Seeking solutions to air pollution, health and congestion, in South Asian cities

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Centre for Science and Environment

Gasping for Fresh Air?

Media Briefing -- Challenges of Air Quality and Mobility Management in South Asian Cities
Centre for Science and Environment), New Delhi
and
TVE Asia Pacific
Colombo, April 27, 2011

Cities under global spotlight

1950-2006: Urban population of the world has increased from 739 million to 3.2 billion.

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

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

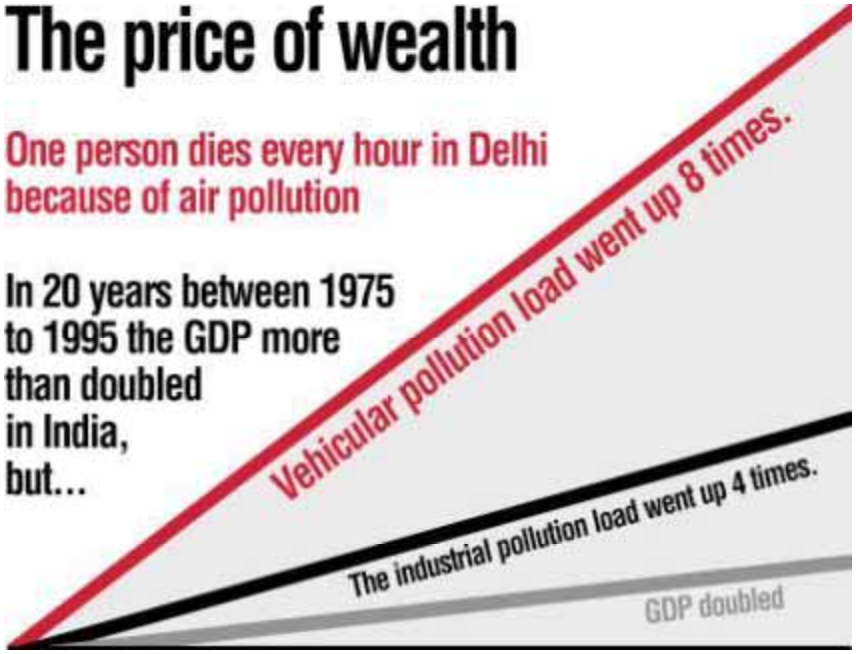
More than 40 per cent of the world children are estimated to be living in polluted cities of developing world (WHO).

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

What about South Asia?

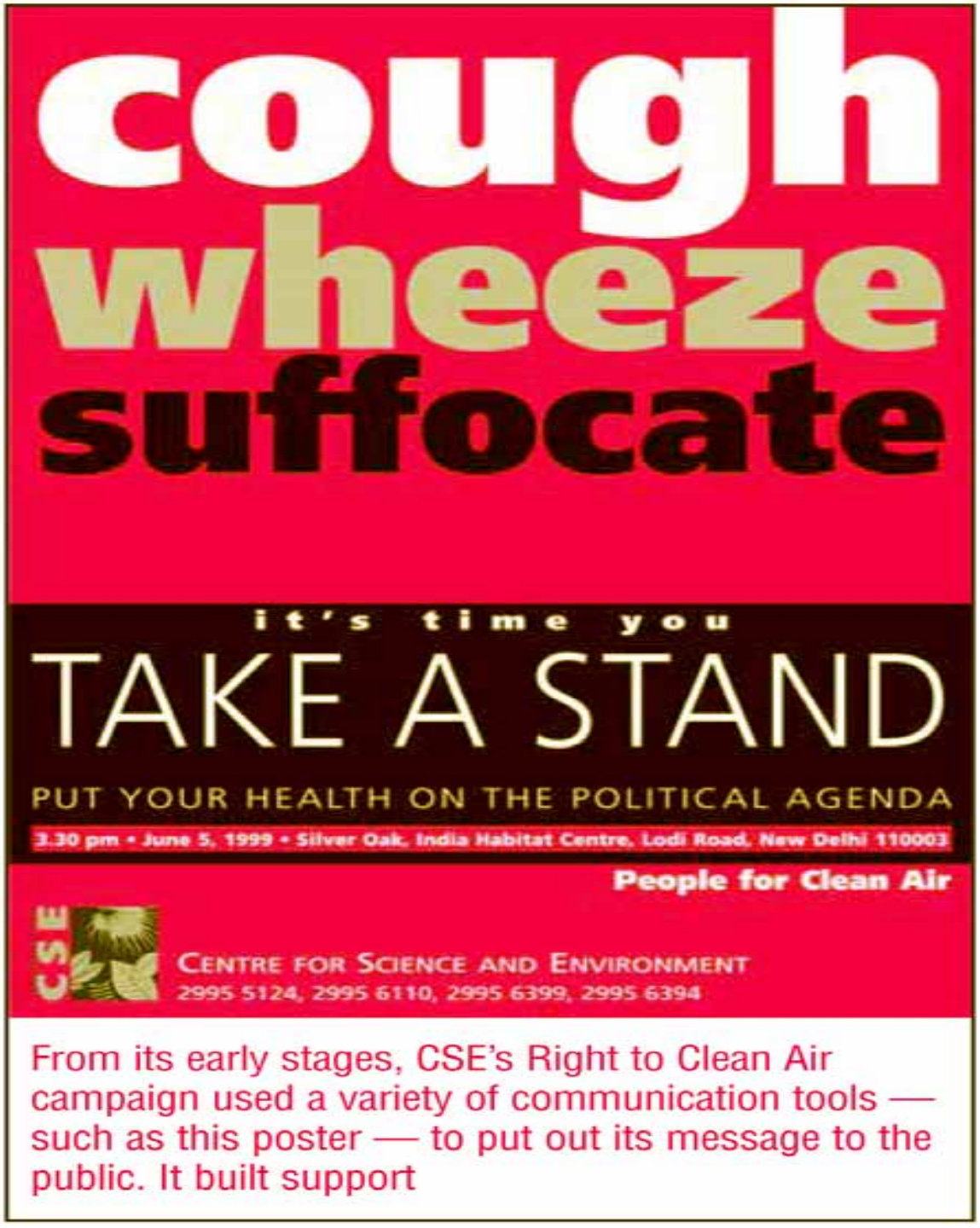
Growing pollution and toxification: new struggles in cities

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



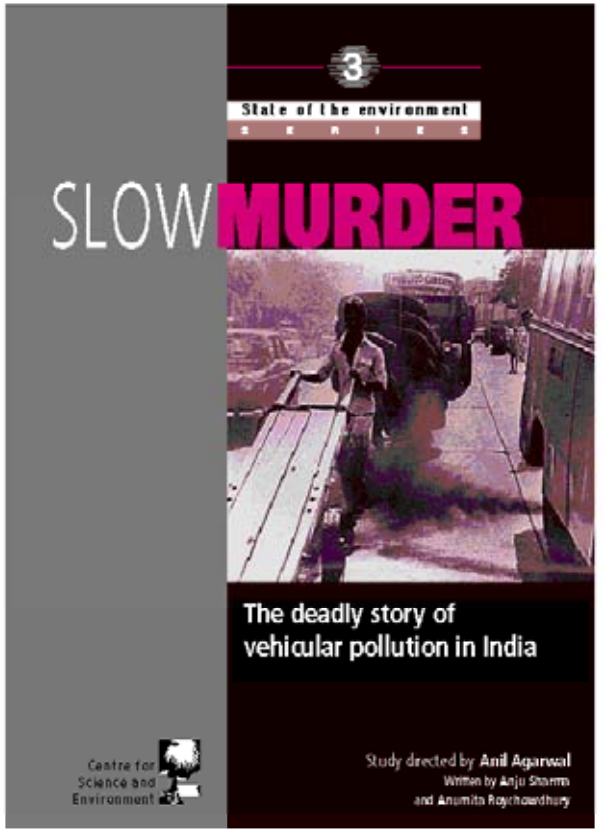
Where will the future growth take us?
It all depends on the choices we make

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

Right to clean air campaign: 1996



Imprint of growth
Our lungs at risk

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	9,669	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	6.8 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, Sunita Narain or Anumita Roychowdhury

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@sdalt.ernet.in

YES, I would like to ☐ Join the campaign

☐ Donate money for the Campaign Against Air Pollution

My contribution, Rs ____ in ☐ Cheque (No _____)

☐ Money Order ☐ Demand Draft is enclosed.

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

Please keep me informed.

Name: _____

Occupation: _____

Address: _____

_____

Telephone: _____ Fax: _____

Email: _____

Ad in newspaper

Roll down the window of your bullet-proof car, Mr Prime Minister
The security threat is not the gun. It's the air of Delhi

Hon'ble Prime Minister,

Here is something that just may convince you: while India's Gross Domestic Product has increased two-and-half times in two decades (1975-1995), the pollution load from industries has gone up four times and from vehicles a shocking eight times.

A study by the Centre for Science and Environment shows that the number of people dying due to air pollution went up by almost 30 per cent in four years between 1991 and 1995. An estimated 52,000 people are dying due to air pollution every year – about 10,000 of them in Delhi itself.

One person dies every hour due to air pollution in the city.

In Delhi vehicles are responsible for 70 per cent of the pollution load. Because of the high toxicity of fumes from transport fuel, one out of every 10-15 people living in Delhi is likely to get cancer.

Your government has failed to arrest this deterioration of air quality in Indian cities. Worse still, it contributes to the pollution in a big way by producing low quality fuel in state-owned refineries. Improving fuel quality is a short-term measure which will go a long way. Vehicles using clean fuel will pollute less.

Seeing your government's inability to tackle air pollution, we present you with a peoples' charter for clean air. This will help to immediately improve the quality of the air we breathe.

Mr Prime Minister, 50 years into Independence, please give us our right to clean air. We hope you will take our concern seriously.

