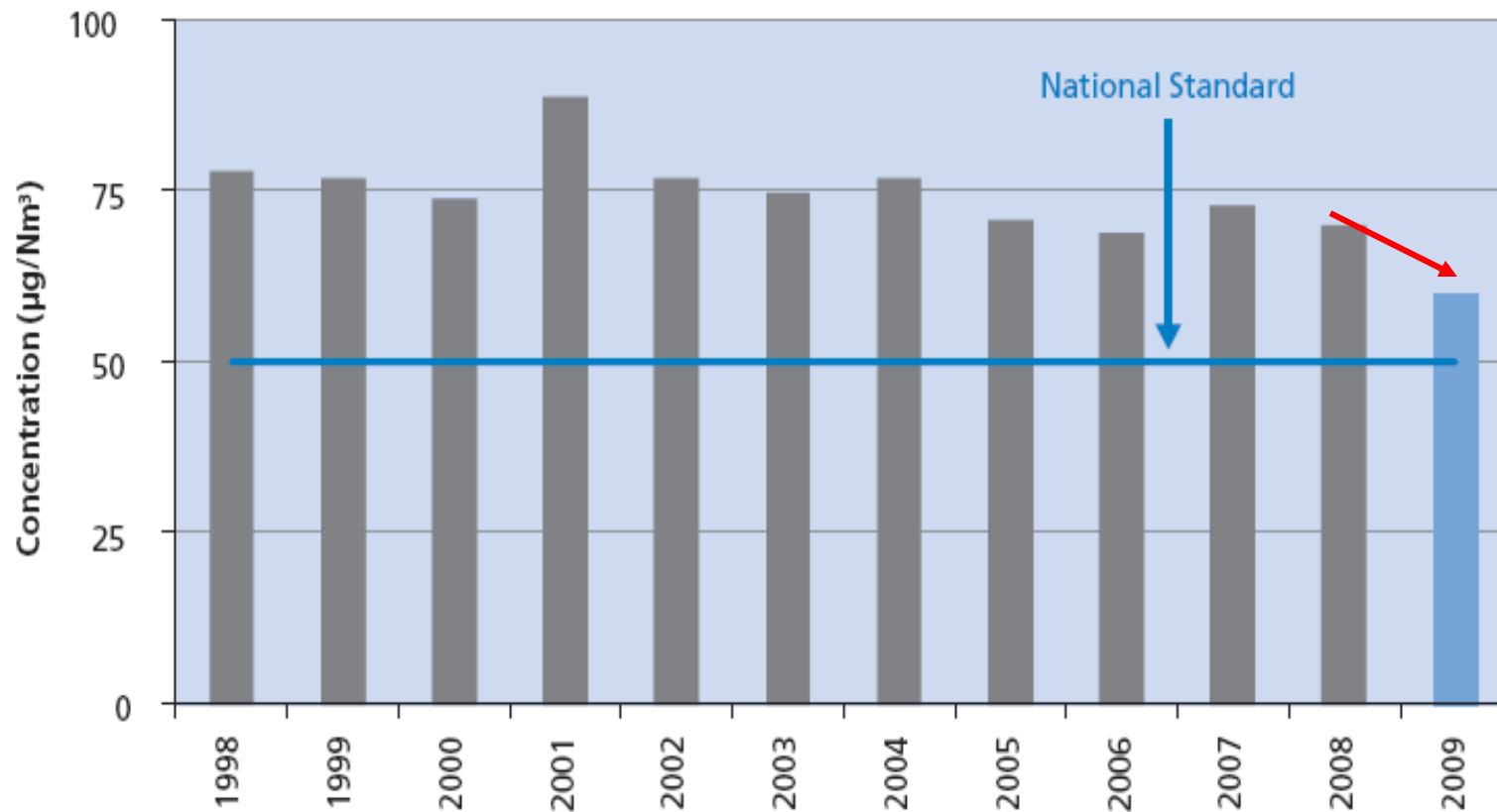
- Introduced Euro I standards for vehicles
- Mandatory annual vehicle emission testing programme launched in 2008. (5% of vehicles failed and removed from fleet)
- Importation of 2-stroke vehicles banned.
- Conversion of 3-wheelers to LPG/CNG/electric
- Construction of refinery that can produce Euro 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

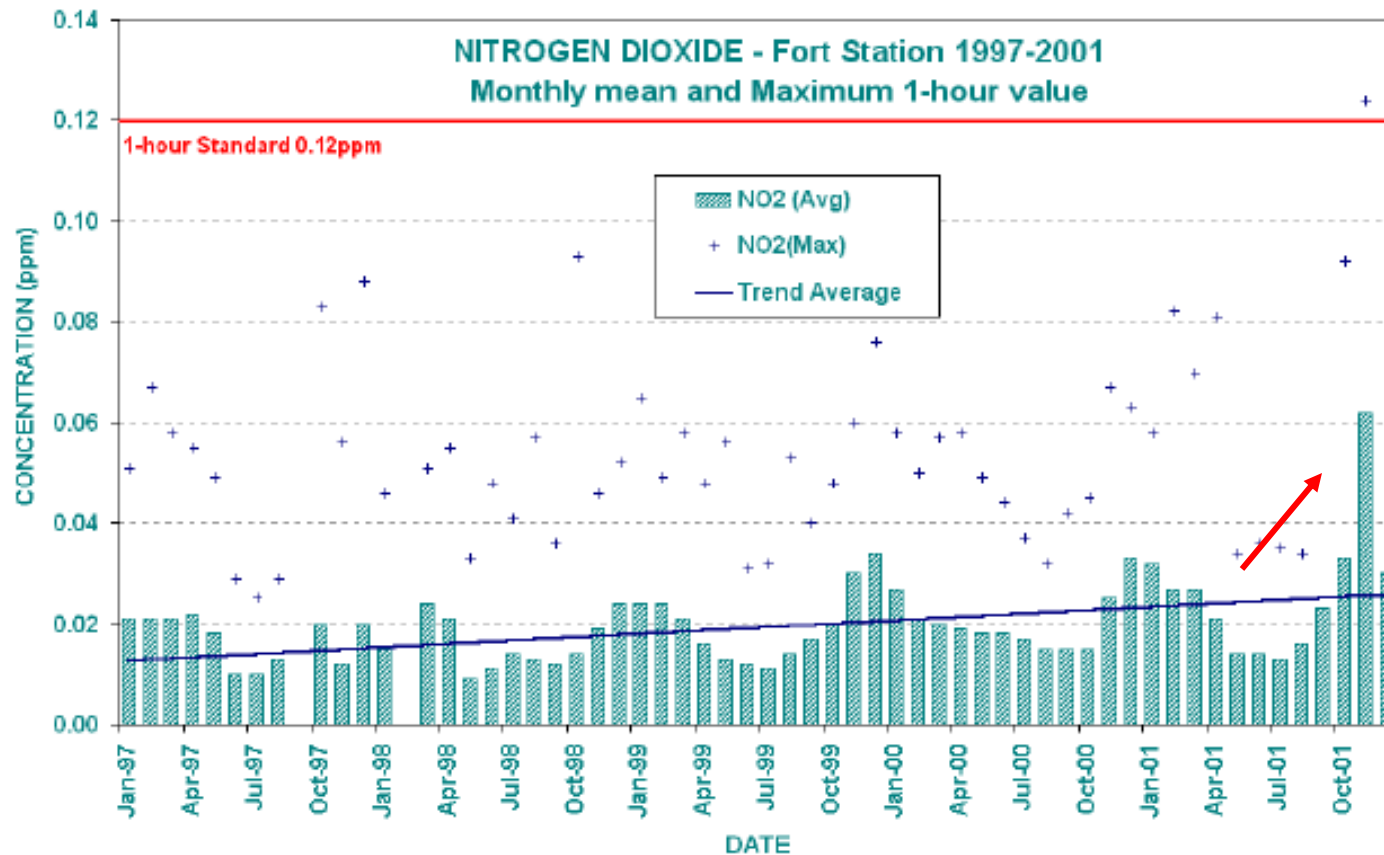
Source: Data of Central Environmental Authority (2010), cited in: Asian Development Bank and CAI-Asia Center. Knowledge management on air quality: Case studies. Mandaluyong City, Philippines: Asian Development Bank and CAI-Asia Center, 2010



Colombo: Newer problems



Nitrogen dioxide (Fort Station, 1997-2001)



NO_x problem is expected to grow. Reported to be high in high traffic areas already

More recent data also indicate a rise



Other cities are vulnerable too Kandy: Valley effect



Pollutants concentration in Kandy, 7-13 July 2010

Pollutants	Maximum Permissible Level (national standards)	Average Concentration	Recorded Maximum Average Concentration
Sulfur dioxide	0.08 ppm (1 hour)	0.02	0.04
Carbon monoxide	26 ppm (1 hour)	1.2	4.4
Nitrogen dioxide	0.13 ppm (1 hour)	0.06	0.08
PM ₁₀	100 µg/Nm ³ (24 hours)	87	103

*Source: Data of Central Environmental Authority (2010), cited in: Asian Development Bank and CAI-Asia Center.
Knowledge management on air quality: Case studies. Mandaluyong City, Philippines: Asian Development Bank and CAI-Asia Center, 2010*



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 tightend 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.



National Air Quality Standards must be made legally enforceable



- **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...



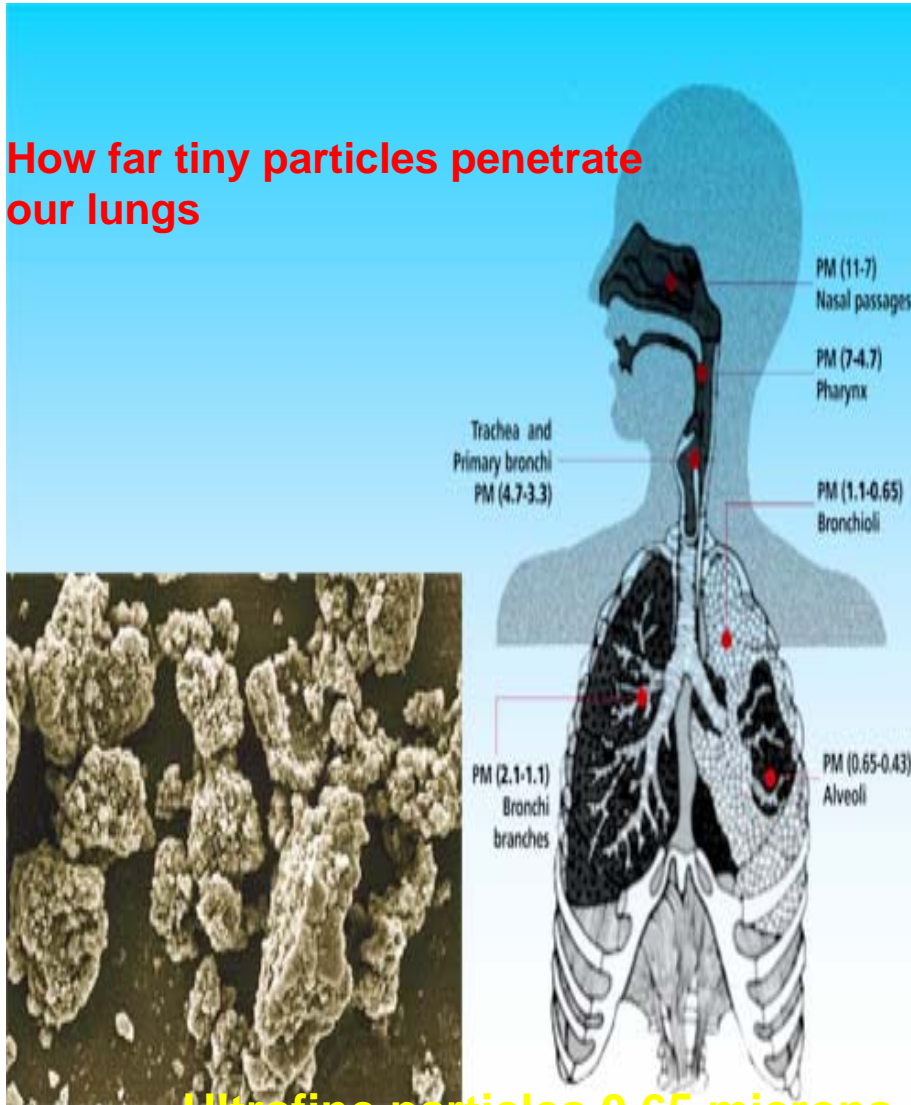
Our health must matter.....



The myth of safe air



**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 PM_{2.5} 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, acetdehydes, benzene, 1,3 butadiene, metals, PAH etc.....Dangerous at trace levels



Scourge

Air quality classification for PM₁₀ for selected cities in 2004 based on annual average standard for residential areas (60 µg/m³)

- Critical
- Moderate
- ▲ High
- ▲ Low

DELHI

- 1997: 50,336 patients admitted in casualty. 6,478 had cardiorespiratory events. In 1998, this rose to 52,268 and 9,334¹
- 1997: an average 100 µg/m³ increase in TSPM was linked with a 2.3% increase in deaths²
- 2004-05: 26% Delhiites have undergone chromosomal changes.³
- A study under PAPA is being conducted from 2005⁴

LUDHIANA

- A study under PAPA is being conducted from 2005⁵

KOLKATA¹⁰

- 43% urban children and 14% rural children have respiratory disorders. 19% and 10% urban children have cough and rhinitis. 94-98% children found to produce sputum
- Alveolar macrophage counts of adults more than eight times higher than the people in the Sunderbans
- Air pollution related allergies seven times higher

MUMBAI

- 18% suffered from chronic cough in high pollution zones⁶
- 20,000 excess cases of chronic bronchitis; 741,000 excess cases of asthma⁵

PUNE

- Respiratory tract of traffic policemen exposed to higher levels of oxidant stress⁶

BANGALORE⁷

- Asthma incidence in 20,000 children increased from 9 to 29.5% between 1979 and 1999
- Highest incidence of asthma (31.14%) reported among children of low socio-economic status in schools located in heavy traffic regions
- 26.12% traffic cops suffered from asthma compared to 14.9% non-traffic policemen

HYDERABAD

- Higher prevalence of heart attacks in persons 30-40 years of age in four high pollution pockets in the twin cities⁹

CHENNAI

- 202 premature deaths in a small municipality of north Chennai⁸
- A study under PAPA is being conducted from 2005⁸

Map not to scale

Notes: *PAPA — Public Health and Air Pollution in Asia Program; µg/m³ — microgramme per cubic metre; TSPM — total suspended particulate matter

Sources: 1. J N Pandey *et al* 2002; 2. Maureen Cropper *et al* 1997; 3. CNCI and CPCB 2005; 4. CPCB and IIT, Mumbai; 5. S R Kamath, *mimeo*; 6. Sundee Salvi *et al*, *mimeo*; 7. H Paramesh, *mimeo*; 8. Sri Ramchandra Medical College and Research Institute, Chennai; 9. Andhra Pradesh Pollution Control Board; 10. Twisha Lahiri *et al* 2000

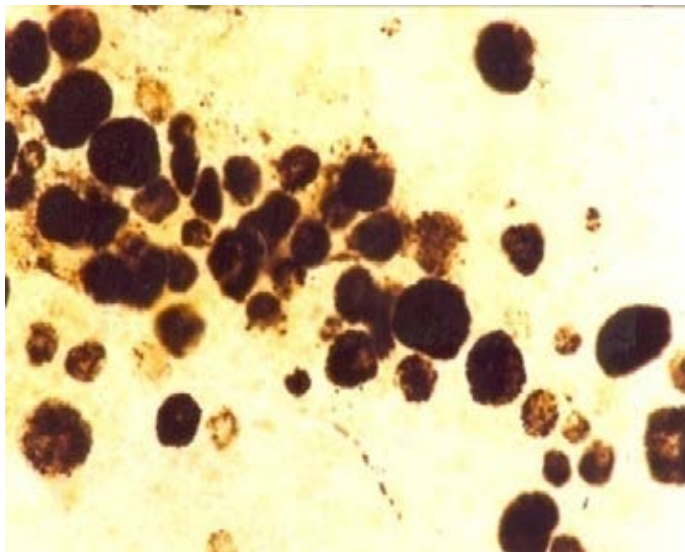
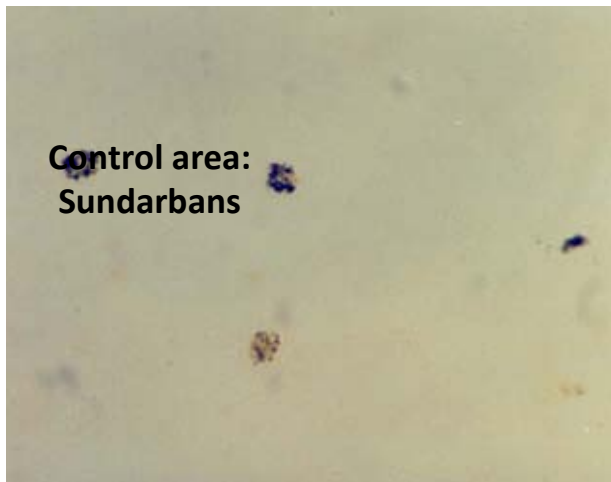


More evidences.....



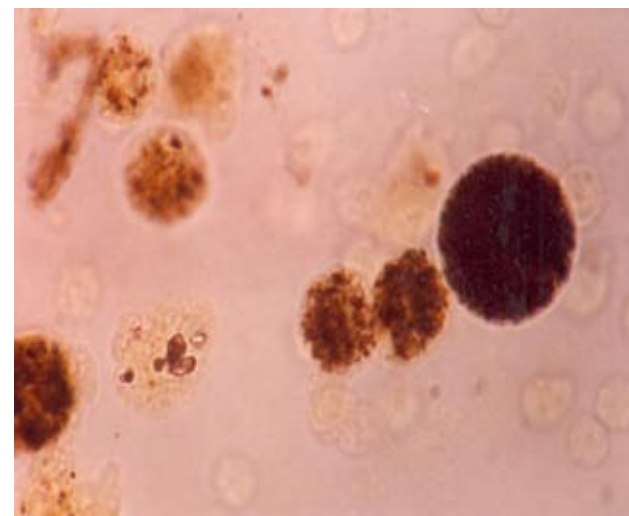
Alveolar macrophage - biomarker of air pollution

Control area:
Sundarbans



Exposed group; Kolkata taxi
driver
Increase in AM number

Larger AM – particle laden





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 NO_x) 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 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?



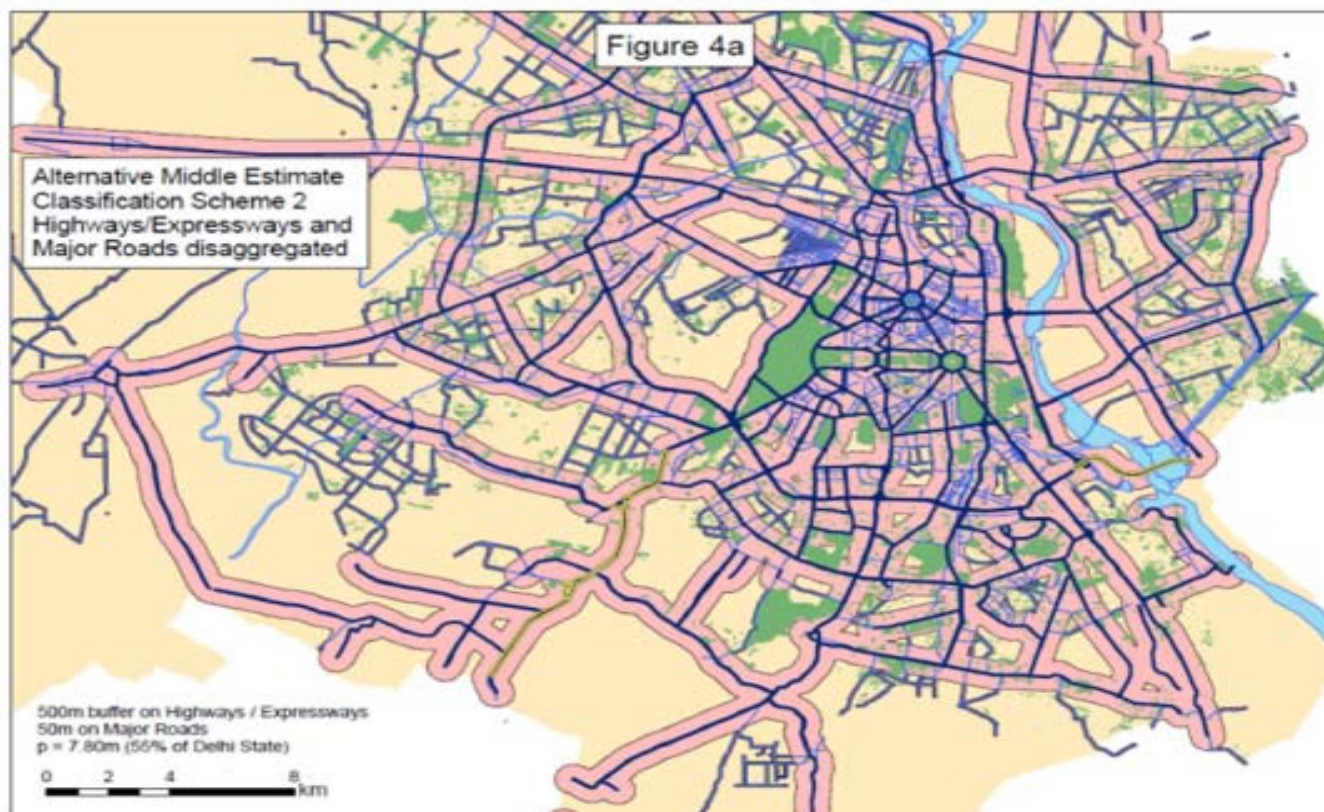
People living close to roads are most exposed to vehicular fume

Evidence from Delhi....

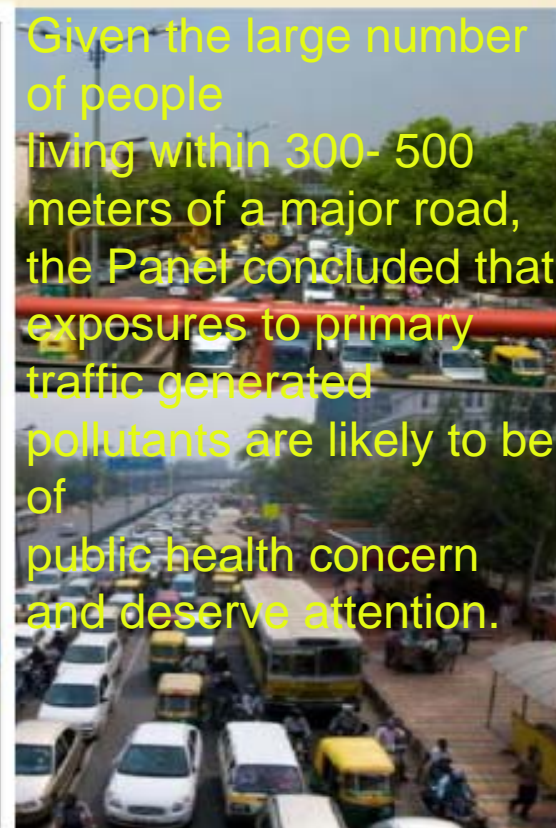


The Traffic Impact Area in Delhi:

***New HEI Analysis: 55% of the Population within
500 meters of a Freeway; 50 meters of a Major Road***

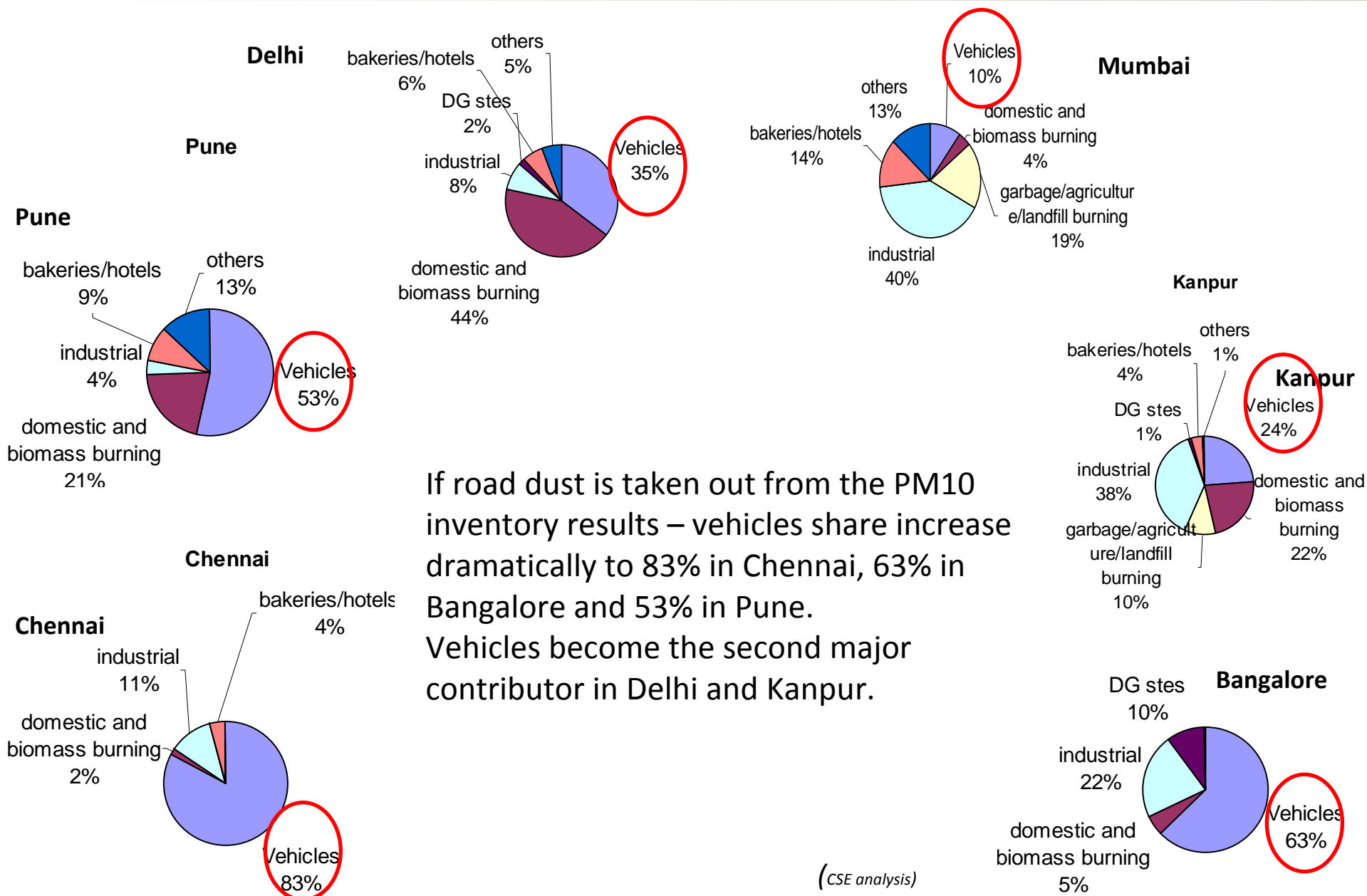


Given the large number of people living within 300- 500 meters of a major road, the Panel concluded that exposures to primary traffic generated pollutants are likely to be of public health concern and deserve attention.





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.

(CSE analysis)



Vehicles major source of air pollution in Colombo



- 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

Region, Country, or Area	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18
European Union	E1	Euro 2					Euro 3				Euro 4			Euro 5					Euro 6					
Hong Kong, China	Euro 1		Euro 2				Euro 3					Euro 4		Euro 5										
Republic of Korea												Euro 4		Euro 5										
PRC ^a						Euro 1				Euro 2			Euro 3		Euro 4									
PRC ^a					Euro 1			Euro 2			Euro 3			Euro 4				Euro 5						
Taipei, China																								
Singapore ^a	Euro 1						Euro 2																	
Singapore ^b	Euro 1						Euro 2					Euro 4												
India ^c							Euro 1				Euro 2				Euro 3									
India ^d					E1		Euro 2				Euro 3				Euro 4									
Thailand	Euro 1						Euro 2			Euro 3									Euro 4					
Malaysia			Euro 1												Euro 2				Euro 4					
Philippines								Euro 1					Euro 2								Euro 4			
Viet Nam													Euro 2										Euro 4	
Indonesia											Euro 2													
Bangladesh ^a											Euro 2													
Bangladesh ^b											Euro 1													
Pakistan															Euro 2 ^a		Euro 2 ^b							
Sri Lanka								Euro 1																
Nepal						Euro 1																		

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.

^e Beijing [Euro 1 (Jan 1999), Euro 2 (Aug 2002), Euro 3 (2005), Euro 4 (1 Mar 2008), Euro 5 (2012)]; Guangzhou [Euro 1 (Jan 2000), Euro 2 (Jul 2004); Euro 3 (Sep–Oct 2006), Euro 4 (2010)]; and Shanghai [Euro 1 (2000), Euro 2 (Mar 2003), Euro 3 (2007), Euro 4 (2010)].

^f 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

Region, Country, or Area	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
European Union					500					50(10) ^f			10							
Japan ^b	500									50		10								
Hong Kong, China		500					50					10 ^a								
United States	500										15									
Republic of Korea	500							430	100		30	15(10) ^f								
Singapore	3,000		500								50									
Taipei, China	3,000			500			350		100				50							
Thailand	2,500			500					350								50			
PRC (metros) ^g	5,000						2,000		500	350			50							
PRC (nationwide) ^f	5,000						2,000			2,000 and 500					350					
India (metros)	5,000				2,500	500				350 ^a					50 ^a					
India (nationwide)	5,000				2,500					500					350					
Malaysia	5,000		3,000				500 ^e								500 ^e					
Philippines	5,000					2,000			500										50 ^a	
Sri Lanka	10,000							5,000 ^d	3,000 and 500			500					50 ^a			
Viet Nam	10,000											500								
Indonesia	5,000										3,500				350					
Cambodia					2,000				1,500											
Bangladesh							5,000													
Pakistan	10,000						7,000 ^c													

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

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

Notes:

^a Under consideration or discussion; uncertain.

^b Nationwide supply of 50 ppm commenced in 2003 and for 10 ppm in 2005 due to voluntary goals set by the oil industry.

^c Marketed.

^d Mandatory.

^e 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.

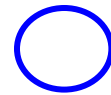
^f Various fuel quality available.

^g Beijing, Guangdong, and Shanghai.

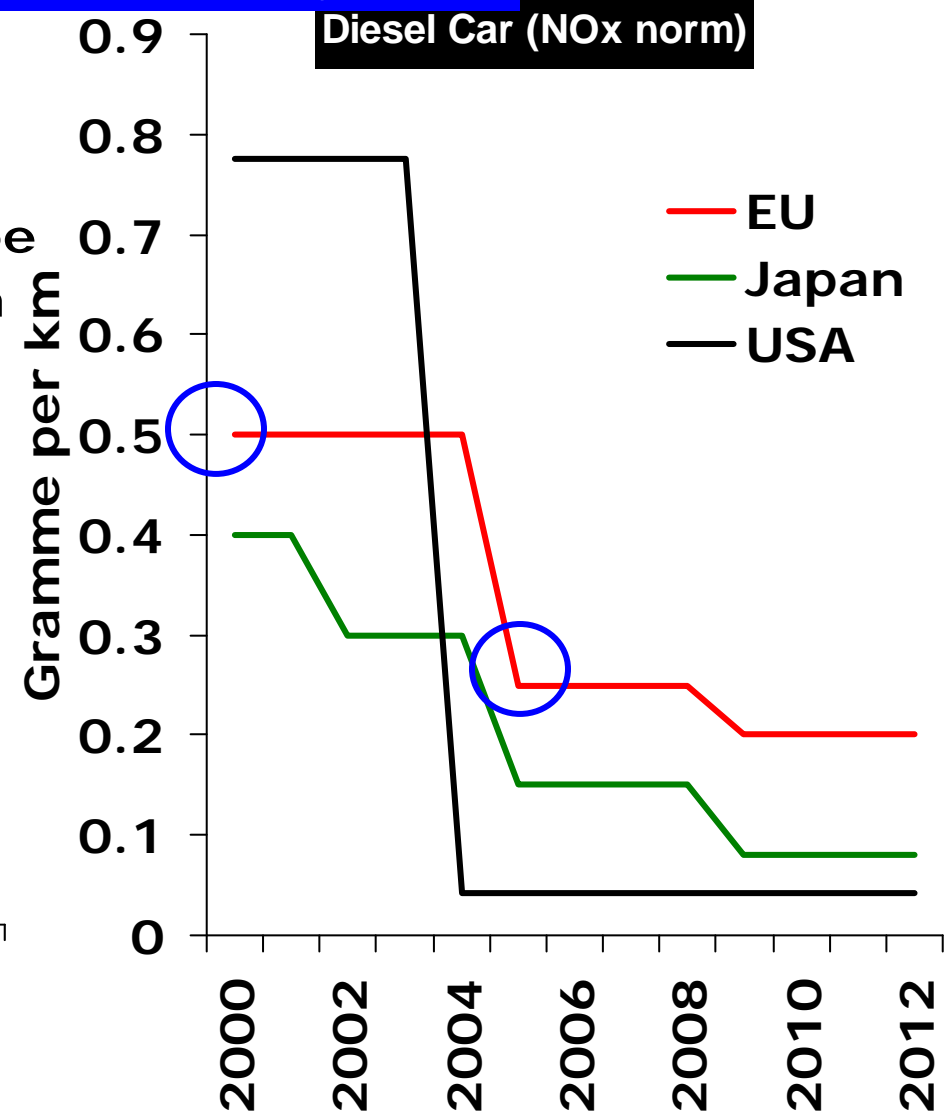
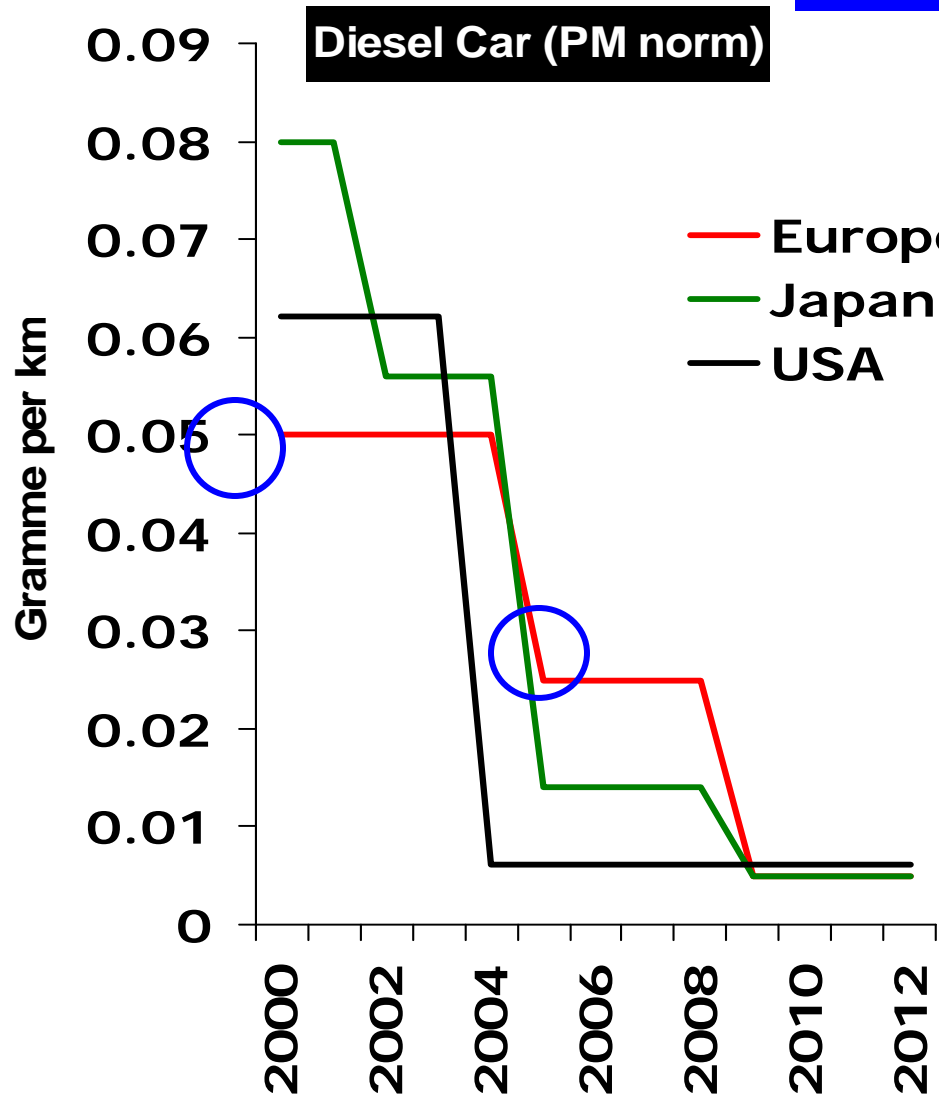
Source: CAI Asia, 2010



Technology-lag in India



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





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
- 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