Yours sincerely

Centre for Science and Environment
November 2, 1998

PEOPLES' CHARTER ON CLEAN AIR

FOR AN IMMEDIATE IMPACT

✔ **PRODUCE CLEAN DIESEL OR IMPORT**
Diesel emissions contain deadly particulate matter with traces of the strongest carcinogen known till date. Indian diesel is 250 times dirtier than the world's best.

✔ **REMOVE BENZENE FROM PETROL**
India is moving towards unleaded petrol. But this fuel contains too much benzene. Though we use one hundred times less petrol than USA, the total amount of benzene emissions from Indian vehicles is the same as in the US.

Benzene causes blood cancer and air should have no benzene at all, says WHO. Yet the level of benzene in and around Connaught Place in Delhi is 10 times higher than the European safety limit. If you live in Delhi, your chances of getting blood cancer are twice as high as people living in Bangalore, Chennai and Mumbai.

✔ **STOP PRIVATE DIESEL CARS**
Registration of all private diesel models should be banned in cities like Delhi. Cheap government diesel means more diesel cars, including luxury models.

✔ **TAX TO IMPROVE VEHICLE TECHNOLOGY**
Penalise vehicle manufacturers for producing polluting technology. Tax vehicles according to their emission level. Manufacturers will then invest in cleaner technology.

✔ **INTRODUCE EMISSION WARRANTY**
Make the industry accountable for the life-long emission efficiency of all vehicles they produce.

✔ **MAKE EMISSION LEVELS PUBLIC**
Manufacturers must inform buyers of the exact emission levels of their vehicles.

✔ **MONITOR ALL HARMFUL GASES**
Improve air quality assesment. A wide range of poisons are not monitored till date. Alert people about pollution levels in the city. It is done all over the world..

Register your protest to the Prime Minister today
PMO, South Block, New Delhi 110 001
Tel: 301 8939 Fax: 301 6857, 301 9817

Join CSE's Right To Clean Air campaign

CSE

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Tel: 698 3394, 698 1124, 698 6399 **Fax:** 698 5879
Email: cse@cseindia.org **Website:** www.cseindia.org

Ad in newspaper

We dared to test the lung of our Chief Minister in the midst of an Auto Show in Delhi

Children demanded clean air from the Prime Minister

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

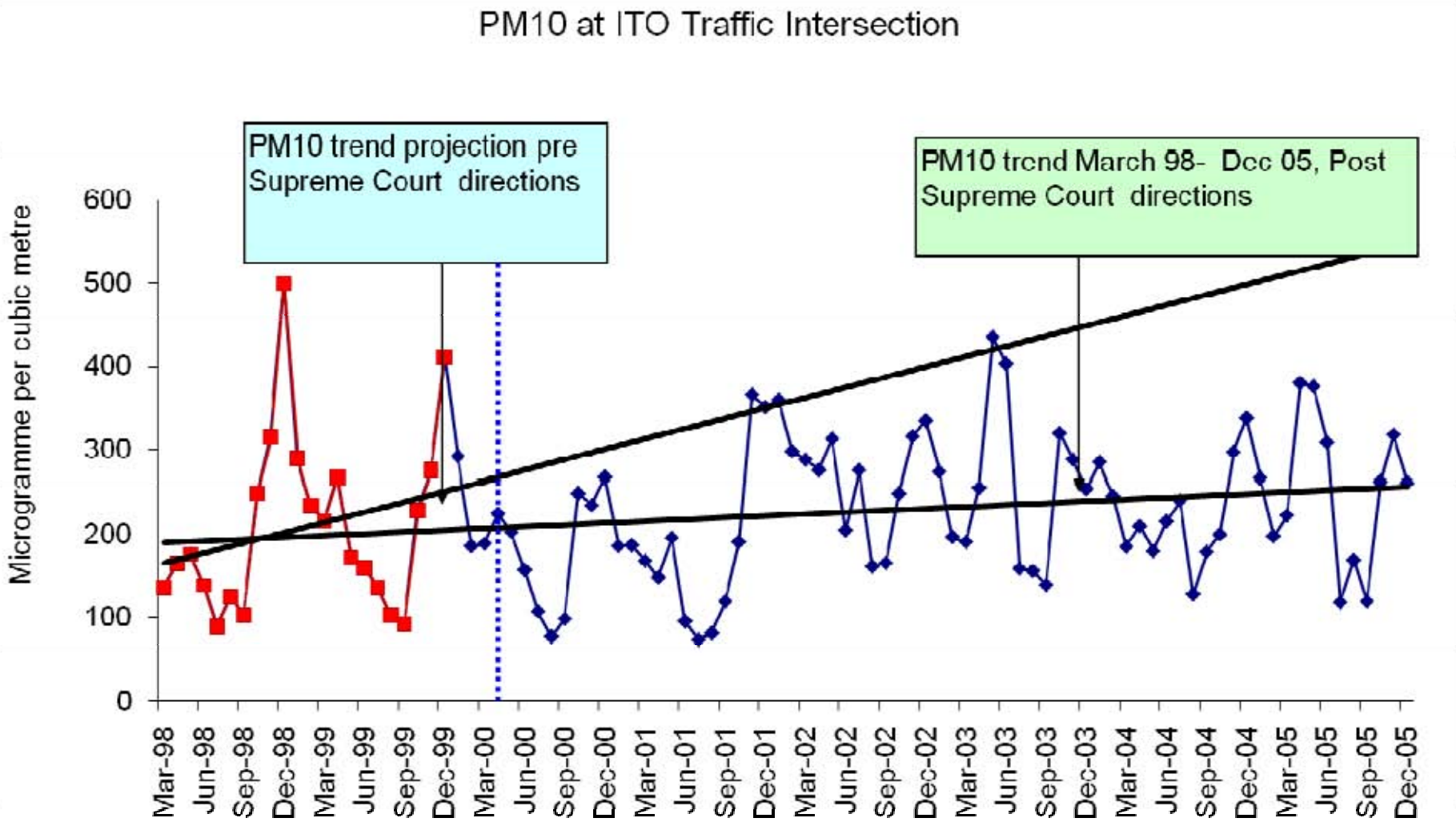
- Adopted new ambient air quality standards
- Expanded air quality monitoring and reporting

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



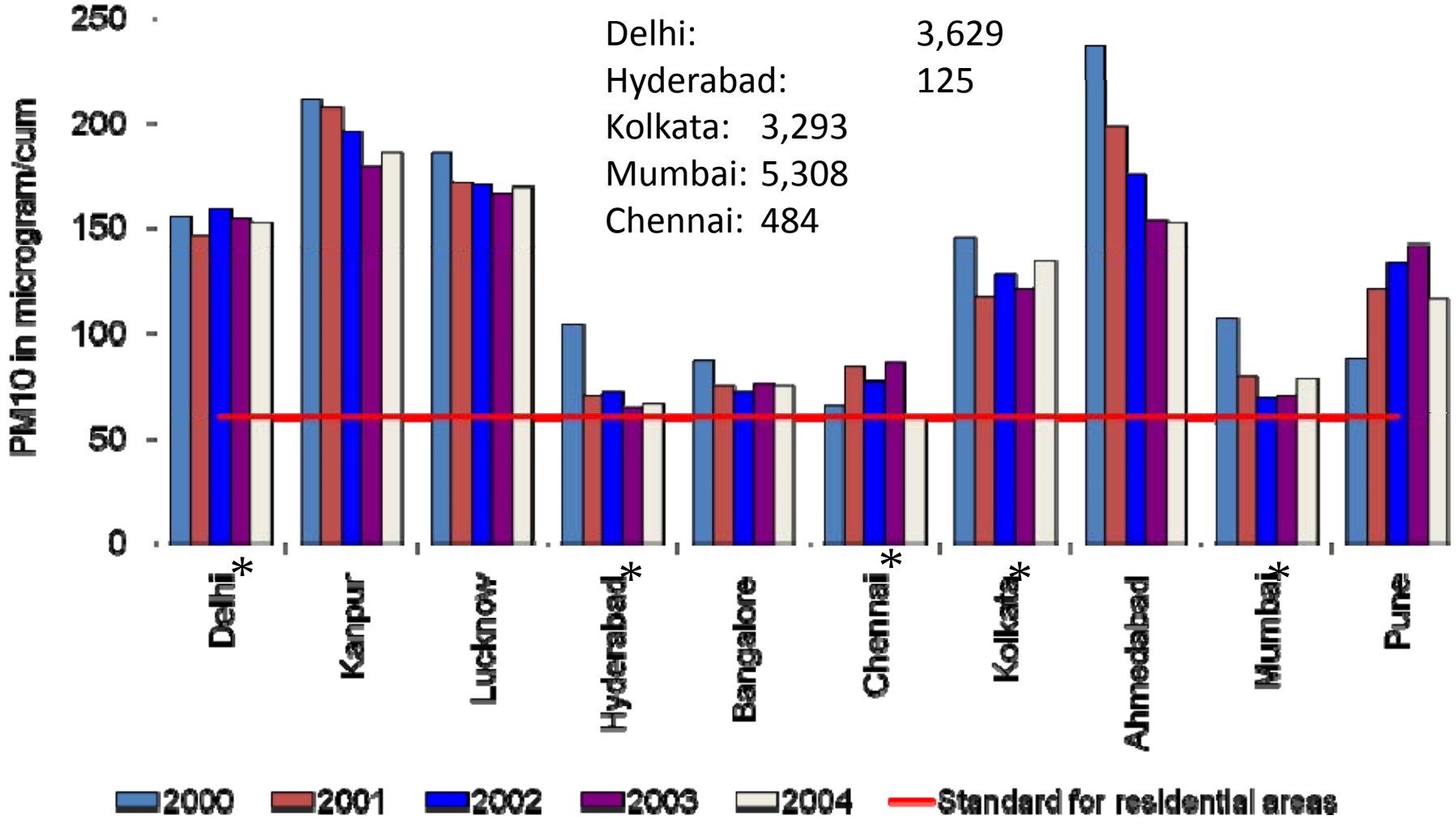
CPCB reported 24% drop in PM10 levels in 2002 compared to 1996 levels.