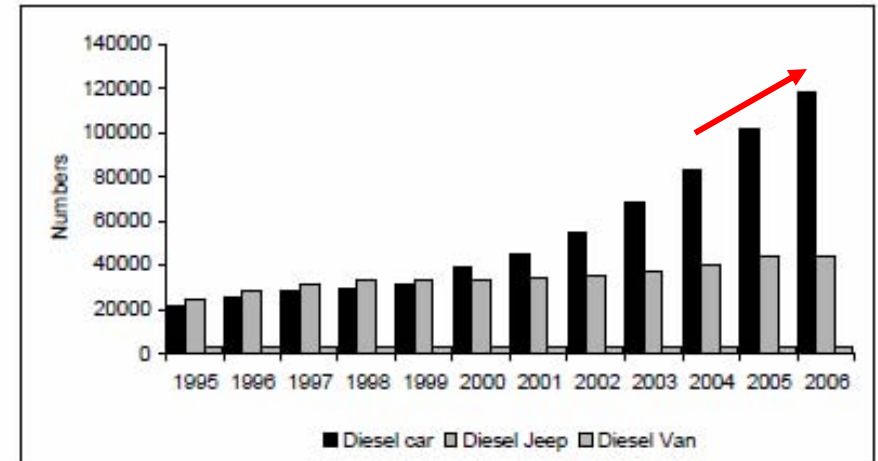


Threat of dieselisation



- 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

Graph 1: Growth of diesel car, jeep and vans in Delhi

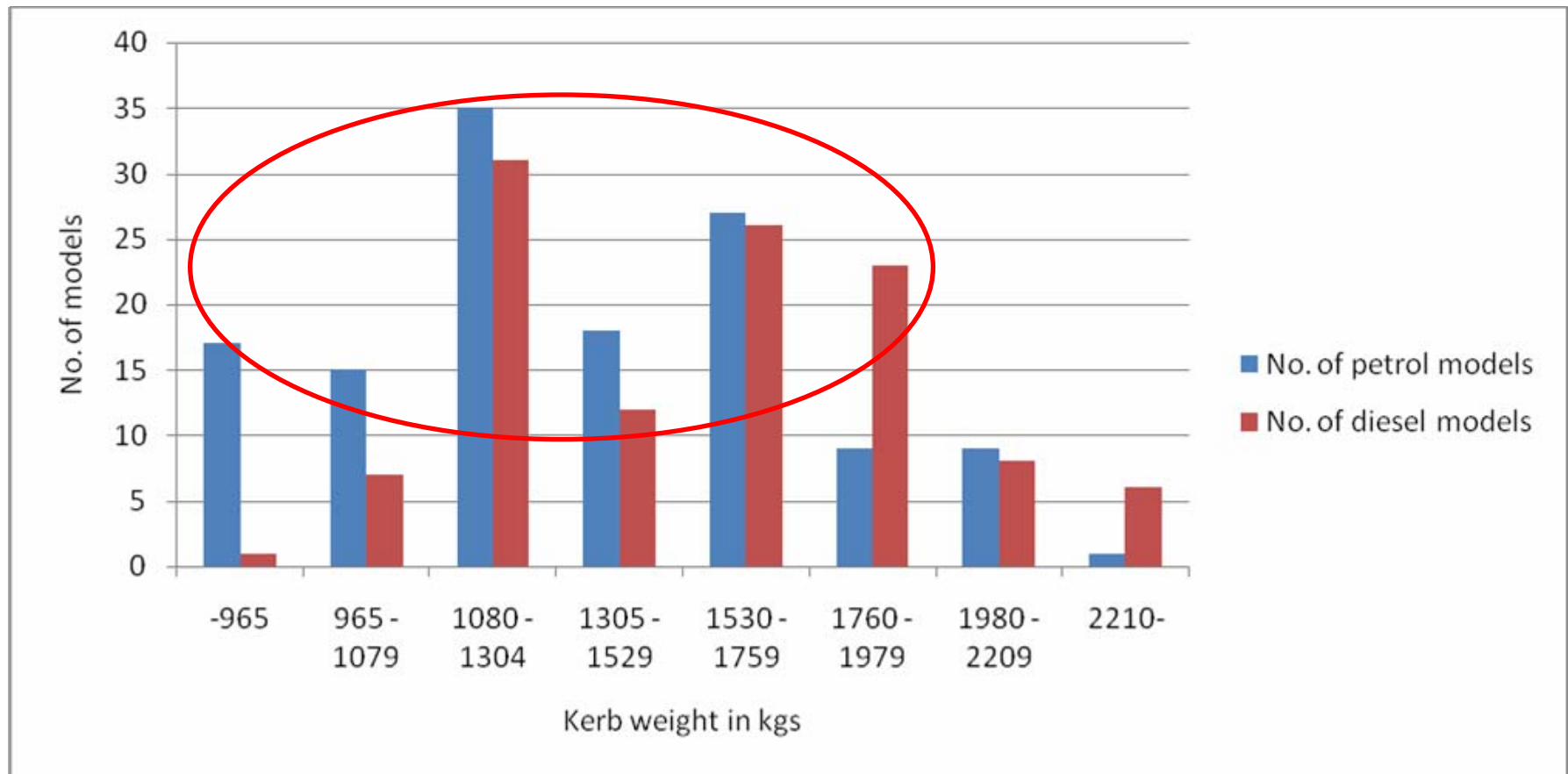




Check dieselisation of car segment



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





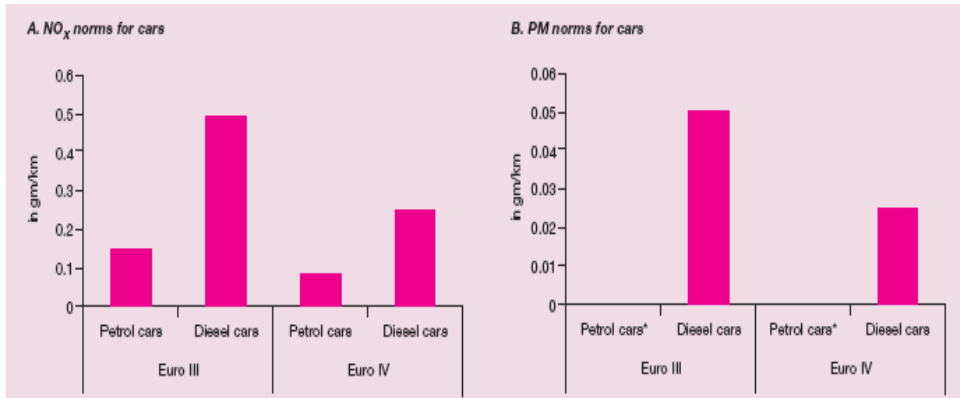
Why are we worried about dieselisation? License to Pollute



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

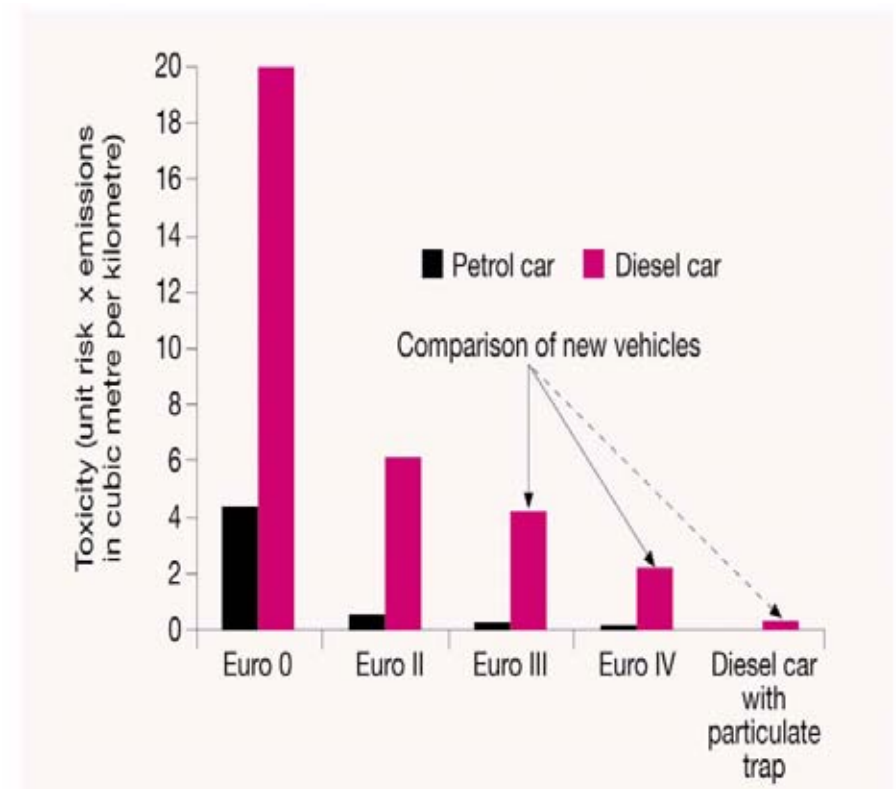
NO_x norms for cars

PM norms for cars



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

Toxicity of diesel emissions



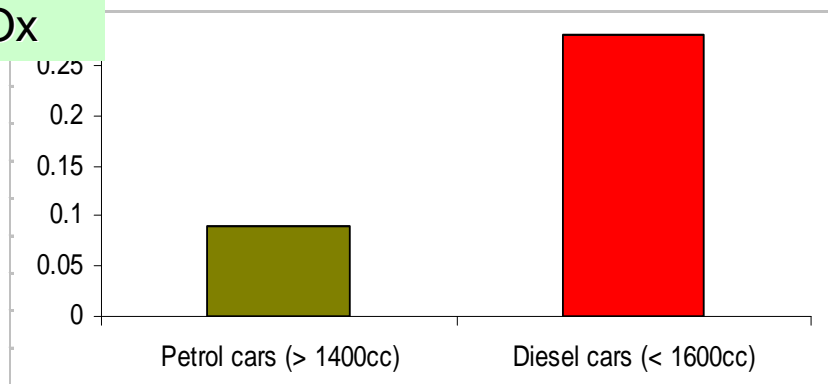
Source: MP Walsh



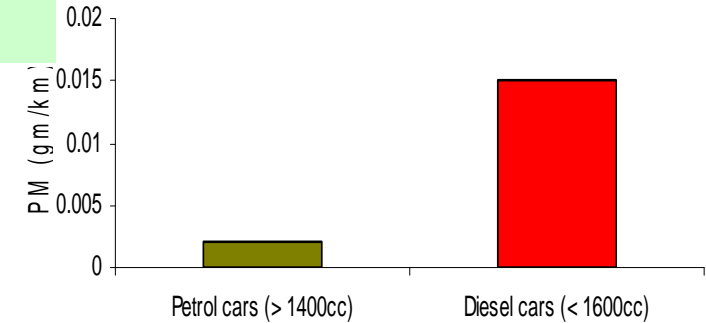
Toxic risk of diesel emissions



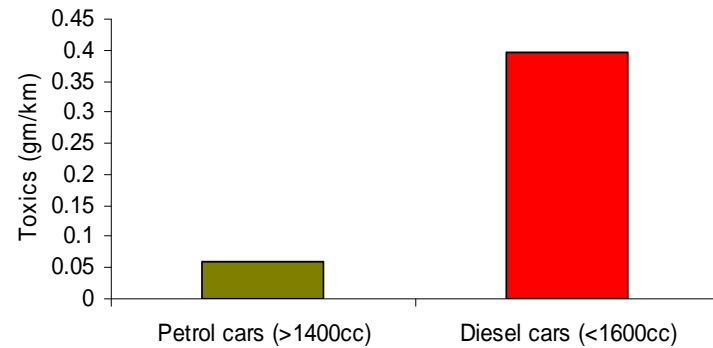
NOx



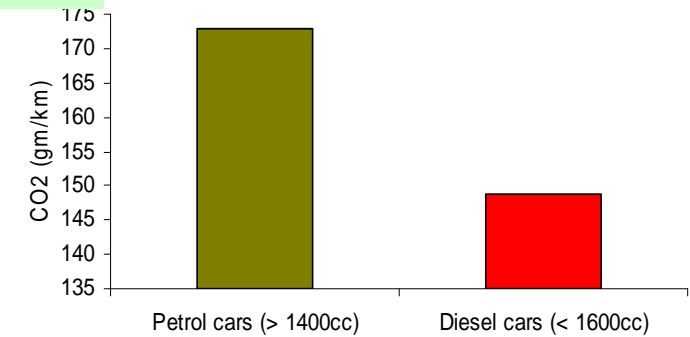
PM



Toxics



CO2



Emissions vs efficiency remains unresolved in India.....

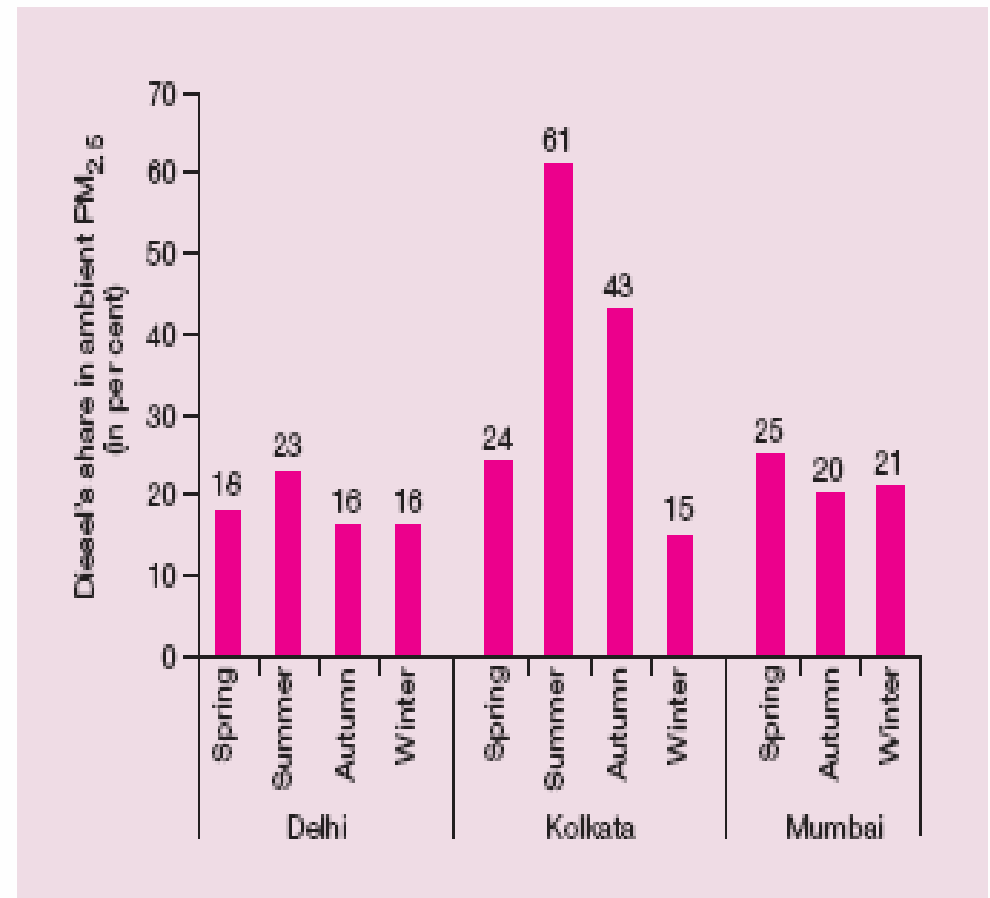


Very high contribution of diesel combustion to PM_{2.5} in Indian cities



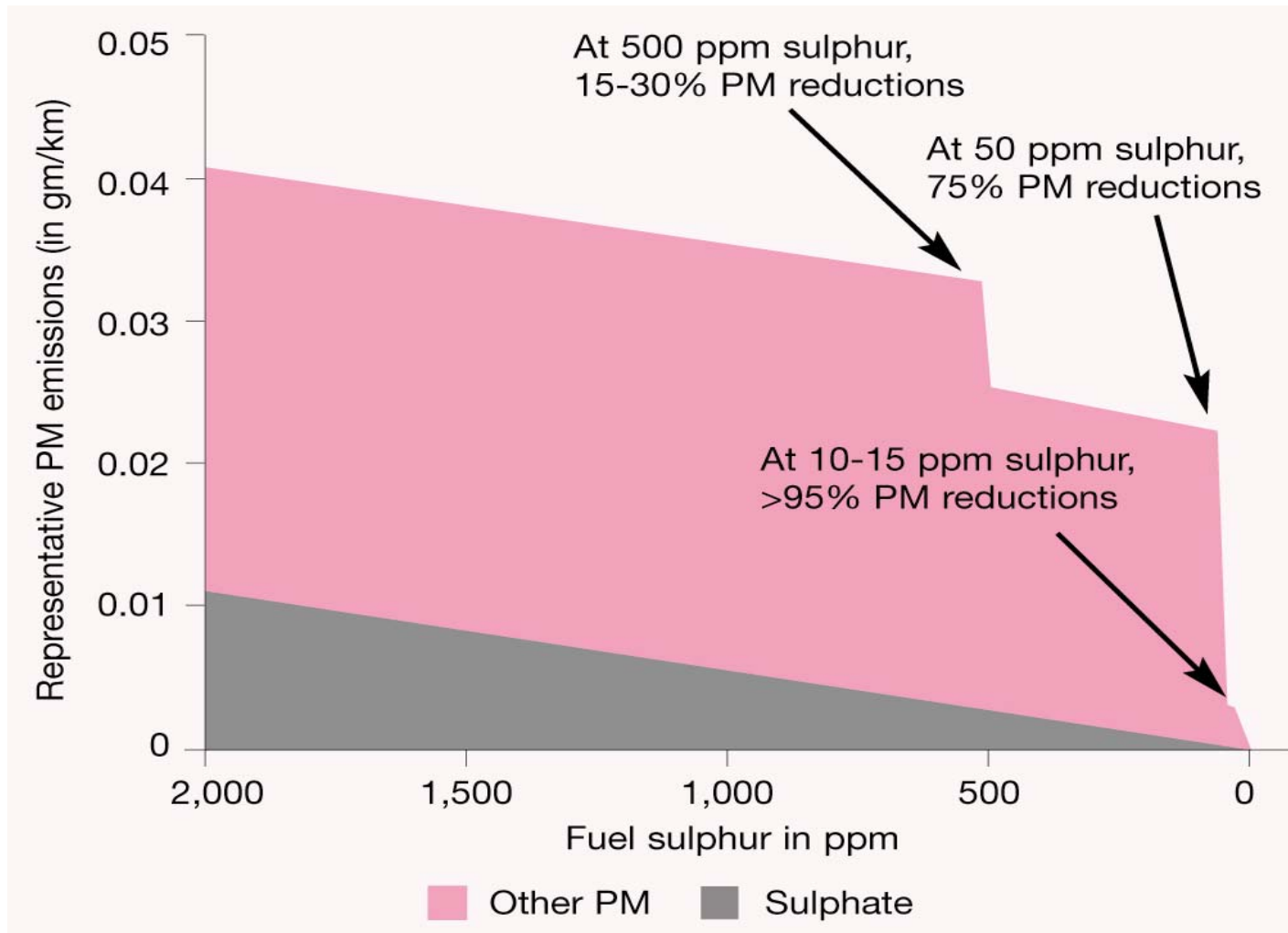
- In three cities among six cities reviewed by the World Bank shows that vehicles contribute an average 50 percent of the direct PM emissions but 70 per cent of PM exposure.
- Nearly 65% of the Kolkata's vehicular population. Nearly 99% of commercial vehicles are diesel-run
- Nationally, 30% of new car sales are on diesel

Diesel's contribution to ambient PM_{2.5} 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**



Source: ICCT

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



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



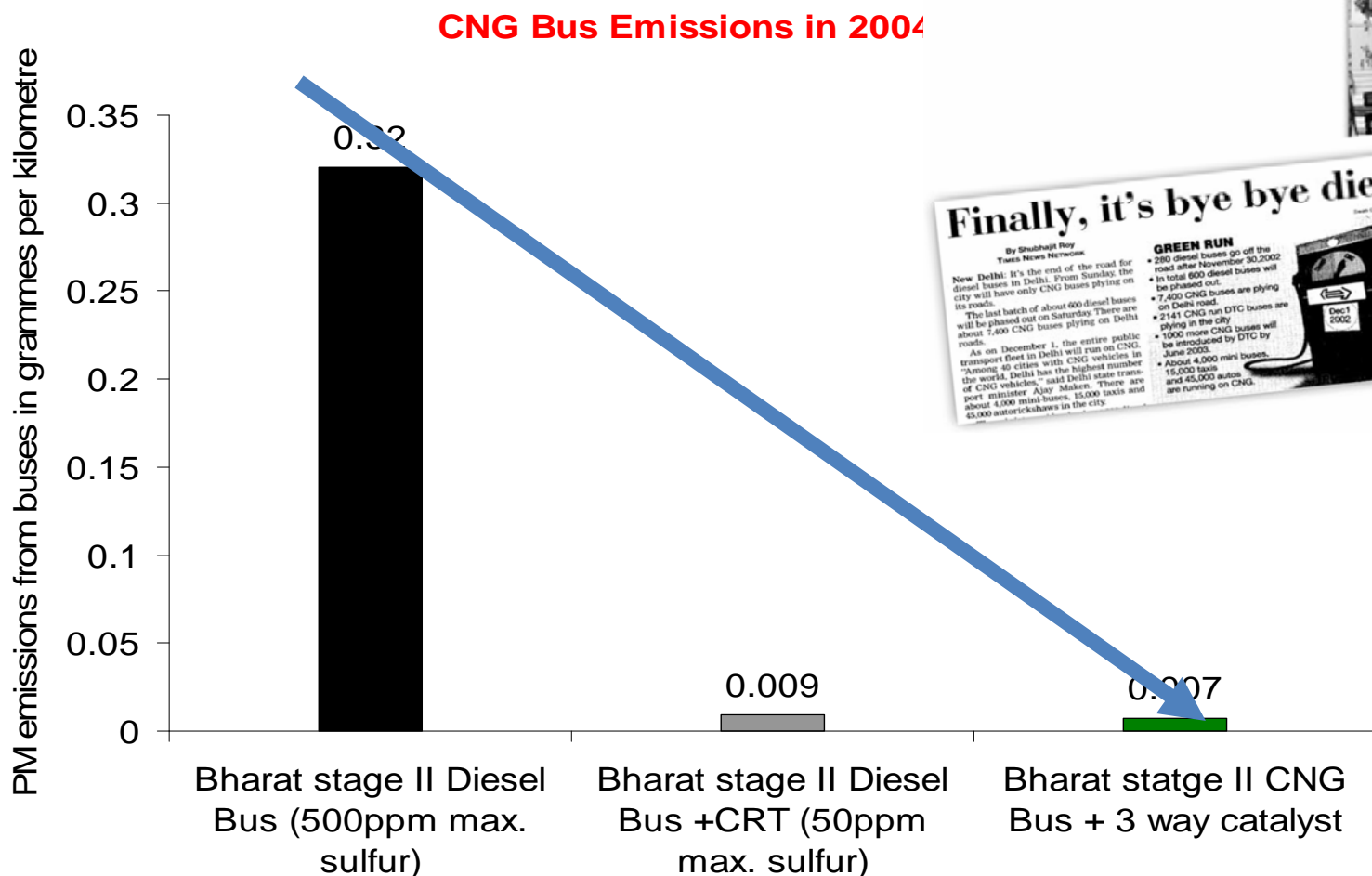
- The government is incurring huge revenue losses as it earns much less from excise on a litre of diesel used by cars, as opposed to petrol. Only in Delhi the loss is as high as Rs 300 crore. This will be mammoth on a nation-wide scale....
- Revenue losses per litre of diesel will compound with increased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





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

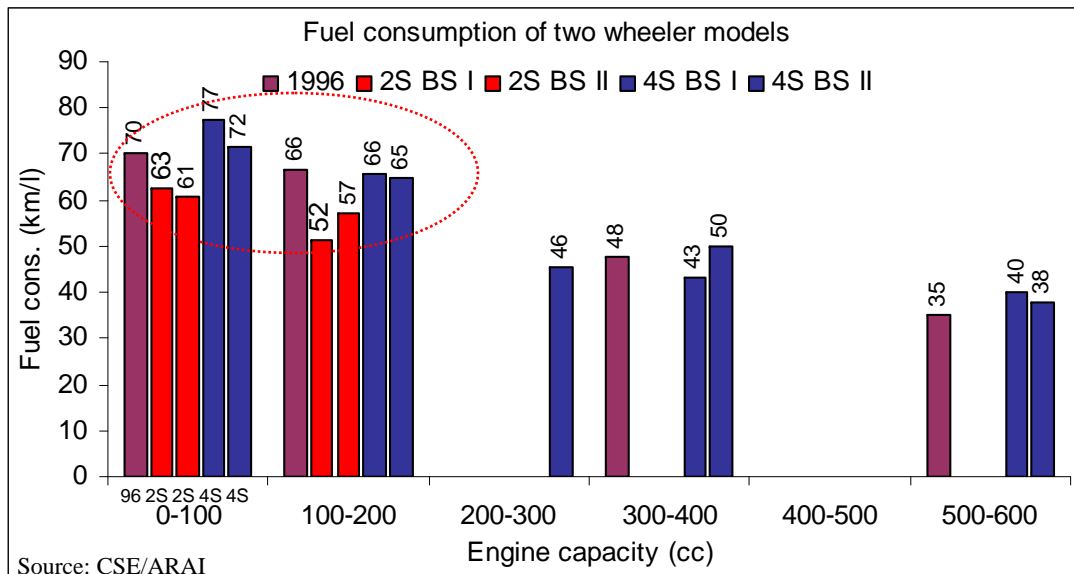


Today two-wheelers are more polluting than cars

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).





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





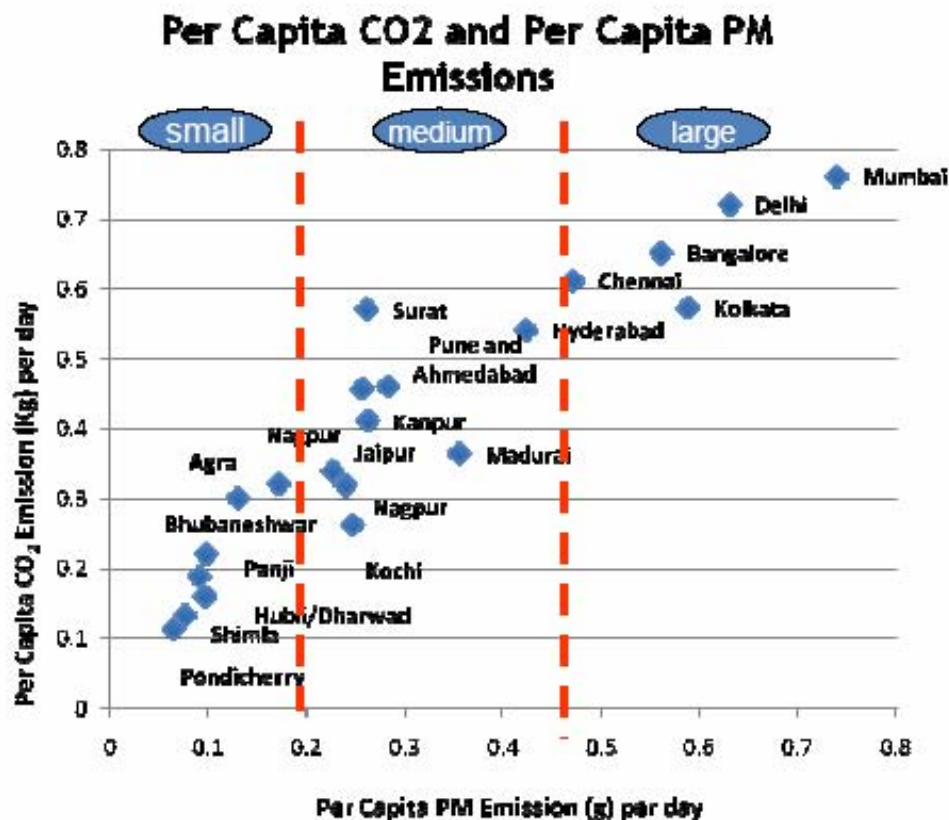
Vehicles make us more energy insecure....
Climate insecure..... Resolve efficiency vs
emissions trade-off



New generation challenge



Pollution, energy guzzling and warming...



Source : Analysis of MOUD- Study on Traffic and Transportation Policies and Strategies in Urban Area By CAI-Asia

- 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.



The subtle link between local air pollution and warming....



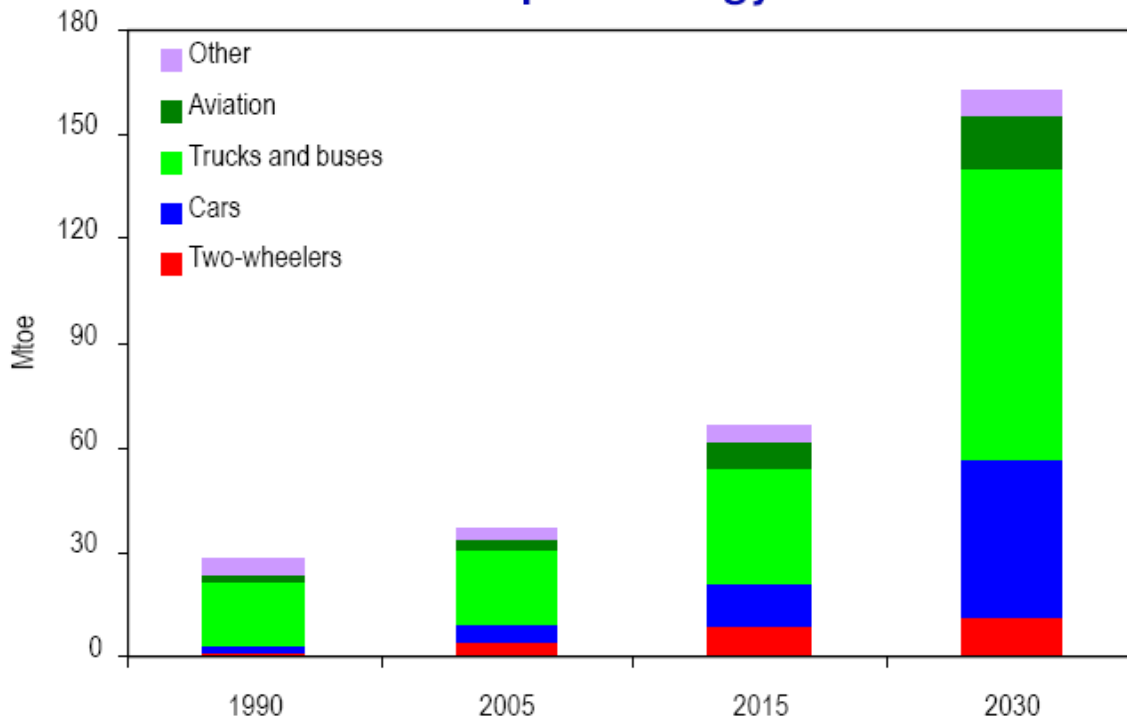
- **Local pollution can enhance the warming effects....Eg,** HC + NO_x lead to regional ozone but also to background hemispheric ozone; CO becomes CO₂ but consumes OH radicals along the way increasing CH₄; Diesel PM increases PM₁₀ & PM_{2.5} & ultrafine PM but also black carbon
- **Warming can also enhance 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.....

Trend in fuel consumption by different modes of transport in India

WEO2007 Reference Scenario: India's Transport Energy Demand



Transport demand – mostly oil – grows rapidly as car ownership increases in line with rising incomes

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)



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



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

	FY 2006-07	FY 2007-08	FY 2008-09	FY 2009-10
Average Vehicle Mass (kg)	948	981	1000	1052
Average Vehicle Footprint (m ²)	3.20	3.25	3.28	3.33
Average engine size (cc)	1202	1221	1226	1299
Average vehicle fuel consumption (l/100km)	6.06*	6.02*	5.93	6.00
Average vehicle fuel economy (km/l)	16.5*	16.6*	16.9	16.7
Sales	962,419 [#]	1,245,504 [#]	1,412,527	1,861,118

* 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

Source ICCT

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.**



Car centric growth encourage fuel guzzling

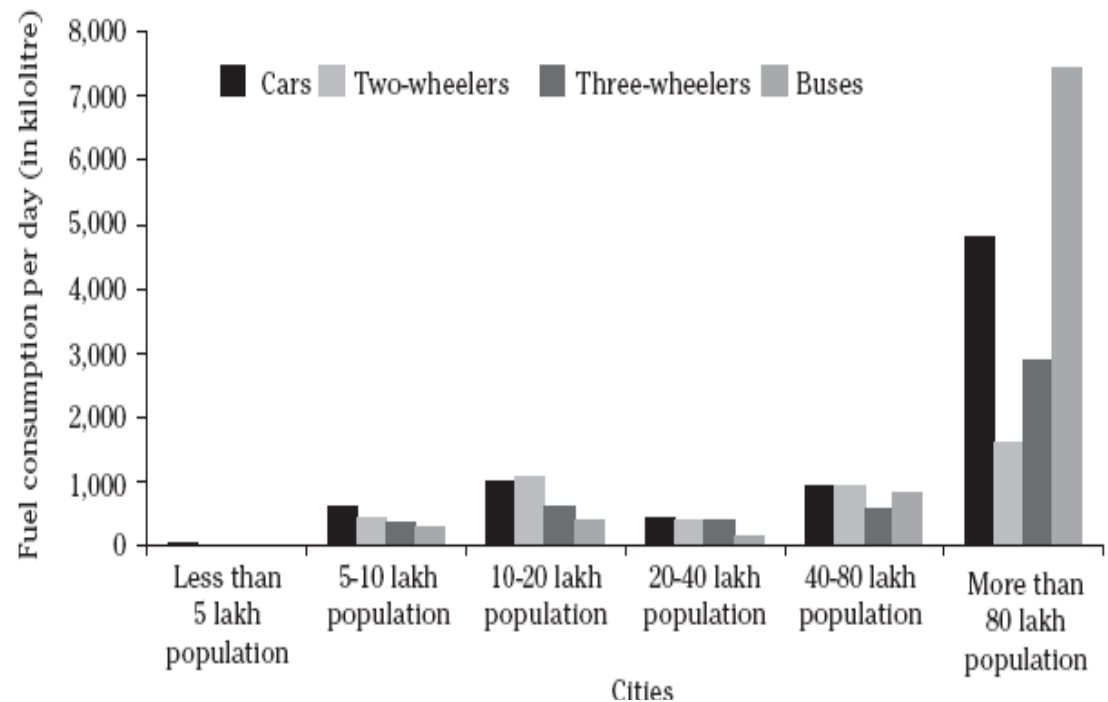


Very high fuel guzzling in the transport sector of big cities These also have high concentration of personal vehicles – cars and two-wheelers

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



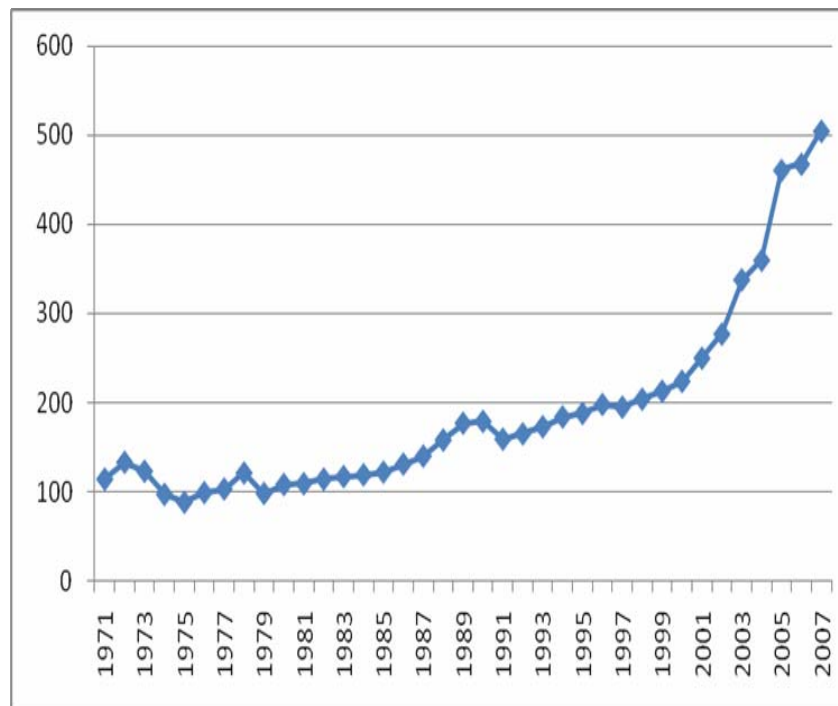


Dependence on imported oil high in Sri Lanka Oil demand is also galloping



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

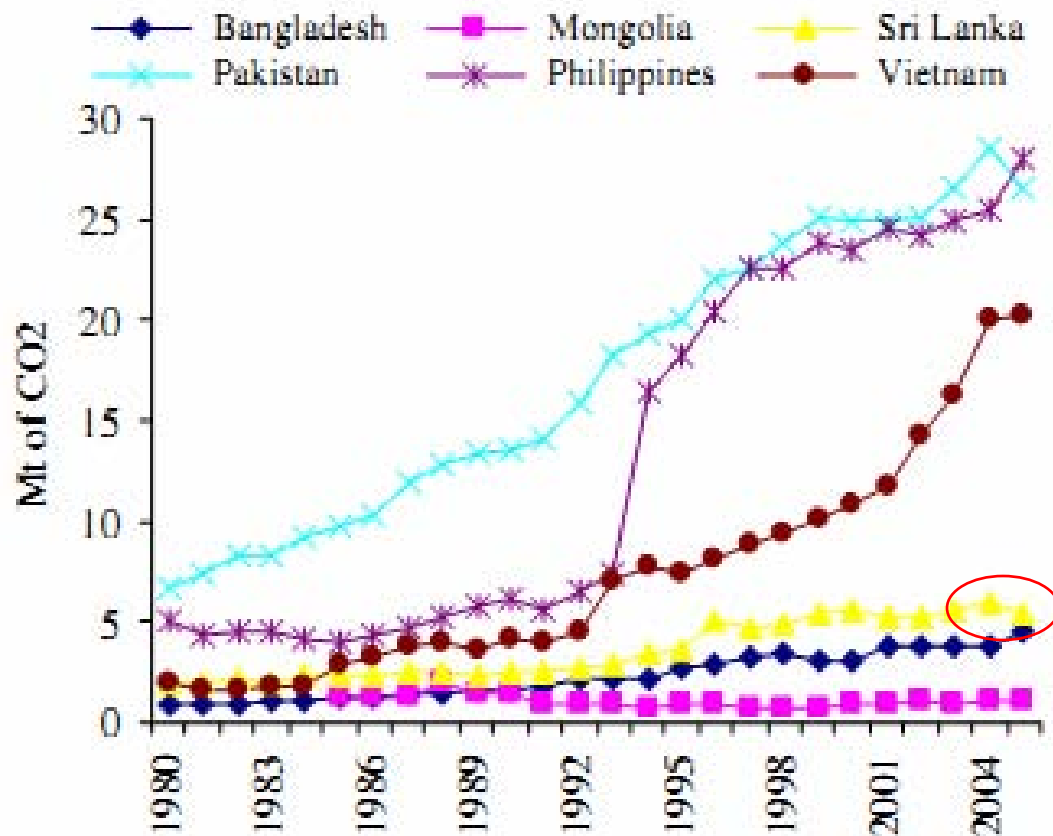
Sri Lanka - road sector petrol fuel consumption (kt of oil equivalent)