Evidence of action: Health Benefits

Downward PM10 trend in some cities* have led to 13,000 less premature deaths and reduction in respiratory illness[1]

Lives saved:

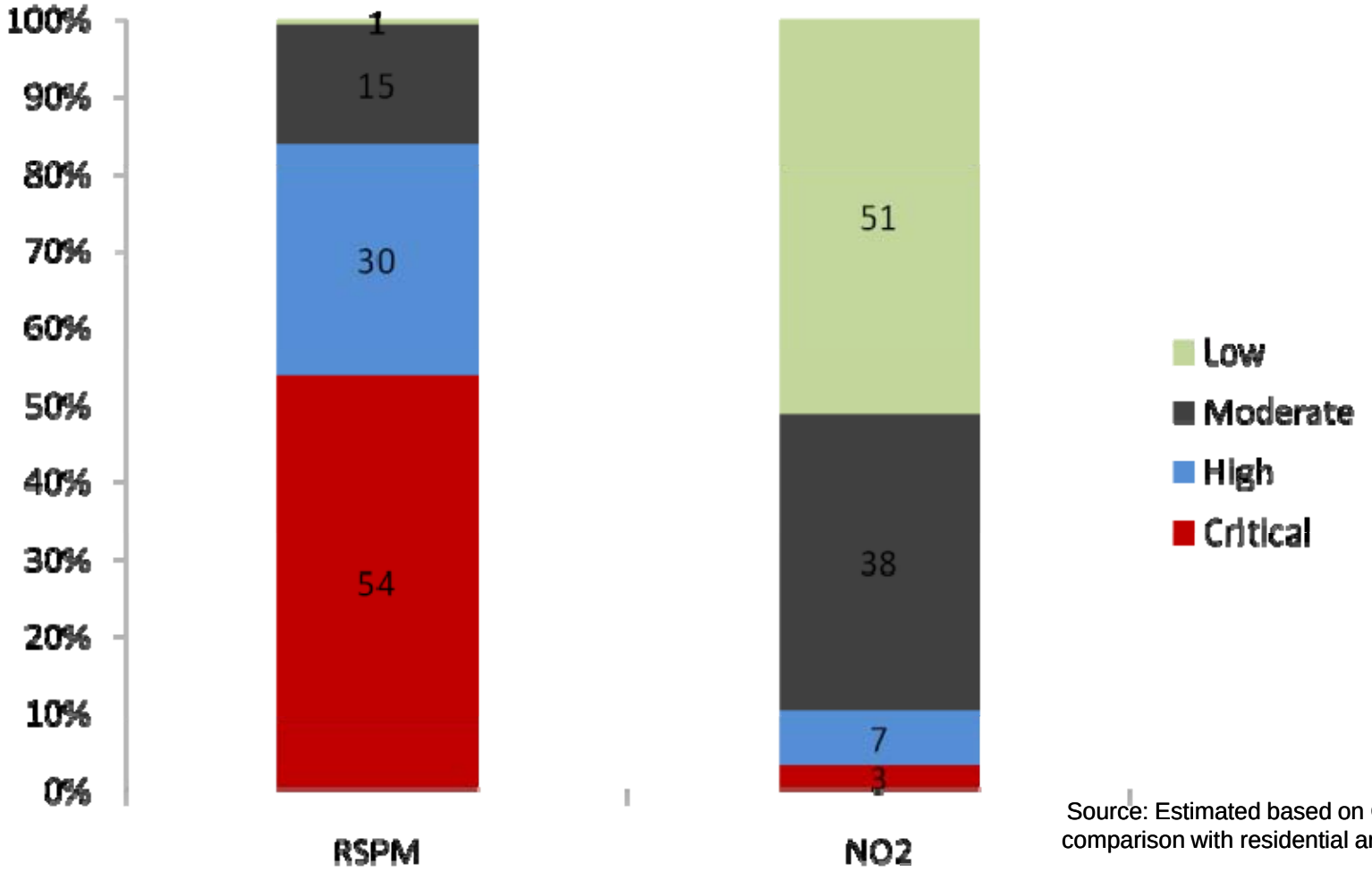
Delhi:	3,629
Hyderabad:	125
Kolkata:	3,293
Mumbai:	5,308
Chennai:	484



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)

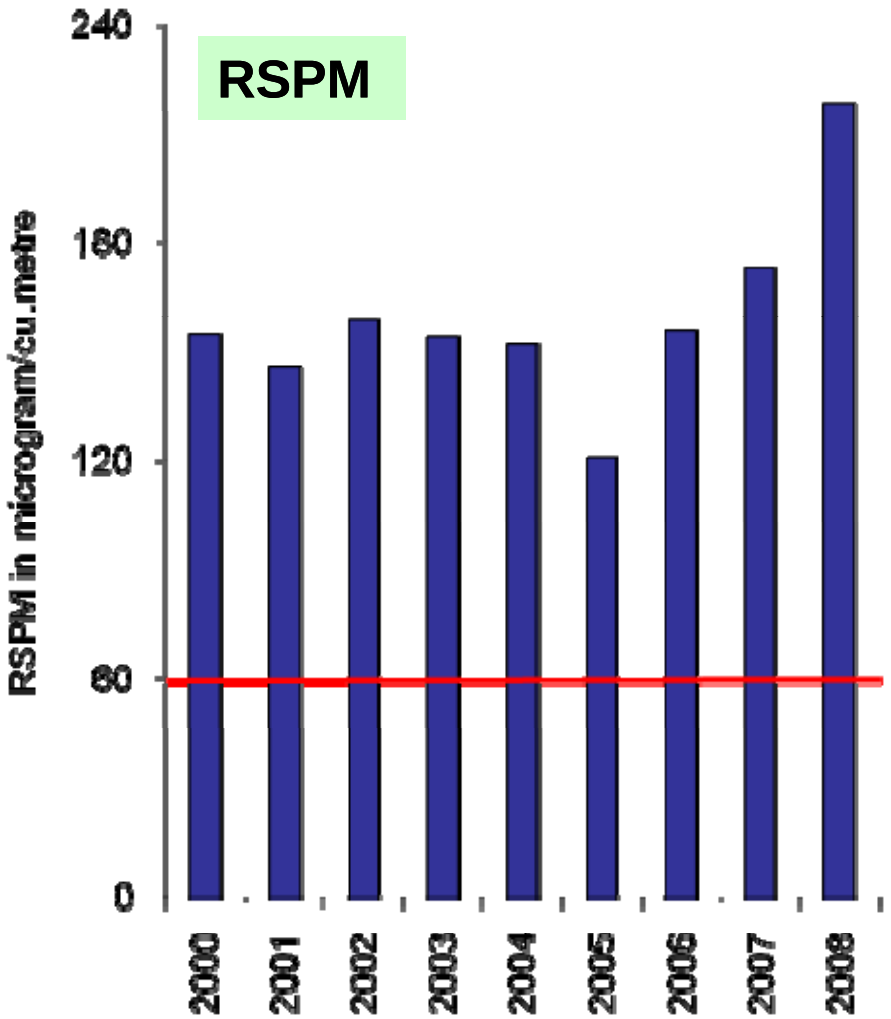
	Cities Name	Annual average
1	Howrah	81
2	Asansol	62
3	**Kolkata**	**56**
4	**Delhi**	**49**
5	Jamshedpur	49
6	Raipur	46
7	Mumbai	42
8	Navi Mumbai	42
9	Jharia	41
Safe level 40 microgramme/cum		

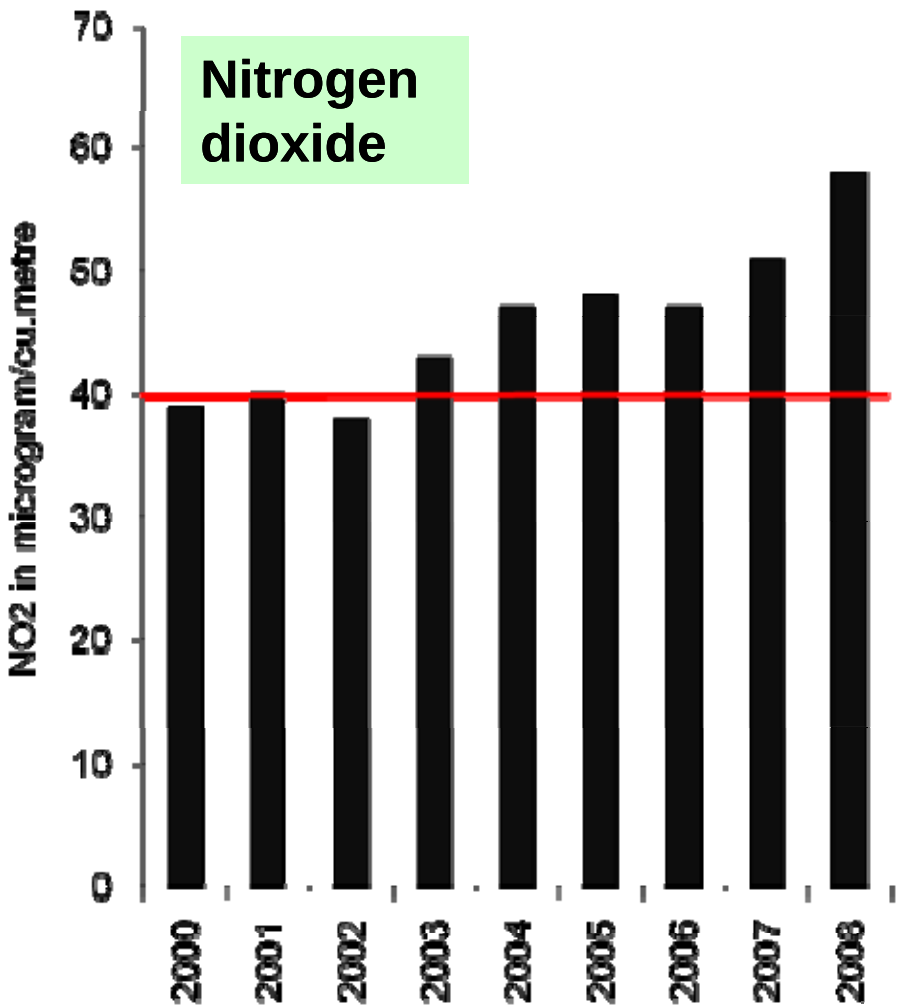
Cities with high PM10 levels in 2009
(Annual average concentrations in micrograms per cubic meter)