Source: Source: International Road Federation, World Road Statistics and electronic file and IEA



Transport Sector impacts on CO2 emissions



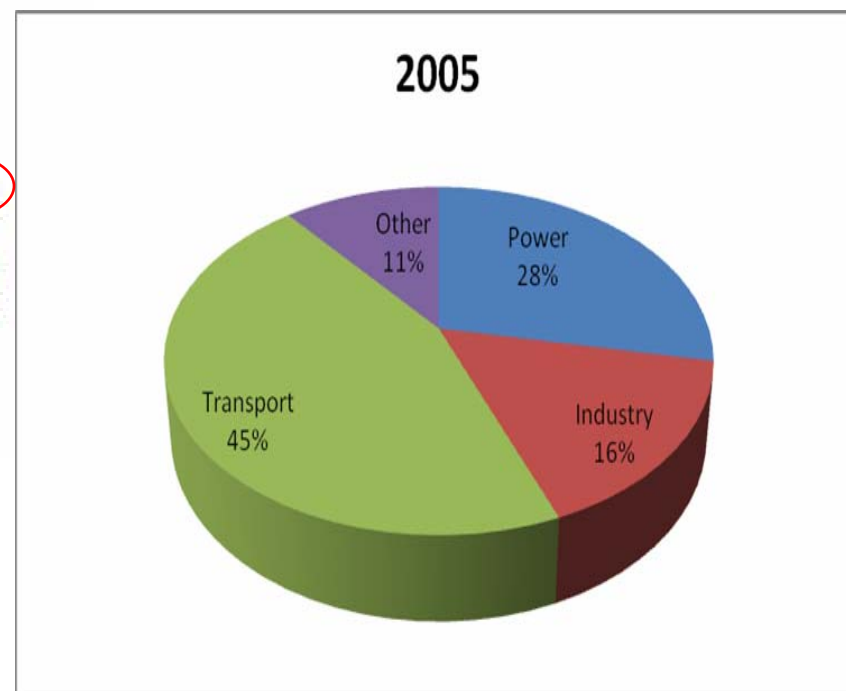
Source: Govinda R. Timilsina, Ashish Shrestha, 2009, "Transport sector CO2 emissions growth in Asia: Underlying factors and policy options", Energy Policy 37

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





MOBILITY CRISIS



Cities are losing battle of car-bulge: **The rapid increase in vehicles is destroying all gains of air pollution and health**

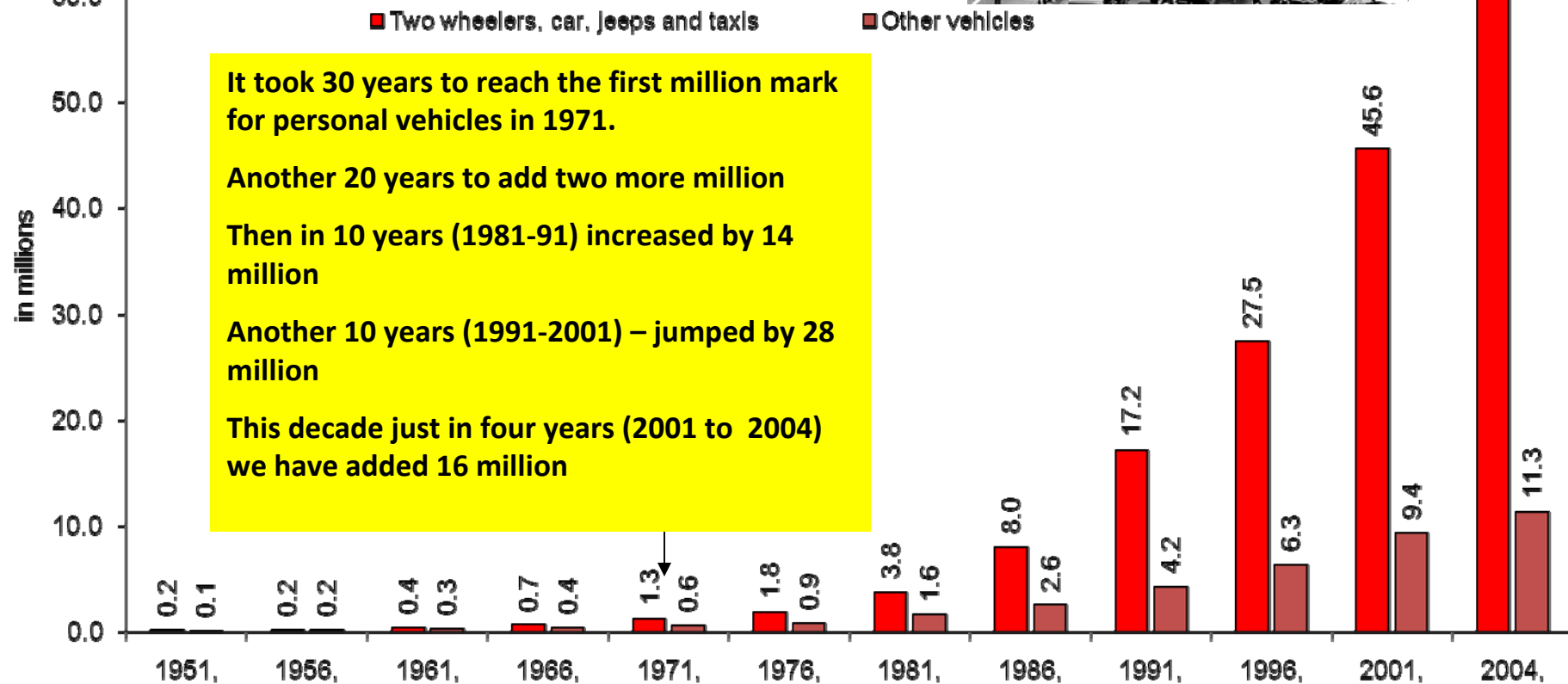




Explosive numbers in India



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

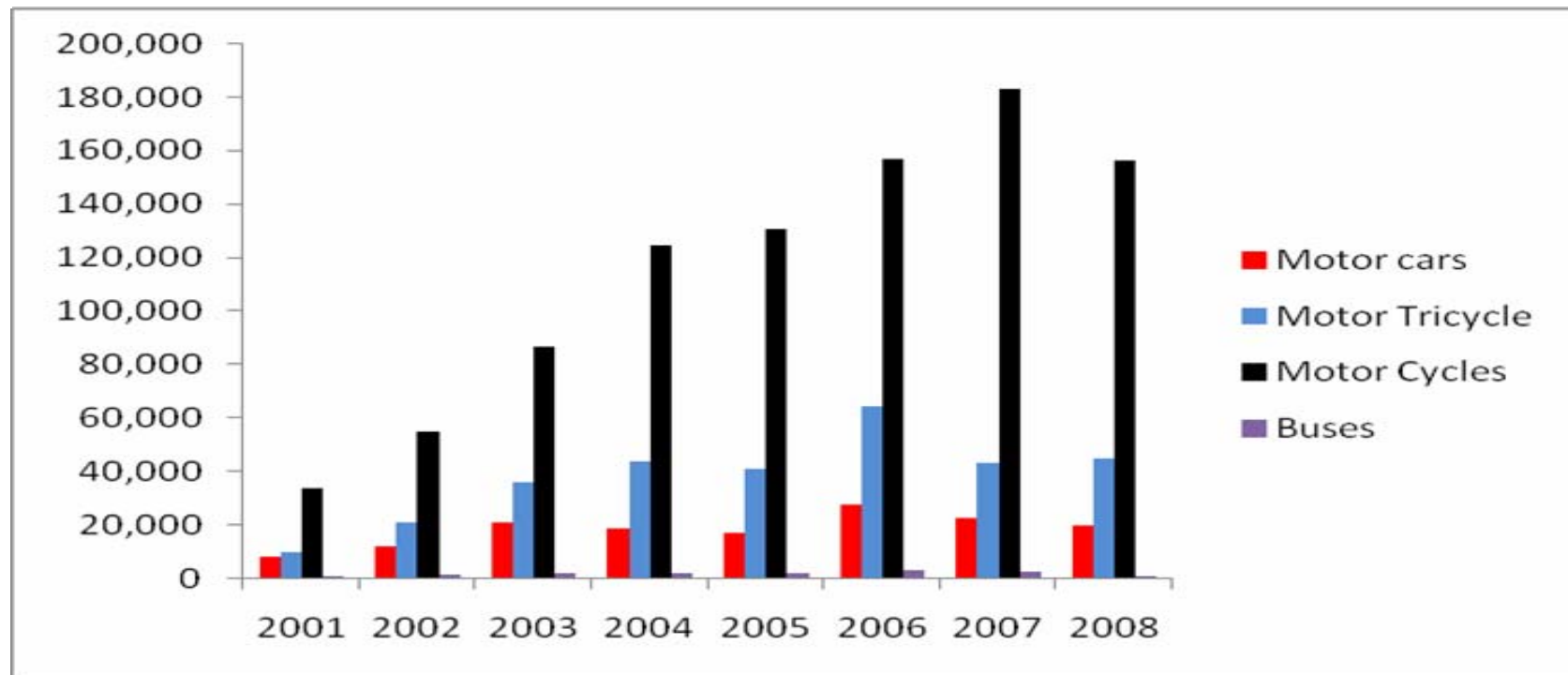




Personal vehicles will skew motorisation in Sri Lanka as well



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

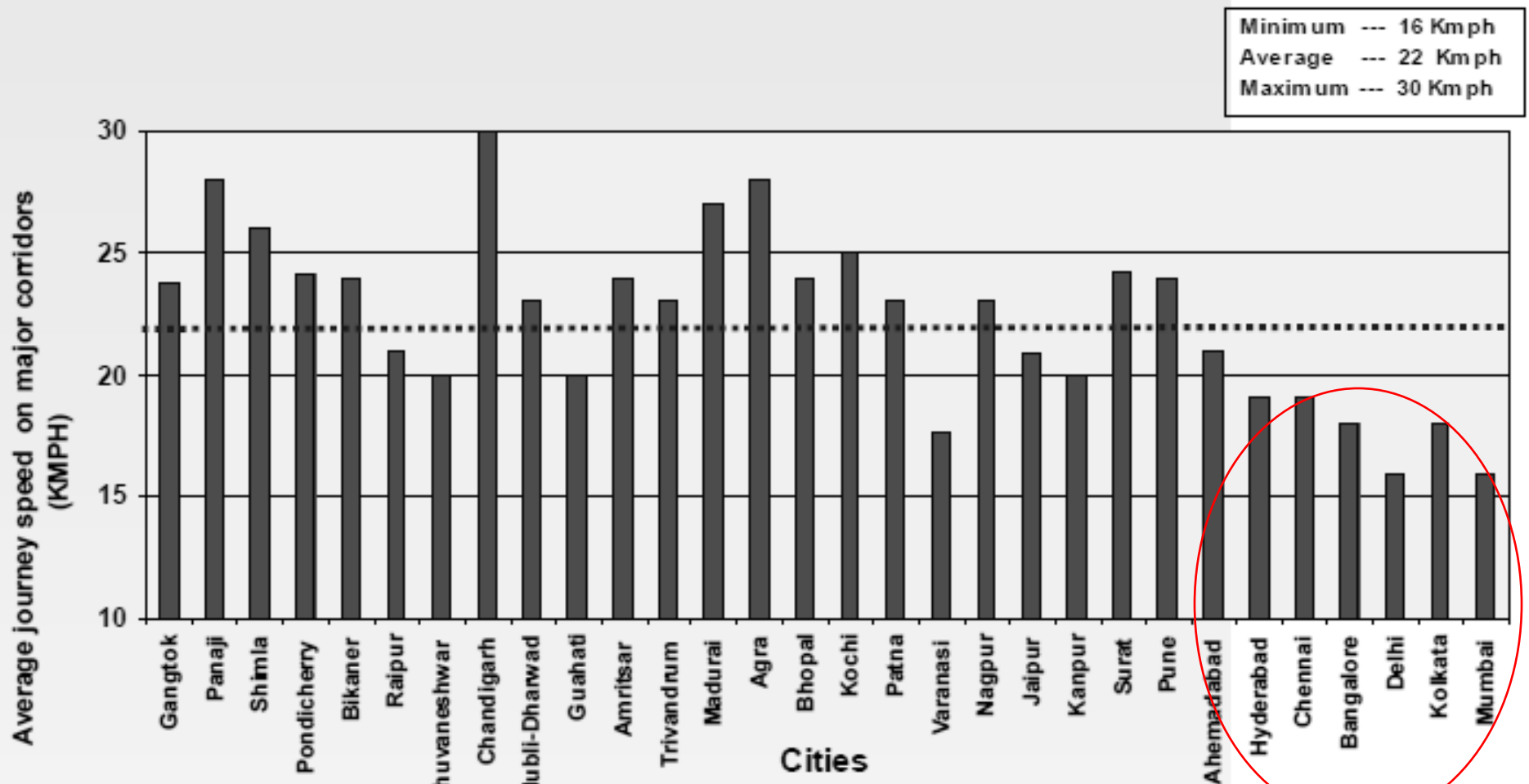


Indian cities are paralyzed

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



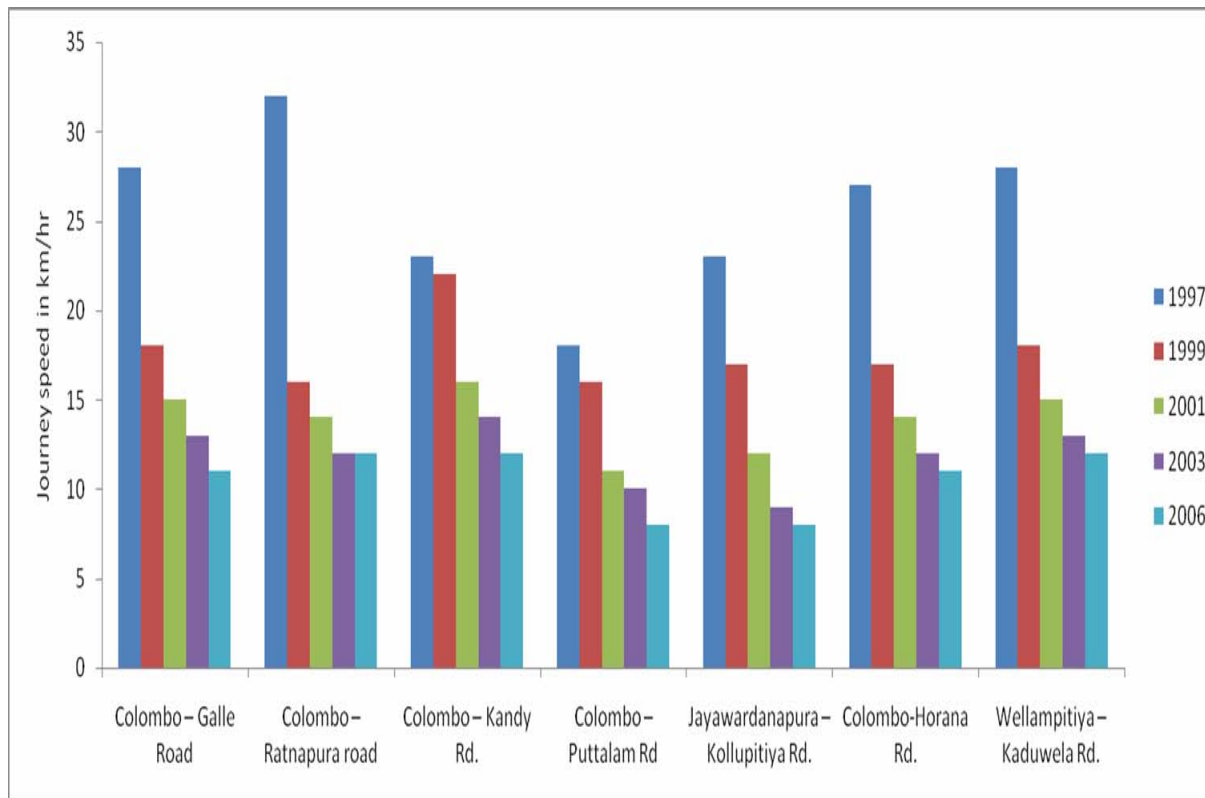
Source: Anon 2008, Study on traffic and transportation policies and Strategies in Urban Areas in India, MOUD, p63



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.



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



Speed (kilometer per hour)	Autos			Buses		
	Change in emissions with speed (gm/km)			Change in emissions with speed (gm/km)		
	CO	HC	NO _x	CO	HC	NO _x
10 km/hr	33.02	4.47	2.53	22.60	5.70	22.30
25 km/hr	21.20	2.60	2.17	14.40	2.30	16.40
50 km/hr	9.80	1.30	2.24	8.20	0.00	11.90
75 km/hr	6.40	0.93	2.97	-	-	-

Source: E A Vasconcellos, 2002, Urban Transport, Environment and Equity — the Case for Developing Countries, Earthscan Publications Ltd, London

Vehicle Emissions vis-à-vis Speed





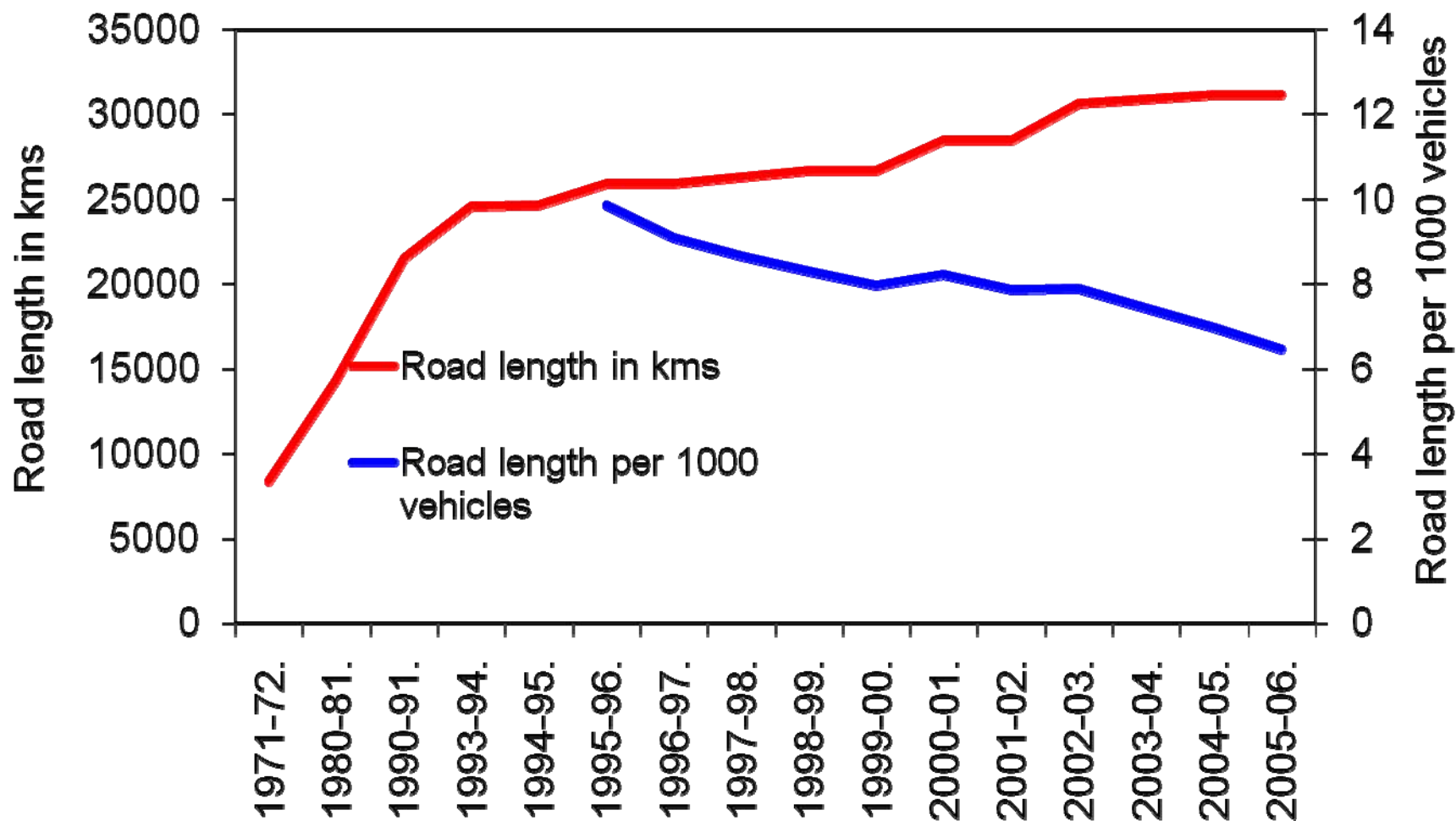
Colombo shaping transportation strategies....