	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	Duala 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

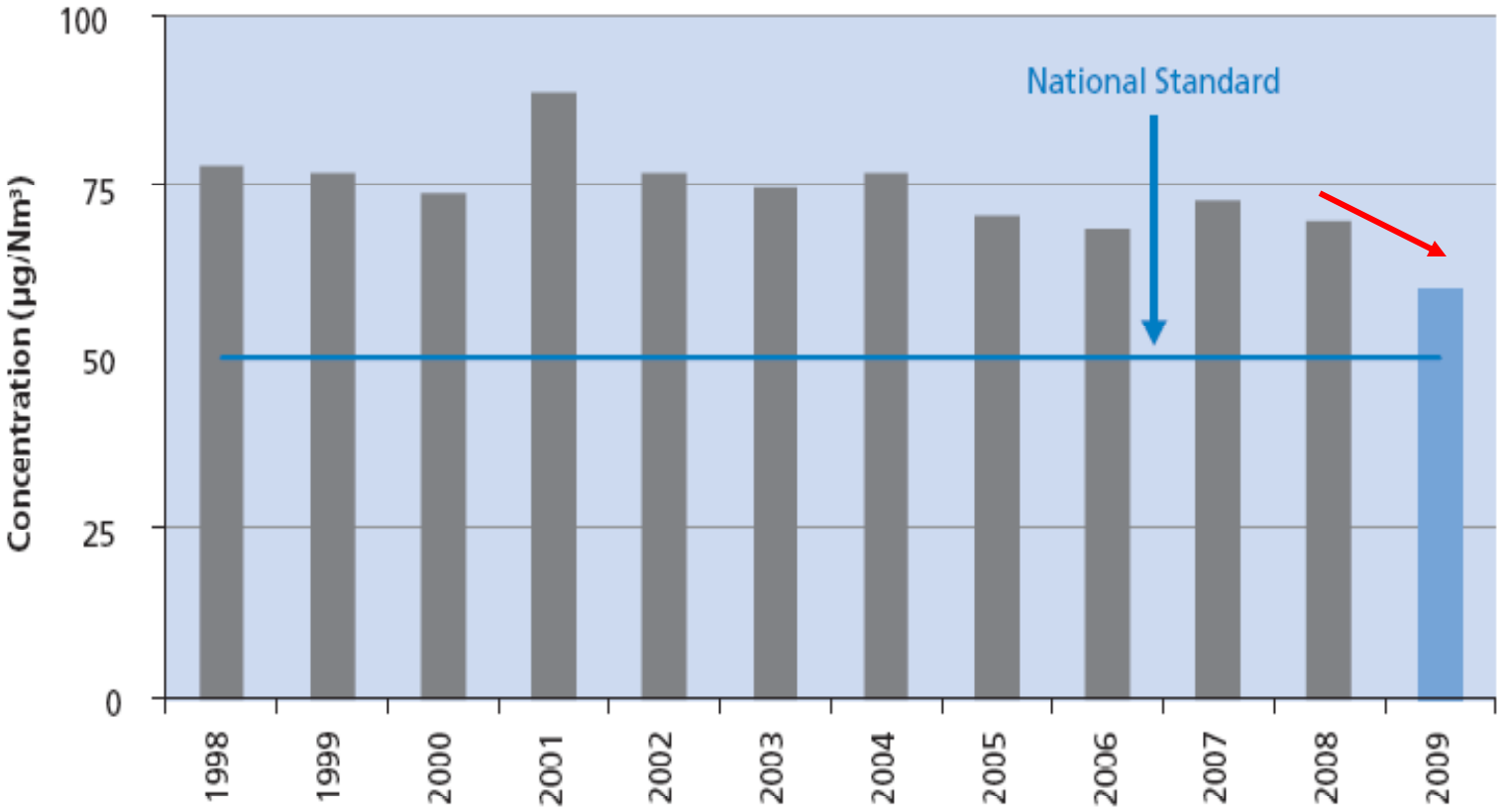
First generation action in Colombo

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

- Introduced Euro I/II 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?

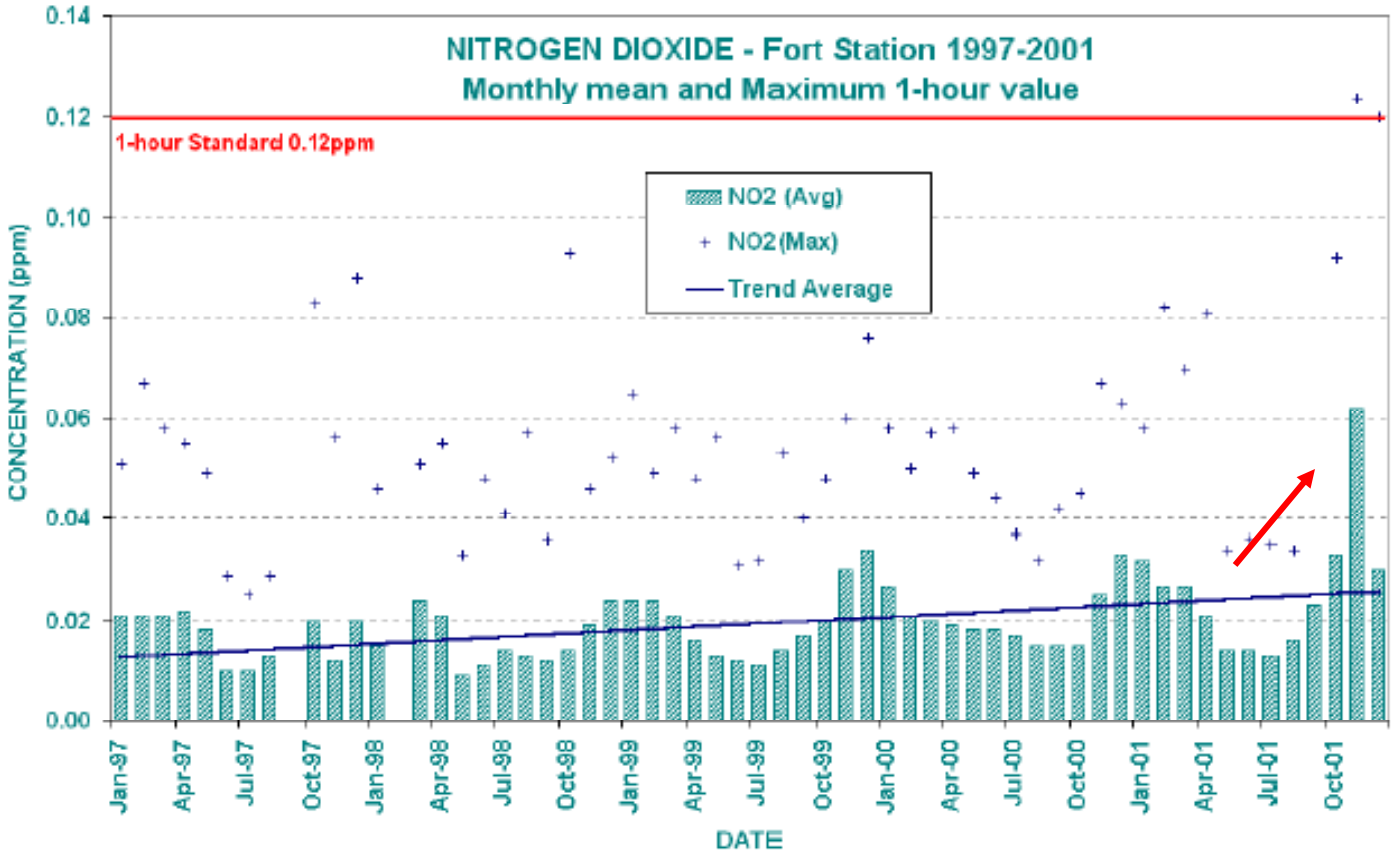
Annual average PM10 levels in Colombo Fort station (1998-2009)



Limited monitoring shows mixed trends in particulate matter and a dip

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

Nitrogen dioxide (Fort Station, 1997-2001)



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

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

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/Nm³ (24 hours)	87	103

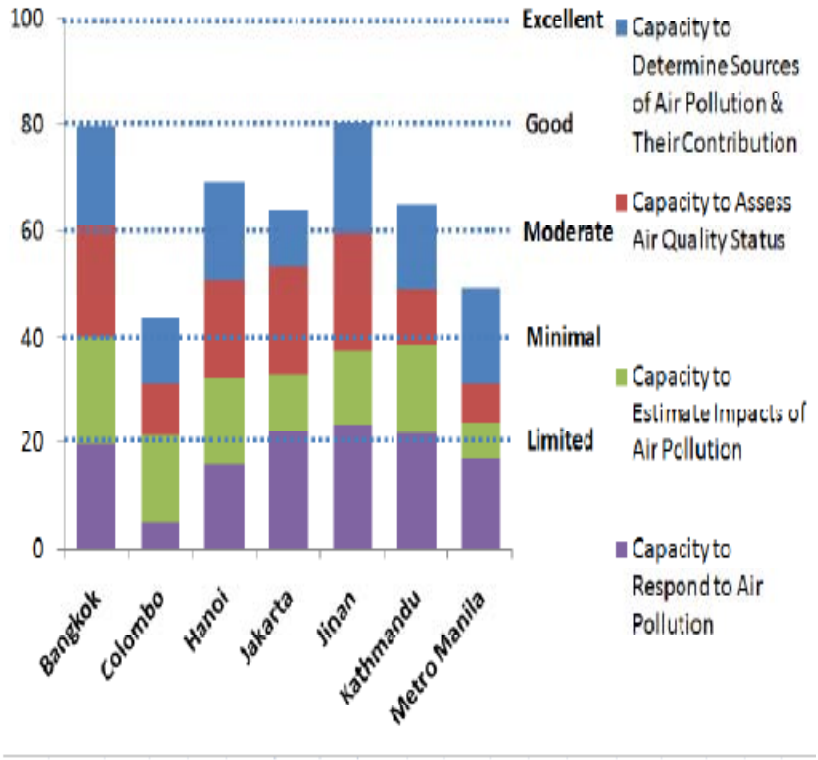
Source: Data of Central Environmental Authority (2010), cited in: Asian Development Bank and CAI–Asia Center. Knowledge management on air quality: Case studies. Mandaluyong City, Philippines: Asian Development Bank and CAI–Asia Center, 2010

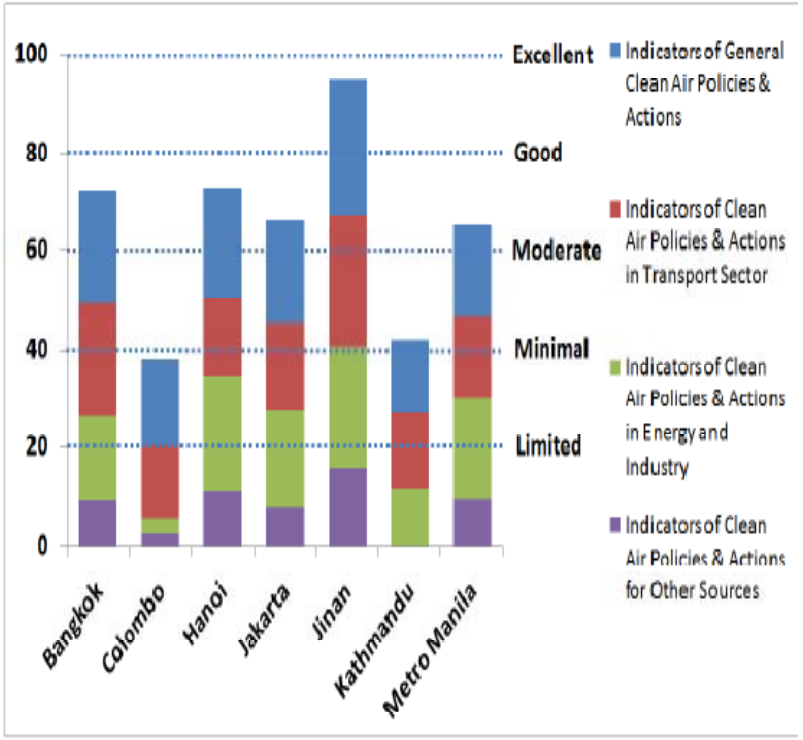
As the bar of health protection is raised more locations show up on the critical and highly polluted list

- **Sri Lanka has set stringent national ambient air quality standards**
- **India has tightend the national ambient air quality standards.** 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.

Air quality management capacity varies across South Asia……..

CAI Asia score card on clean air management capacity, policies and action
Most South Asian cities face similar dilemma.....





Source: Kaye Patdu 2010, Clean Air Scorecard: Summary of Results, Clean Air Initic Center, BAQ 2010, 8 November 2010

National Air Quality Standards must be made legally enforceable

- **In India no punitive action on state governments for not meeting the ambient air quality norms.**
- **Abatement plans are not designed to meet local air quality targets**
- **Emissions regulations are kept weaker for most of India.**
  - In the US the air quality standards are federally enforceable. EPA impose sanctions if states fail to meet the air quality targets -- such as cut highway funds.
  - Civil society can sue the state governments.
  - **"**Citizen Court Suits" allowed against EPA for failure to promulgate NAAQS, emissions standards or implement state implementation plans.

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

Ensure enforcement of air quality standards, accountability and compliance.

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.

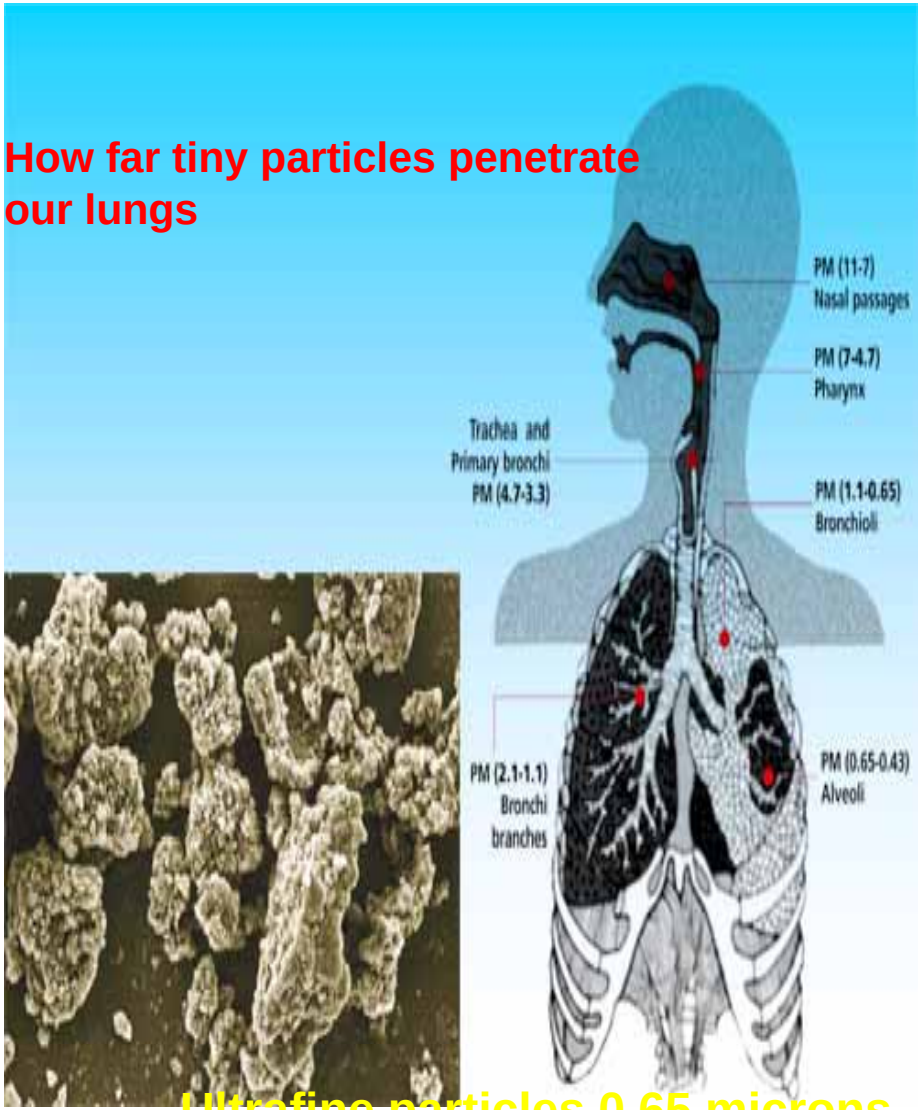
Article 39: The state shall direct its policy towards securing health …