- 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**



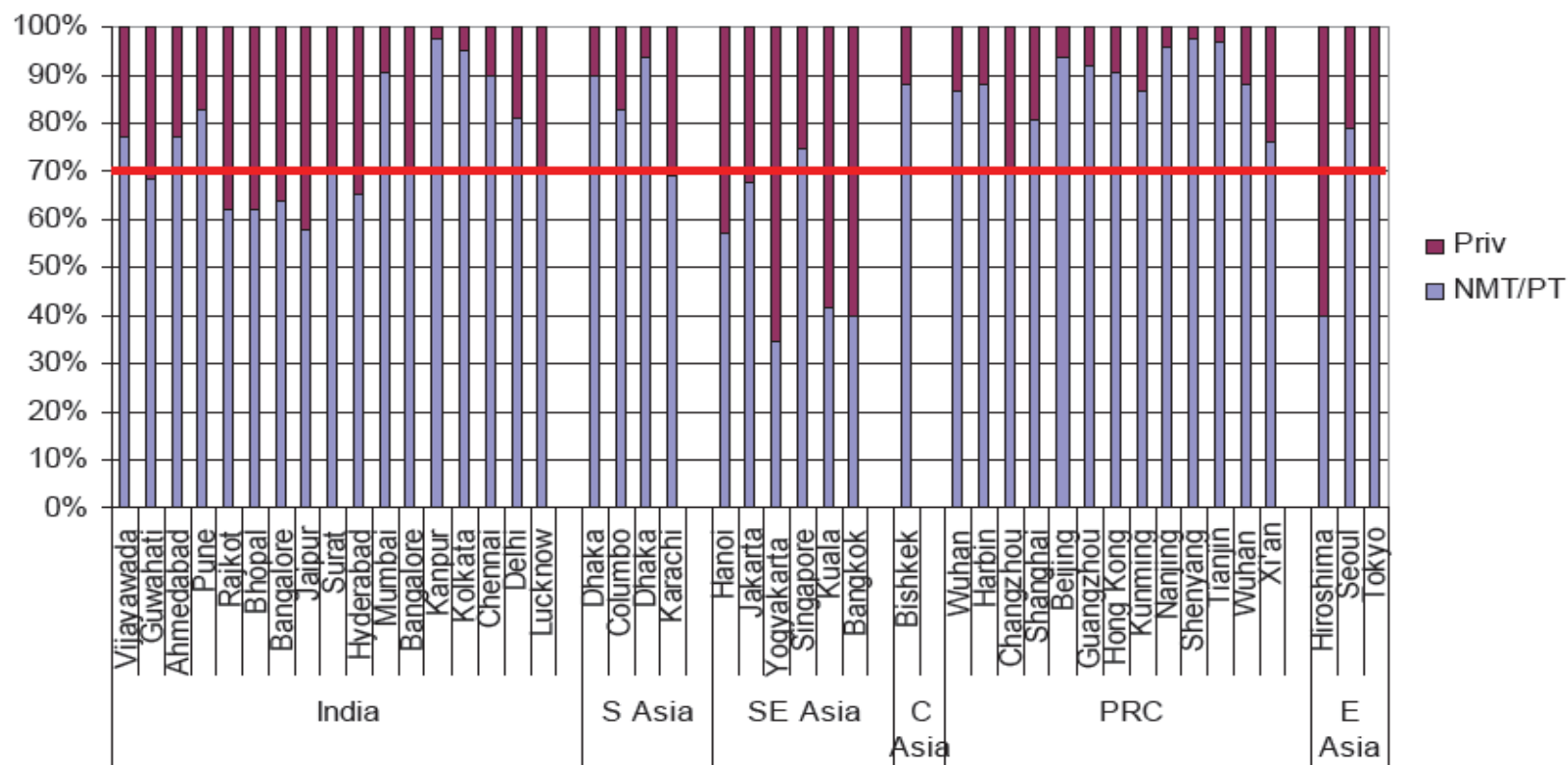
Source: On the basis of Economic Survey, Delhi Govt



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

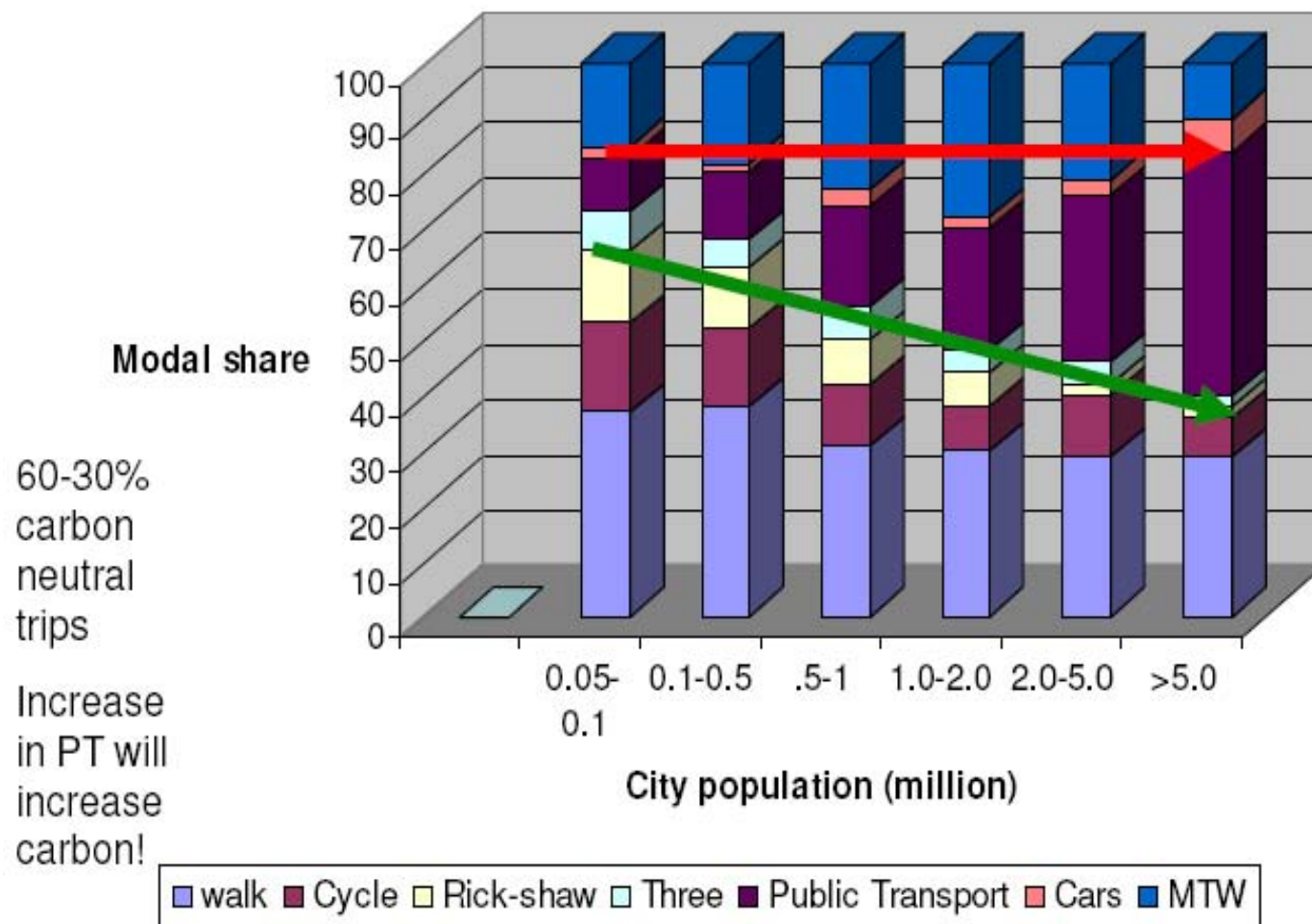


Strength of our cities....



Urban Mobility

PT and NMV based, MTW majority personal vehicles

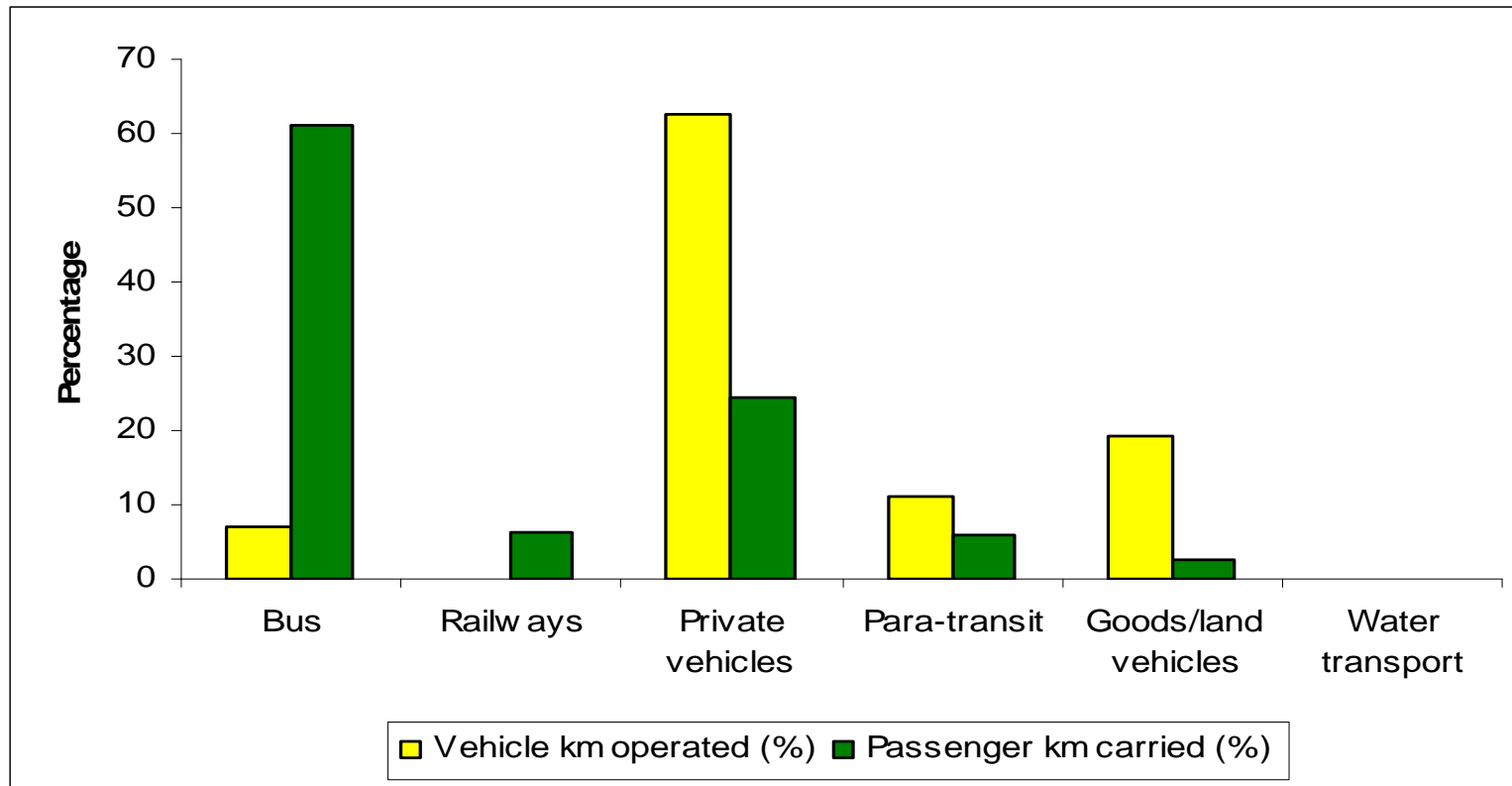




Transport modal share in Sri Lanka (2007)



Bus is less than 10% of the vehicles kms but carries 60% of the passenger km

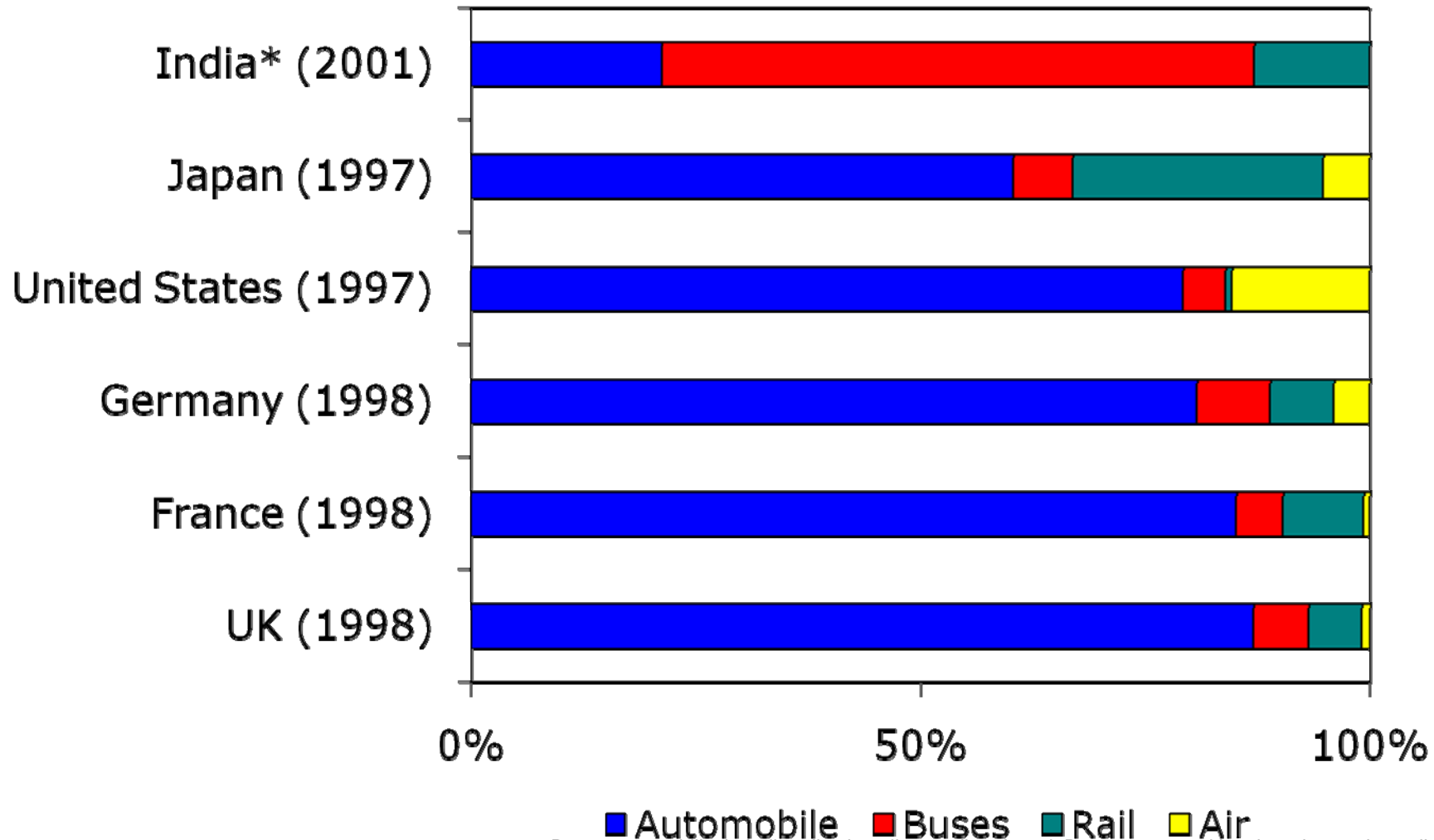


Source: Country presentation Sri Lanka, Ministry of Transport and Ministry of Environment and Forests, Sri Lanka, Fifth Regional EST Forum, 23-25 August 2010, Bangkok, Thailand



This strength is reflected at the global level

Modal split for passenger transport in selected countries



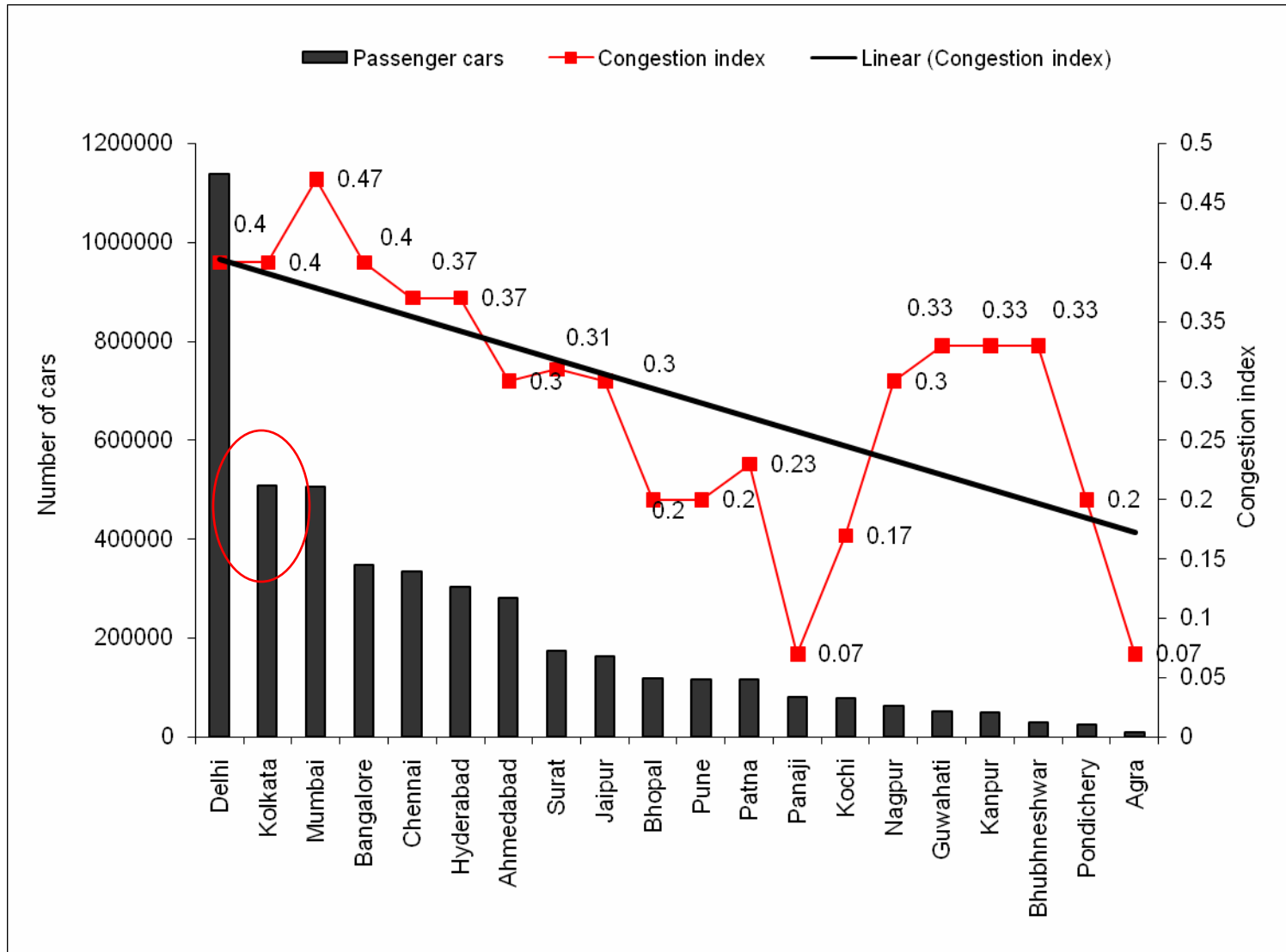
*India Note 1: automobile include cars, two wheelers, IPT. Note 2: Passenger mobility in India relies heavily on rail and road. Passenger travel by air and water is negligible in comparison to rail and road.