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

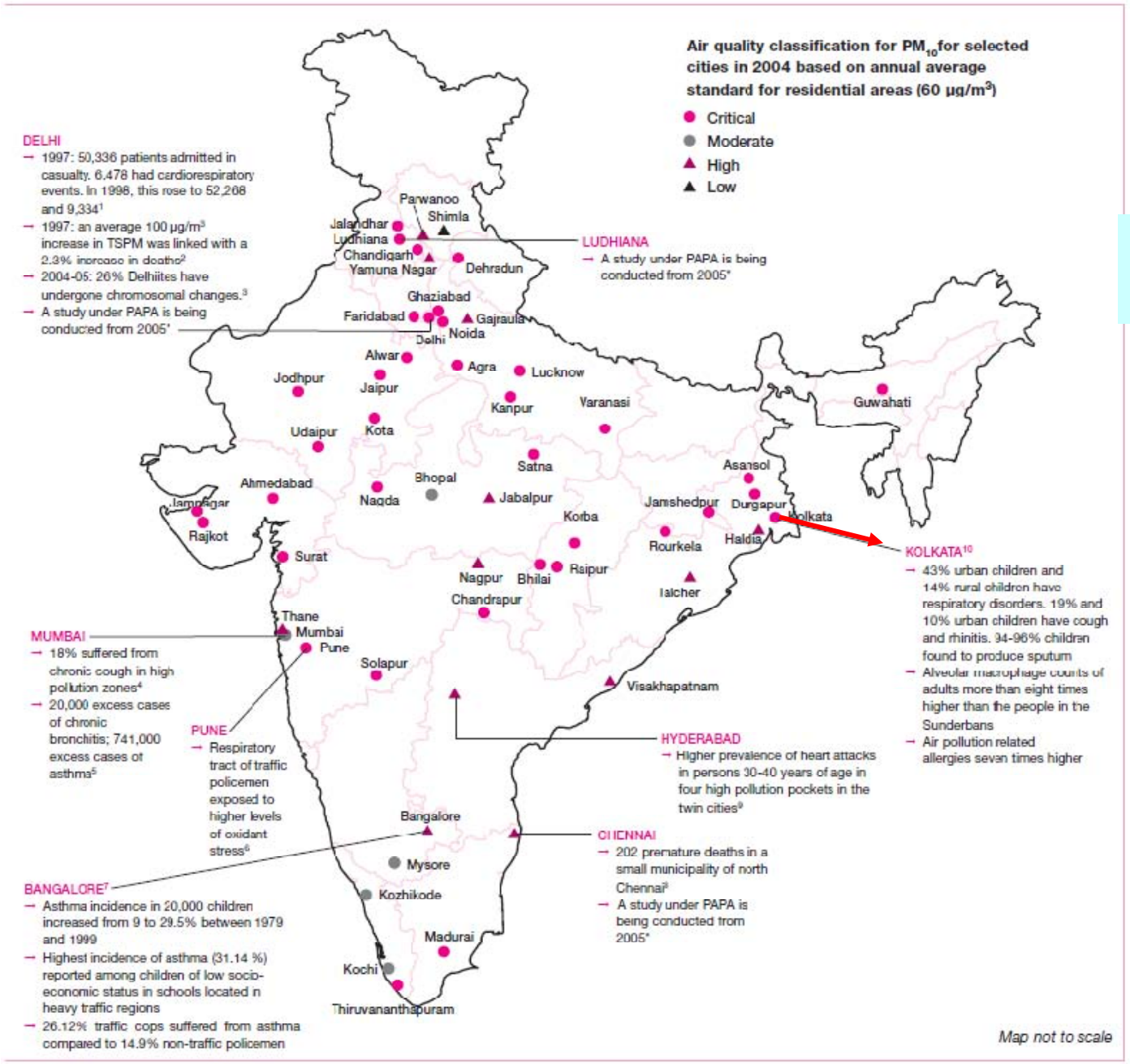
Global evidences abound: Clinching evidences from American Cancer Society study that tracked effects in 600,000 people over 18 years.

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

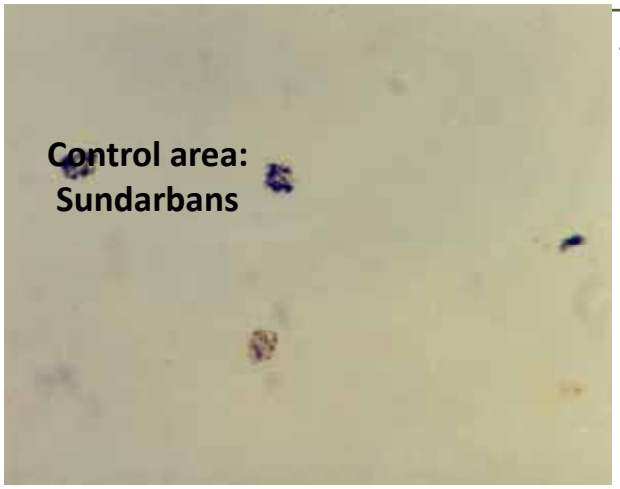
Scourge

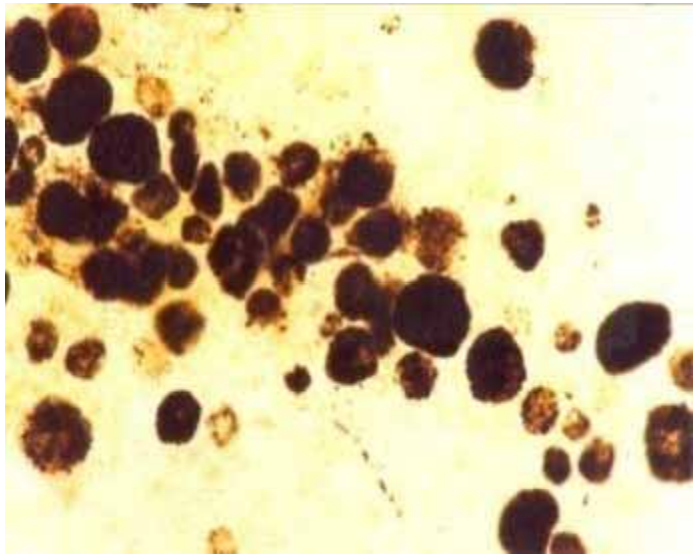


Notes: *PAPA — Public Health and Air Pollution in Asia Program; µg/m³ — microgramme per cubic metre; TSPM — total suspended particulate matter
Sources: 1. J N Pandey *et al* 2002; 2. Maureen Cropper *et al* 1997; 3. CNCI and CPCB 2005; 4. CPCB and IIT, Mumbai; 5. S R Kamath, *mimeo;* 6. Sundeep Salvi *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…….

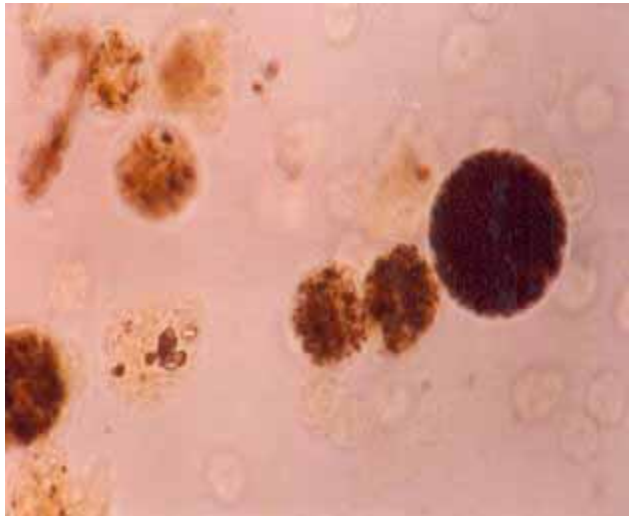
Alveolar macrophage - biomarker of air pollution





Exposed group; Kolkata taxi driverIncrease 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 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……

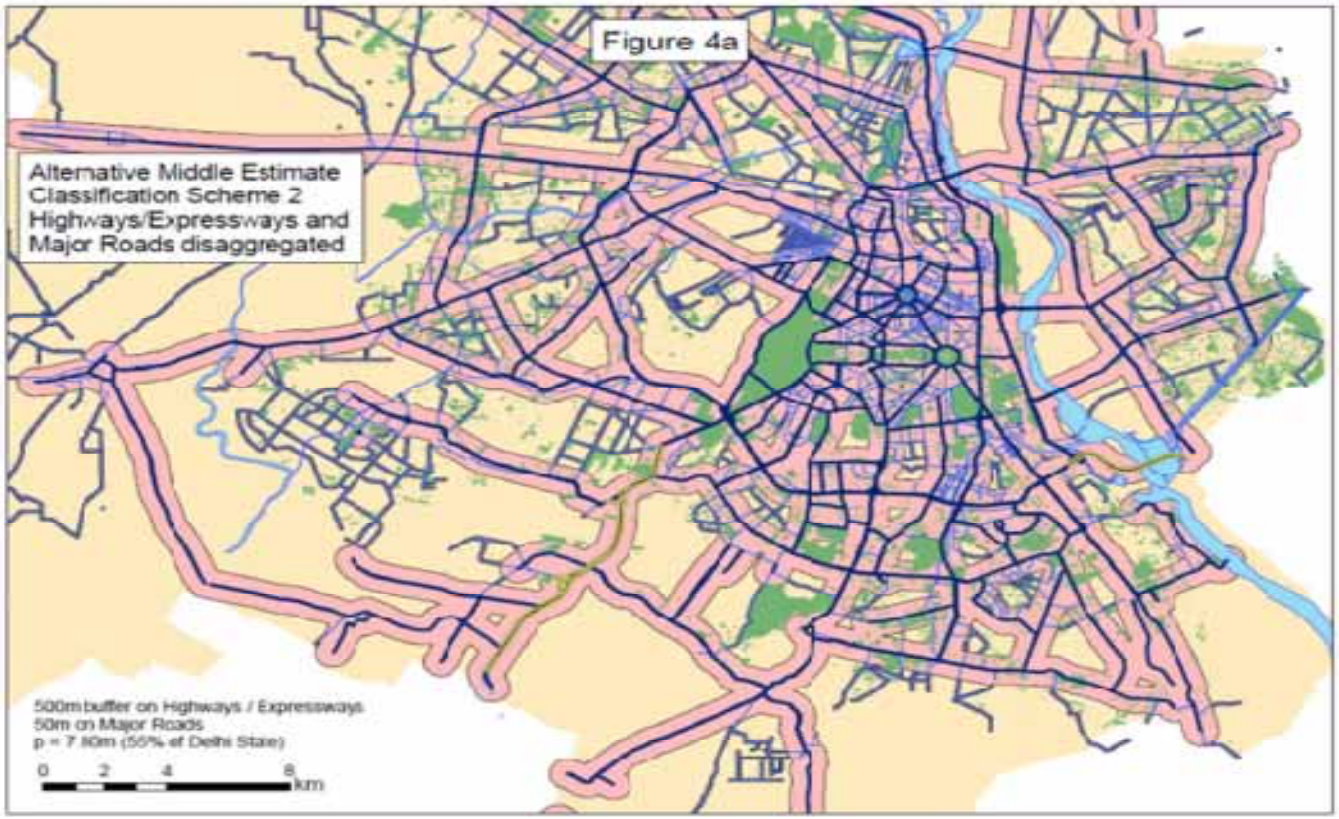
Why are we specially worried about vehicles?

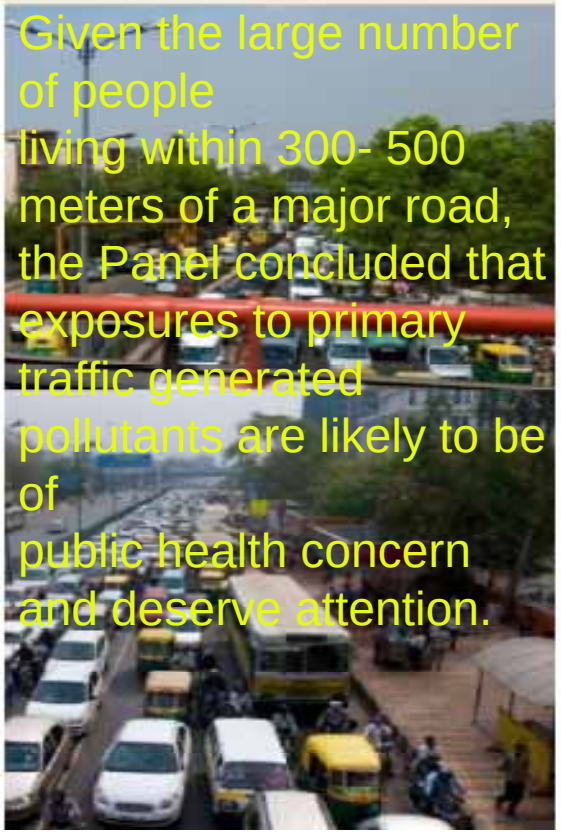
People living close to roads are most exposed to vehicular fume

Evidence from Delhi….

The Traffic Impact Area in Delhi:

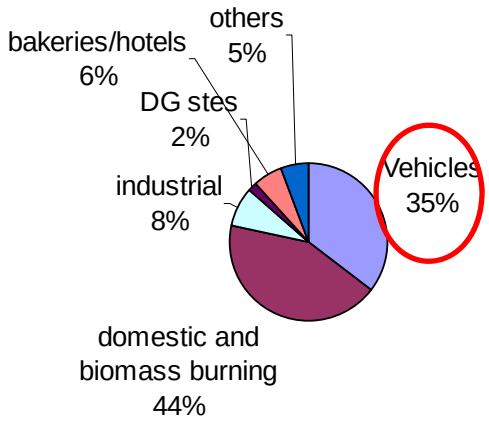
*New HEI Analysis: **55% of the Population** within 500 meters of a Freeway; 50 meters of a Major Road*



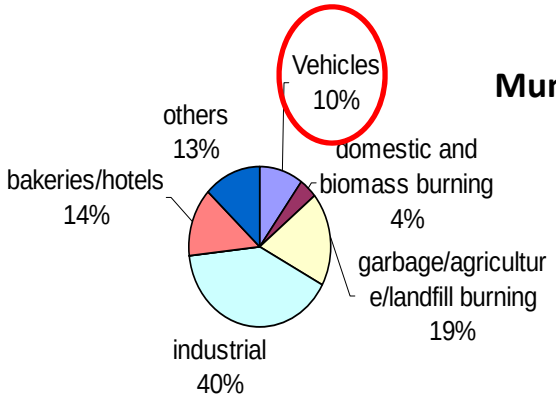


Vehicles: Significant contributor amongst the combustion sources in Indian cities

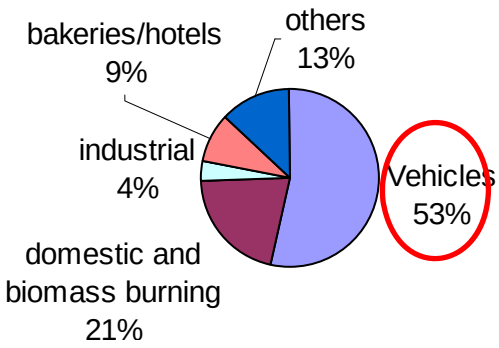
Delhi



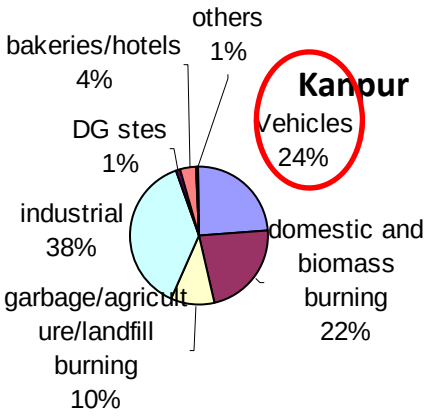
Mumbai



Pune



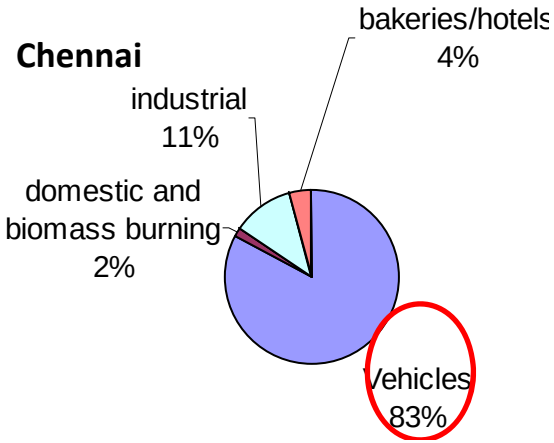
Kanpur



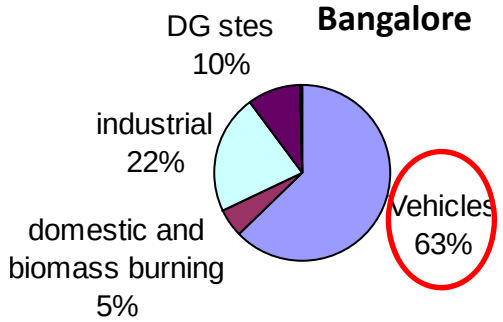
If road dust is taken out from the PM10 inventory results – vehicles share increase dramatically to 83% in Chennai, 63% in Bangalore and 53% in Pune.

Vehicles become the second major contributor in Delhi and Kanpur.

Chennai



Bangalore



(CSE analysis)

Vehicles major source of air pollution in Colombo

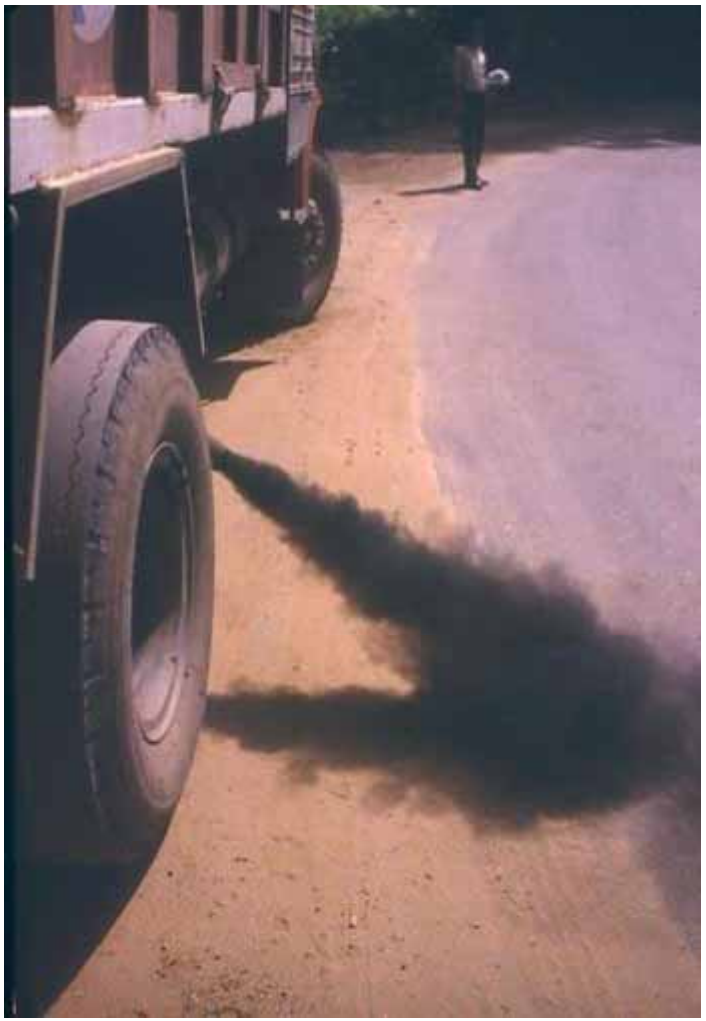
- Vehicles contribute overwhelmingly to the air pollution load in Colombo --- Transport sector contributes about 60% to air pollution