Source: 1. First Review of Available Data: Modal Split in Different Countries (2000), Fachgebiet Verkehrsplanung und Verkehrstechnik Prof. Dr.-Ing. Manfred Boltze Institut für Verkehr Fachbereich 13 Bauingenieurwesen und Geodäsie

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?

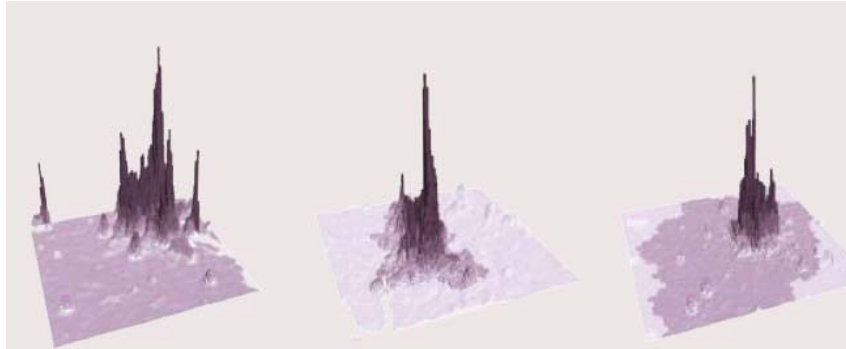


Source: Compiled from SIM AIR, and MOUD report



Our cities are built differently

High density, mixed land use, and narrow streets -- an opportunity to plan mobility differently



Delhi

Kolkata

Bangalore



Mumbai



London

Source: Urban age

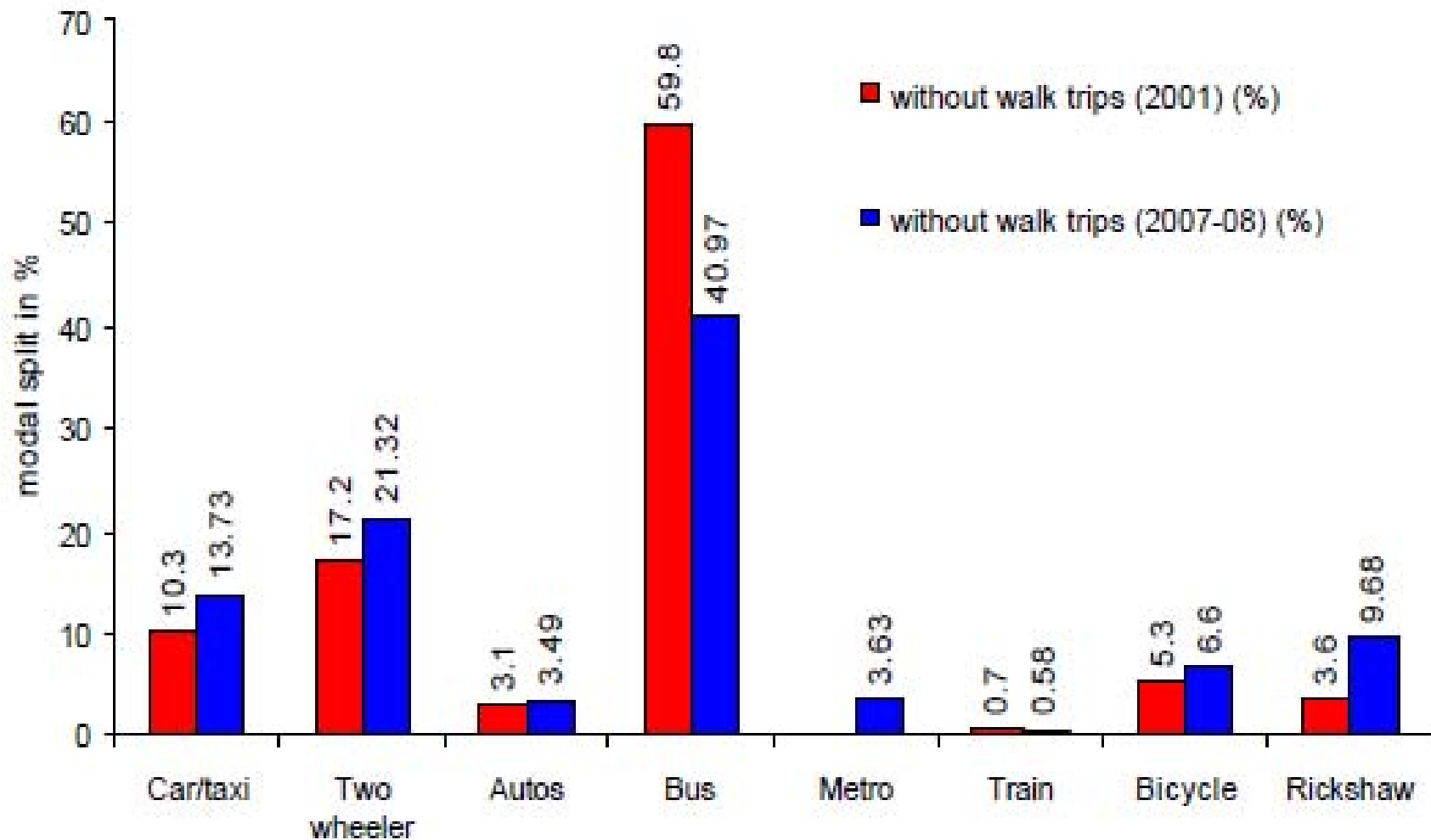
- In a typical city the core can just be 5 km across and easily walkable within a reasonable time.
- Studies show more than 40 to 50% of the daily trips in many cities have distances less than 5 kilometers. -
- These have enormous potential to convert to walking and non-motorised trips.





This slide has already begun in Delhi.....

Public transport losing ground



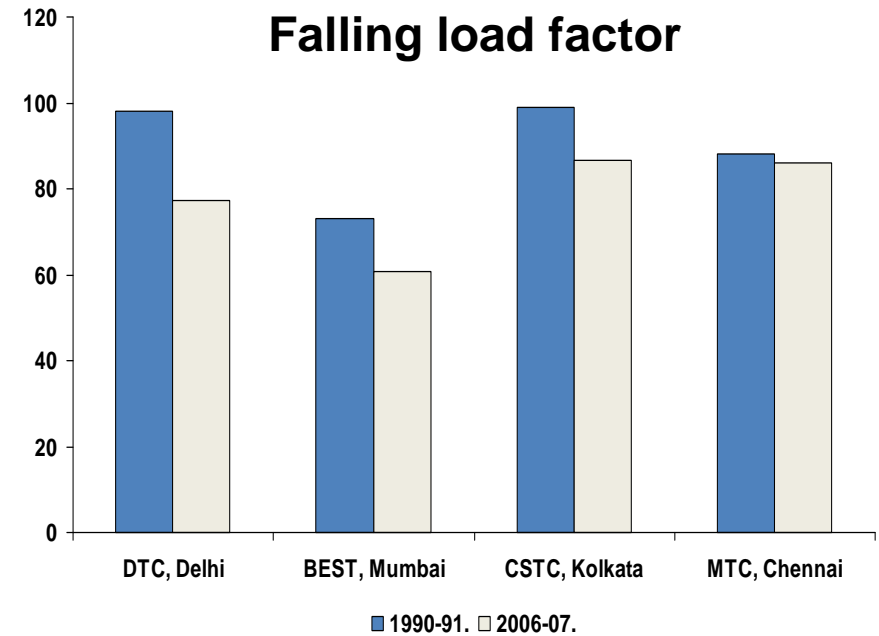
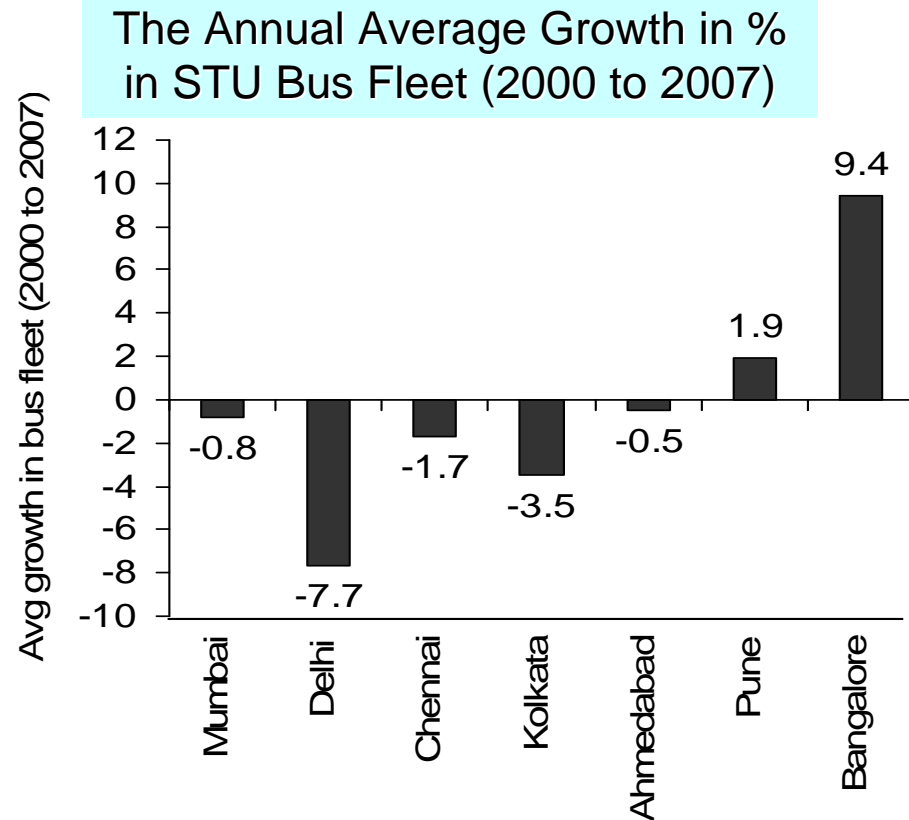


Challenges of rebuilding public transport

-- Delhi Master Plan has set the target of 80% public transport ridership by 2020.....



Reality Check....





City bus corporations in India: In the red



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

*Runs on CNG, and price has not increased, so costs of fuel are under control
Source: Review of the performance of state road transport undertakings, Ministry of Shipping, Road Transport and Highways, Government of India, 2007

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 makes a difference.....Evidence from our cities

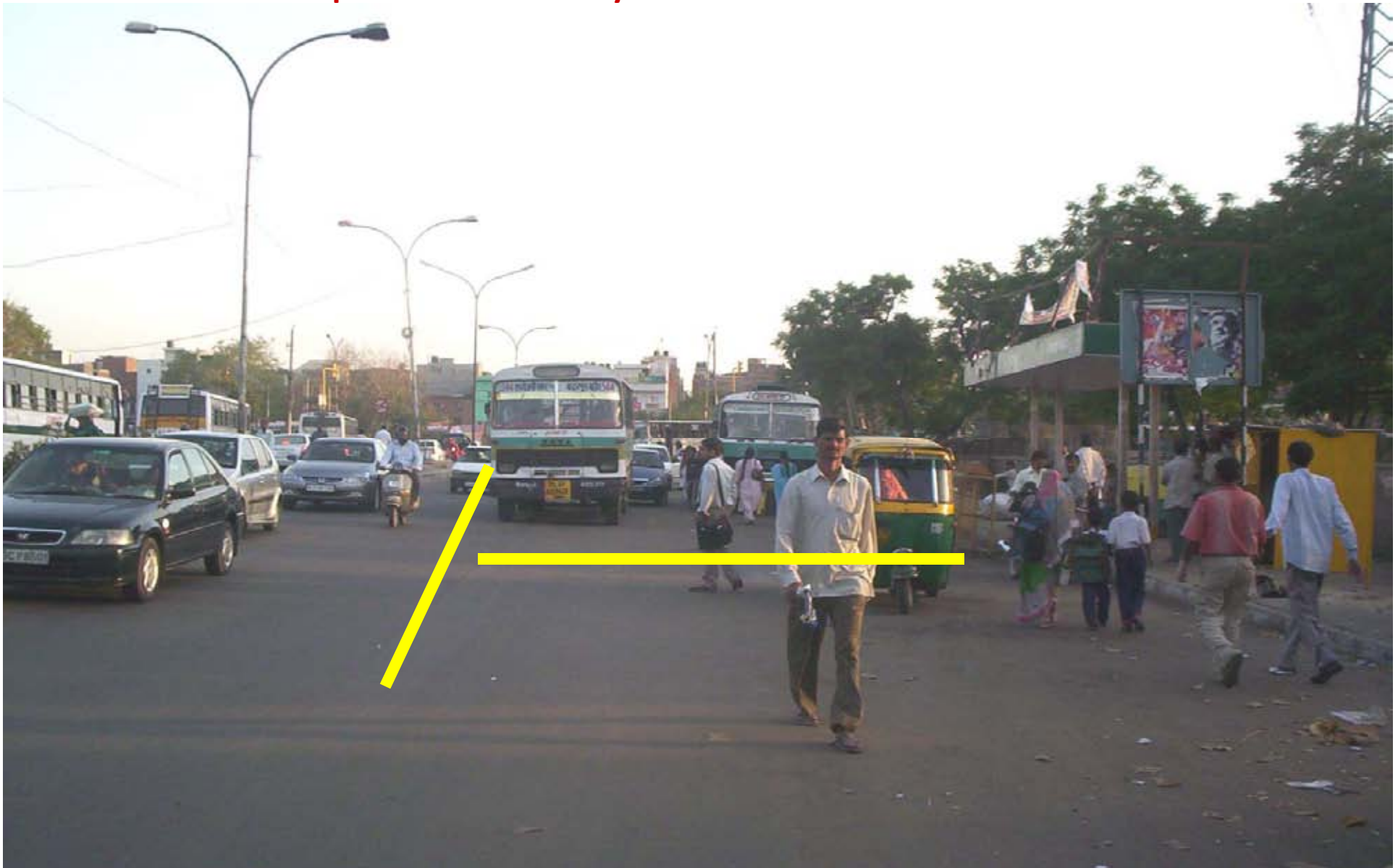


Bus transport can make a big difference...

- **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.
- 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 NO_x 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 NO_x 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.....





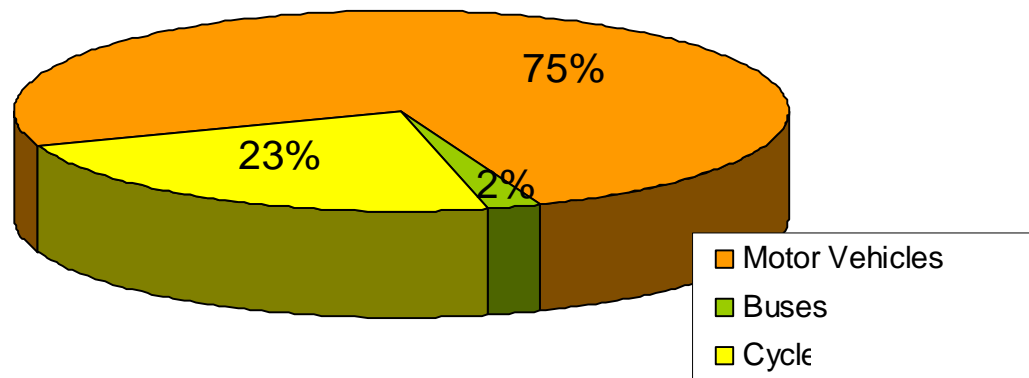
Who must get the priority – People or Vehicle? Plan for people. Not vehicles.



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

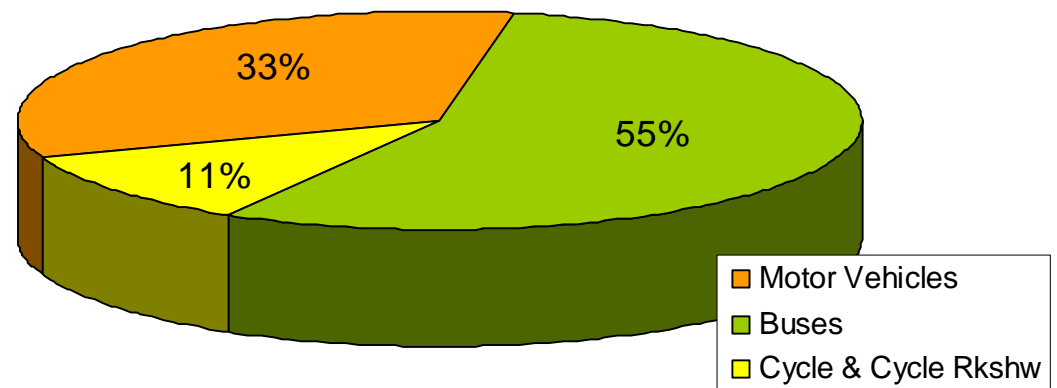


Chirag Delhi Junction
Morning Peak Hour
AK to MC

4,916 Vehicles

11,480 People

Distribution of People - By Mode





Other governments are doing this as well.....
Taipei

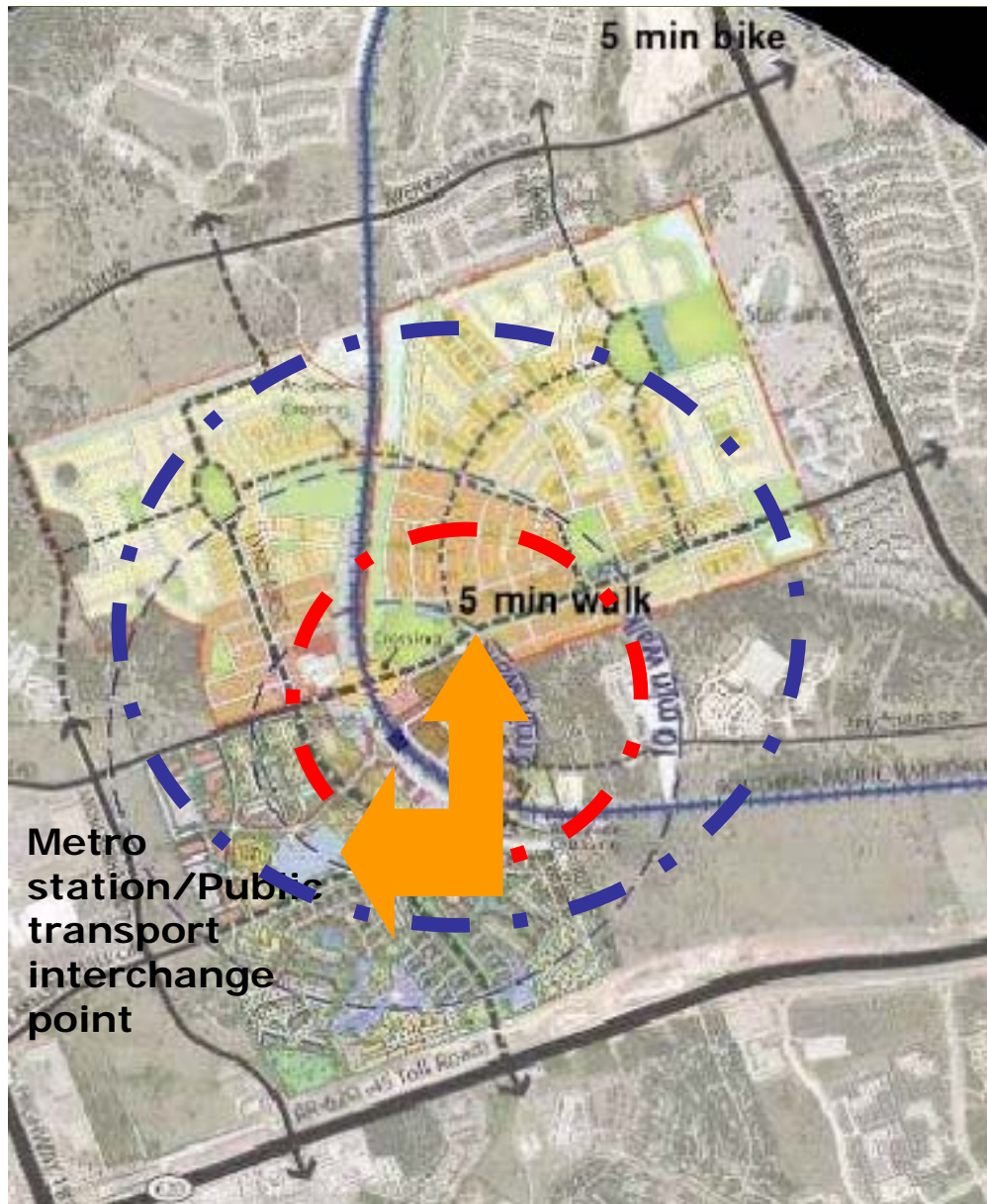




Integrate, integrate integrate.....

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.



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



Para transit: Small informal public transport -- autos, tempos, cycle rickshaws – Unique in South AsiaUseful 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.



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.



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



Car infrastructure severing neighbourhoods and pedestrian routes



(All India Institute of Medical Sciences intersection)



Before



After

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



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



Unusable infrastructure: Wasteful



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.....





Retrofitting changes.....



Connaught Place

- Sidewalks are now being rebuilt in Delhi



Source: CSE



It is possible to change

Redesigned streets in a small town of Nanded in Maharashtra



Before

After



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 say 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



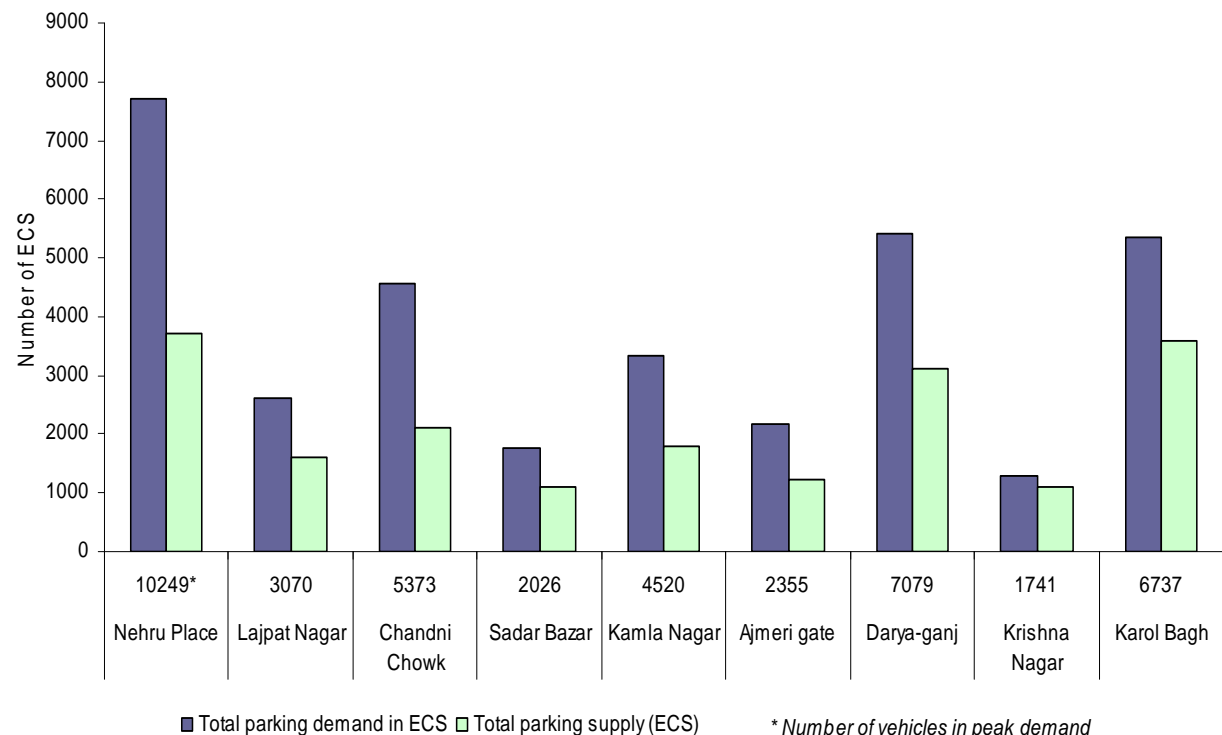
Should we keep supplying more parking? Is that the solution?

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 CRRRI report: (2006), New Delhi,



Understanding cost of multi level parking



Example from Delhi

	BKM multi level parking		HT multi level parking	
	Parking and commercial	Parking only	Parking and commercial	Parking only
ECS	941	780	1,209	1,025
Cap. Cost Rs in lakh per ECS	4	4	4	4
Total Cost in lakhs (including cap, working, taxes etc) (Net Present Value)	5,290 (Rs 1672 per sq feet)	3,849	7,523	5,310
Revenue in lakhs (NPV)	6,724	4,168	9,352	5,574
IRR in %	12.68	12.67	12.68	12.69
Parking charges	Rs 10/h	Rs 30.25/h	Rs 10/h	Rs 39/h

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?.....

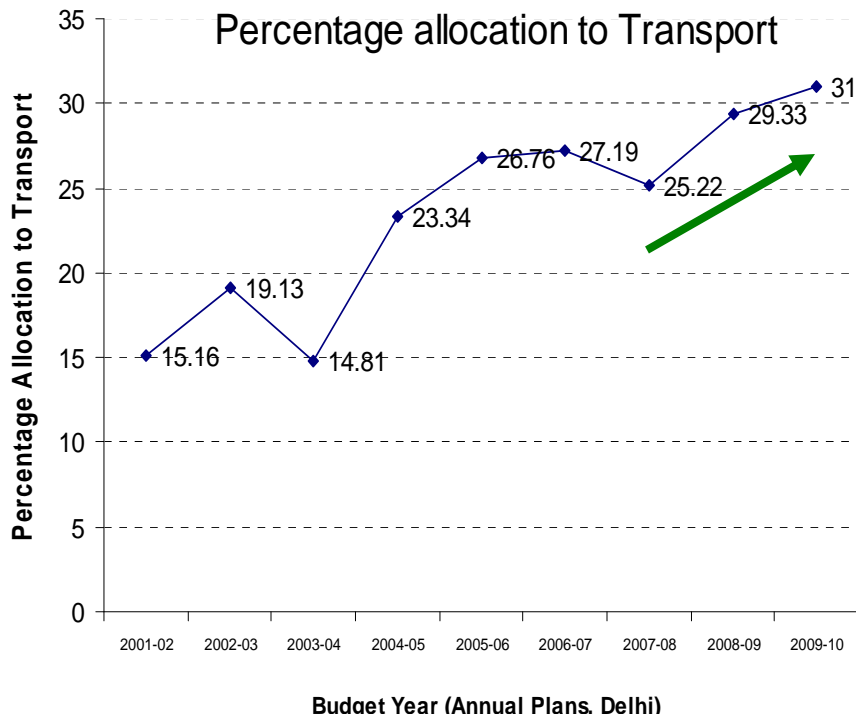


Delhi: Do we see any inconsistency here?

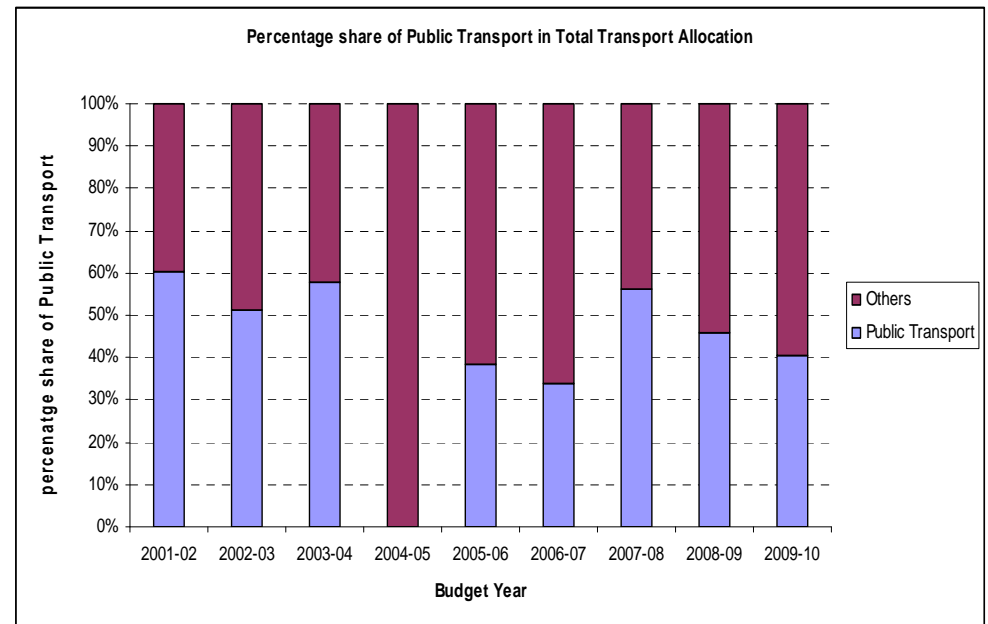


Percentage share of public transport in total transport allocation

Rationalise budgetary allocation



Percentage share of allocation to transport





National urban renewal mission for transport in India: Disproportionate focus on roads



In India National Urban Renewal Mission has a reform based funding scheme for transport.

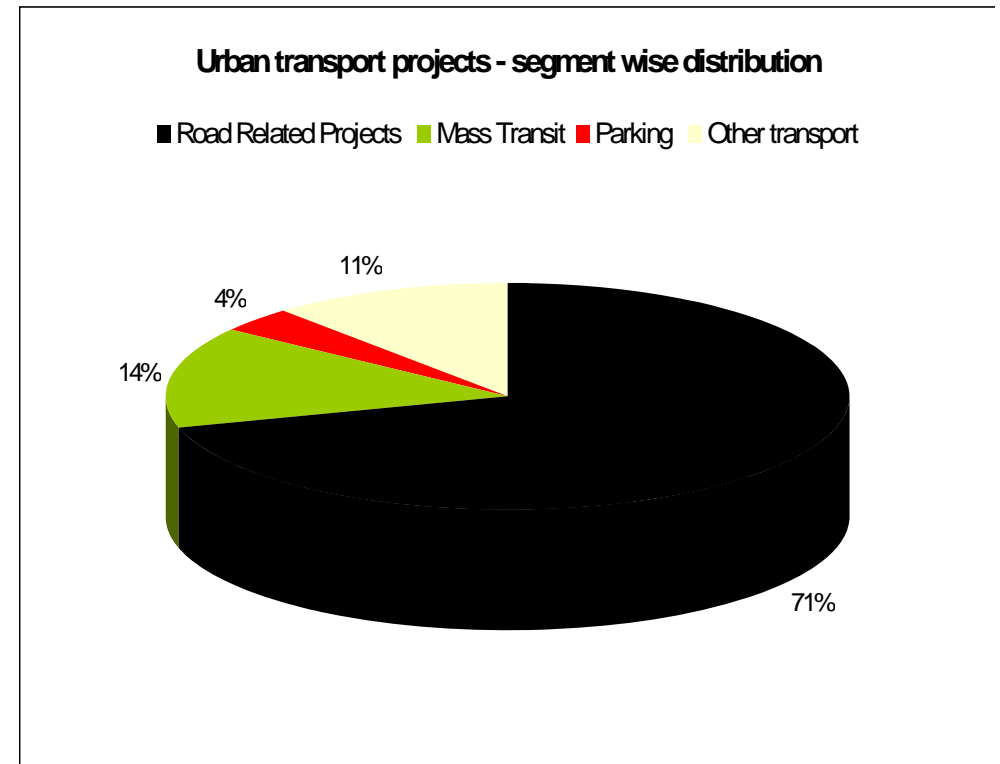
But.....

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.

Funding ignores sustainable modes



Source: CSE



Indian style socialism



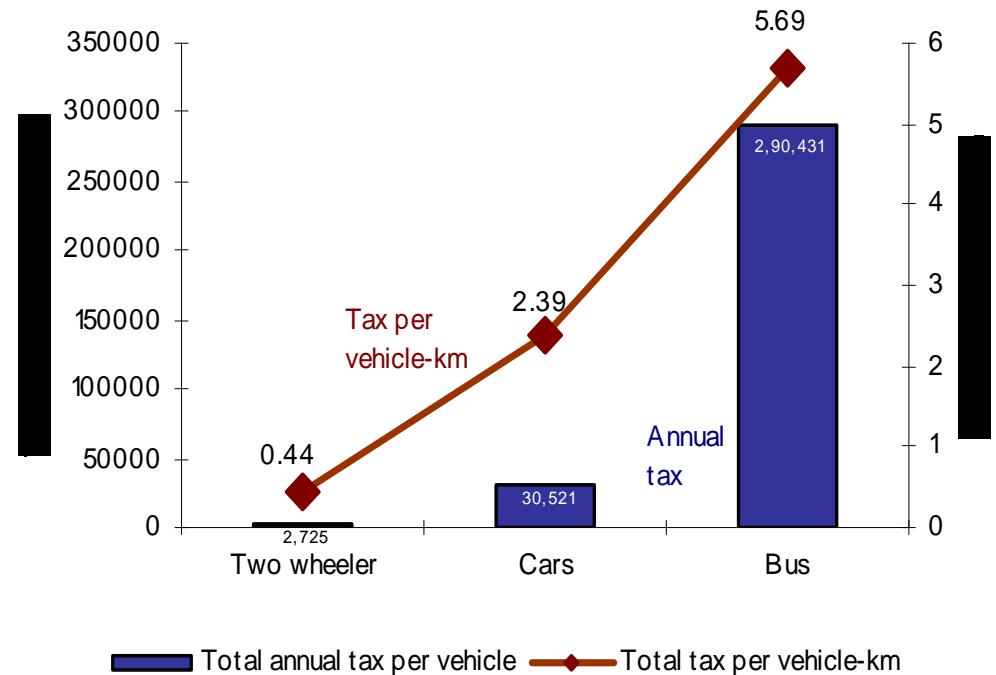
We tax our public transport more than cars...

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



Nascent beginning...



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

London, Singapore -- Direct fees for using roads and congestion. London reduced congestion by 26%. Increased in public transport ridership.

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



	Budget year	Inhabitants	Income from car transportation	Expenditure for car transportation	Difference	Subsidy per inhabitant	Cost-Recovery
Heidelberg	2004	142.500	13.137.822	30.634.581	17.496.759	122,8	42,9%
Rotenburg	2003	22.500	693.380	3.094.252	2.400.872	106,7	22,4%
Ludwigsburg	2000	86.936	9.090.874	19.293.557	10.202.683	117,4	47,1%
Düsseldorf	2002	569.046	24.699.867	167.106.878	142.407.011	250,3	14,8%
Lüneburg	2000	70.000	3.411.848	9.194.623	5.782.775	82,6	37,1%
Augsburg	2000	254.867	21.046.353	47.766.056	26.719.703	104,8	44,1%
Aschaffenburg	2002	67.788	3.041.045	11.366.940	8.325.895	122,8	26,8%
Freiburg	2000	201.000	17.163.087	37.993.383	20.830.296	103,6	45,2%
Ingelheim	2003	26.000	1.264.617	6.985.282	5.720.665	220,0	18,1%
Bremen	2000	547.000	12.551.020	72.959.184	60.408.163	110,4	17,2%
Dresden	2000	459.000	9.132.653	65.306.122	56.173.469	122,4	14,0%
Stuttgart	2000	581.000	20.663.265	104.591.837	83.928.571	144,5	19,8%
Average Germany (based on inhabitant numbers)						145,5	29,1%
Graz	2003	238.000	20.832.664	60.959.484	40.126.820	169,0	34,0%
Geneve	2002	182.560	13.944.143	40.038.362	26.094.219	142,0	34,8%
Ferrara	2002	130.000	3.553.267	9.310.289	5.757.022	440	38,2%

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...