- 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

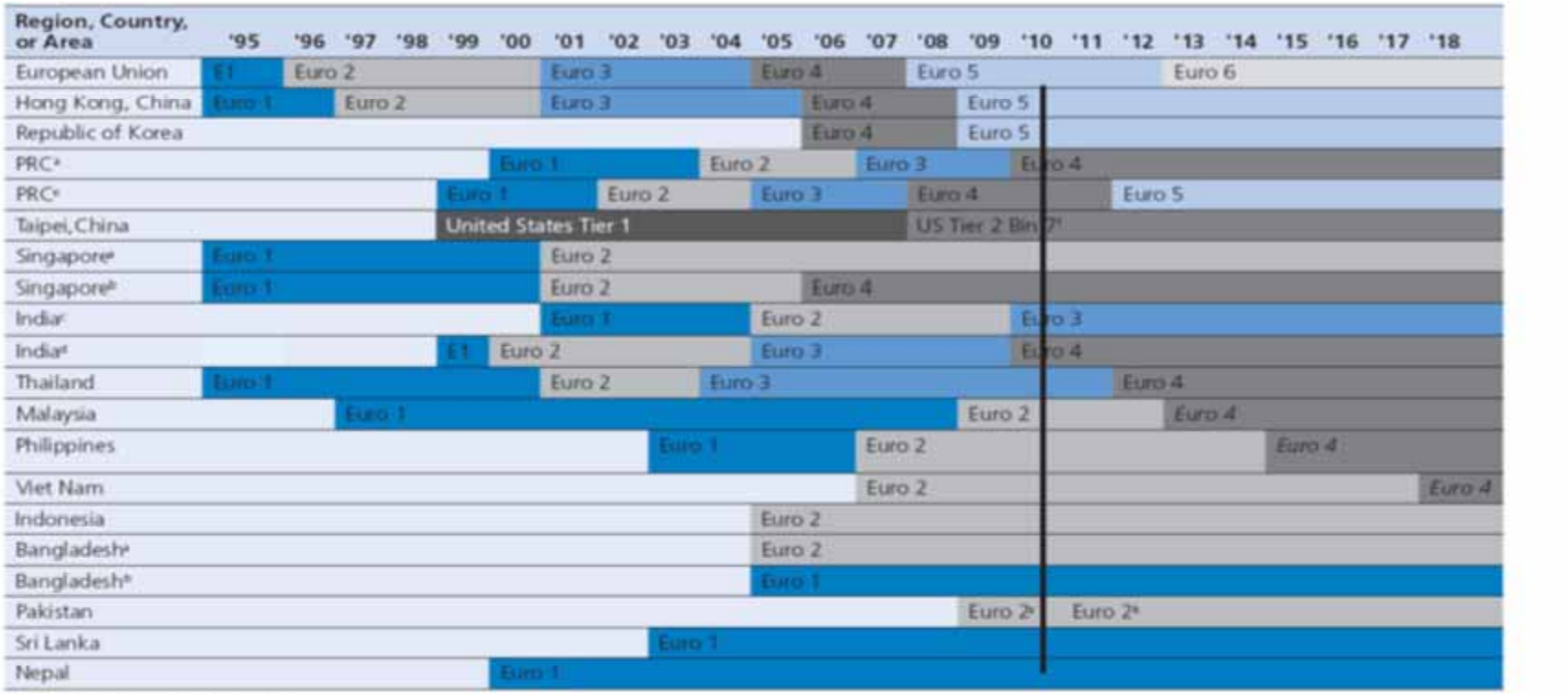
- Vehicular emissions contribute to significant human exposure. Pollution concentration in our breathe is 3-4 times higher than the ambient air concentration.
- In densely-populated cities more than 50 – 60% of the population lives or works near roadside where levels are much higher. This is very serious 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



PRC = People's Republic of China.

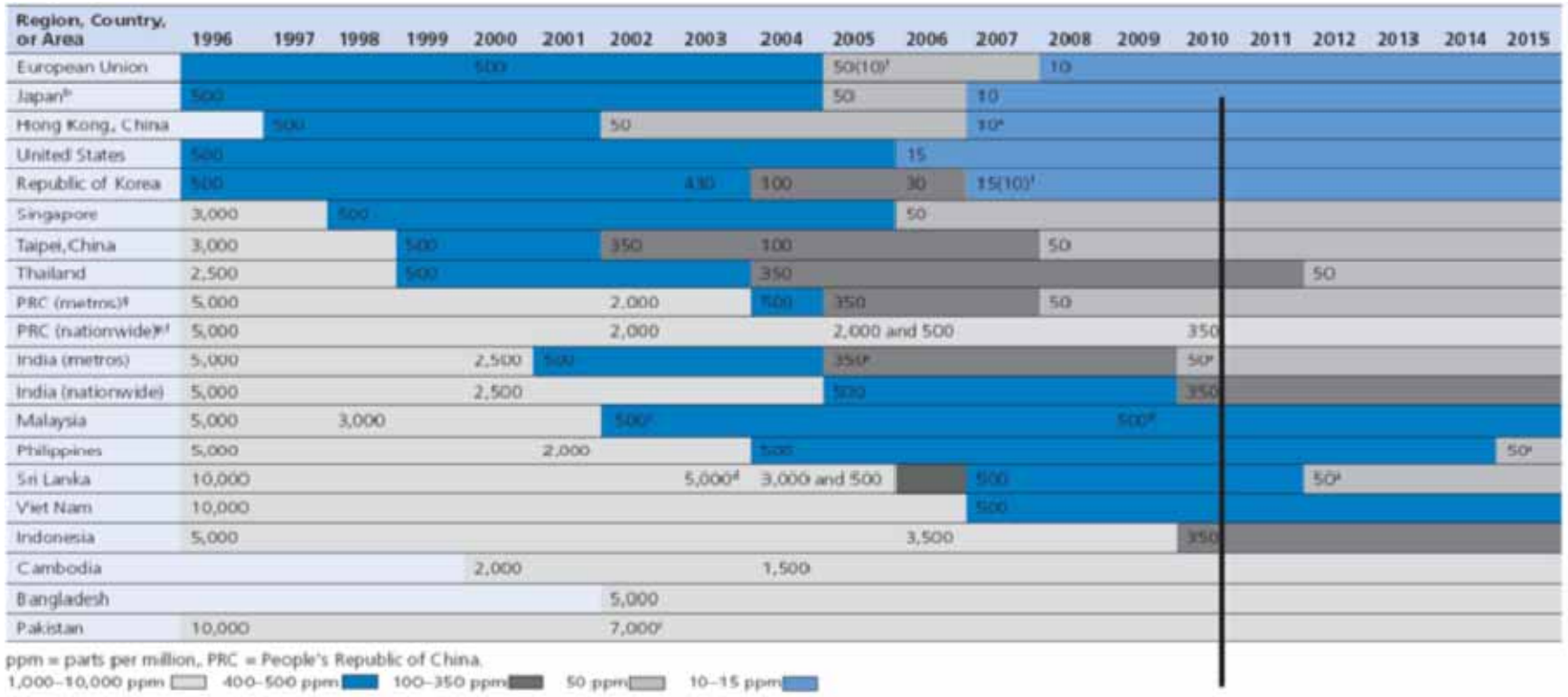
Notes: The level of adoption varies by country but most are based on the Euro emission standards. Italics indicate that they are under discussion.

[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



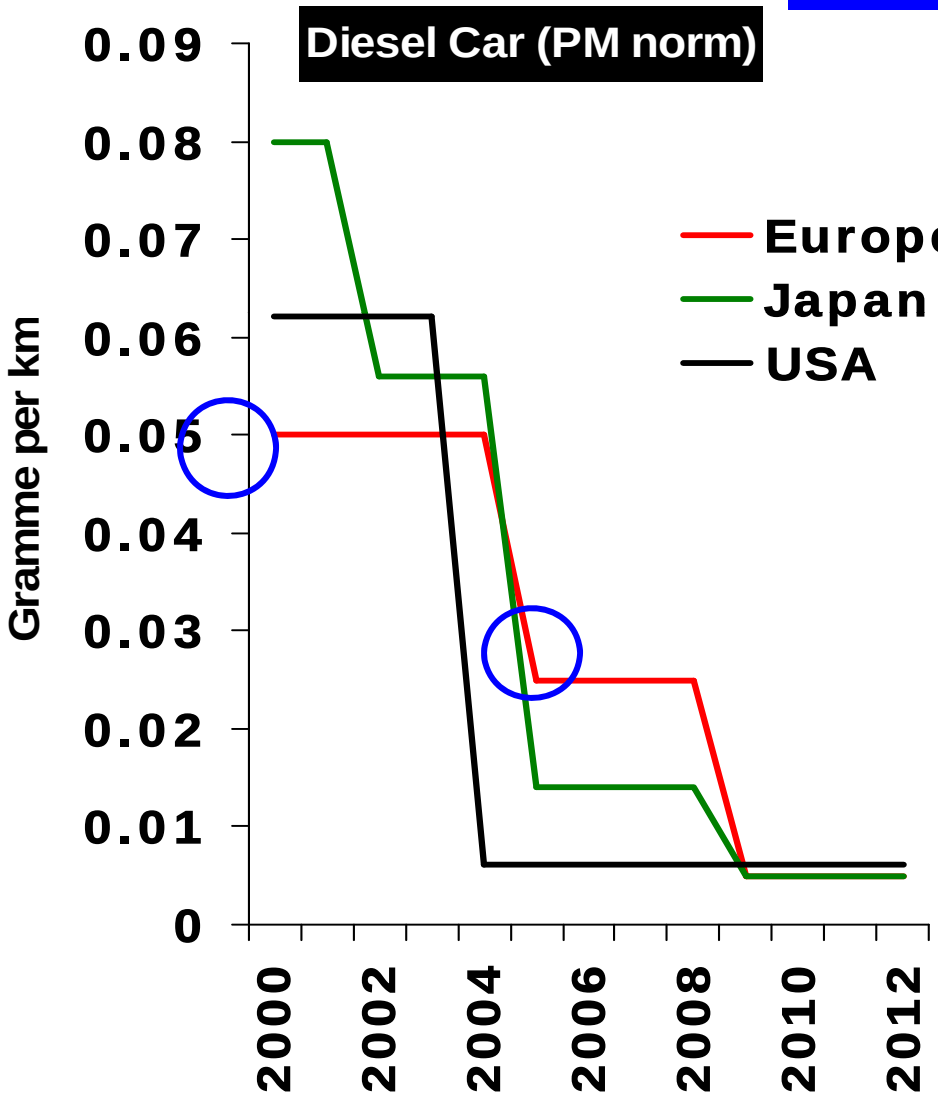
Notes:

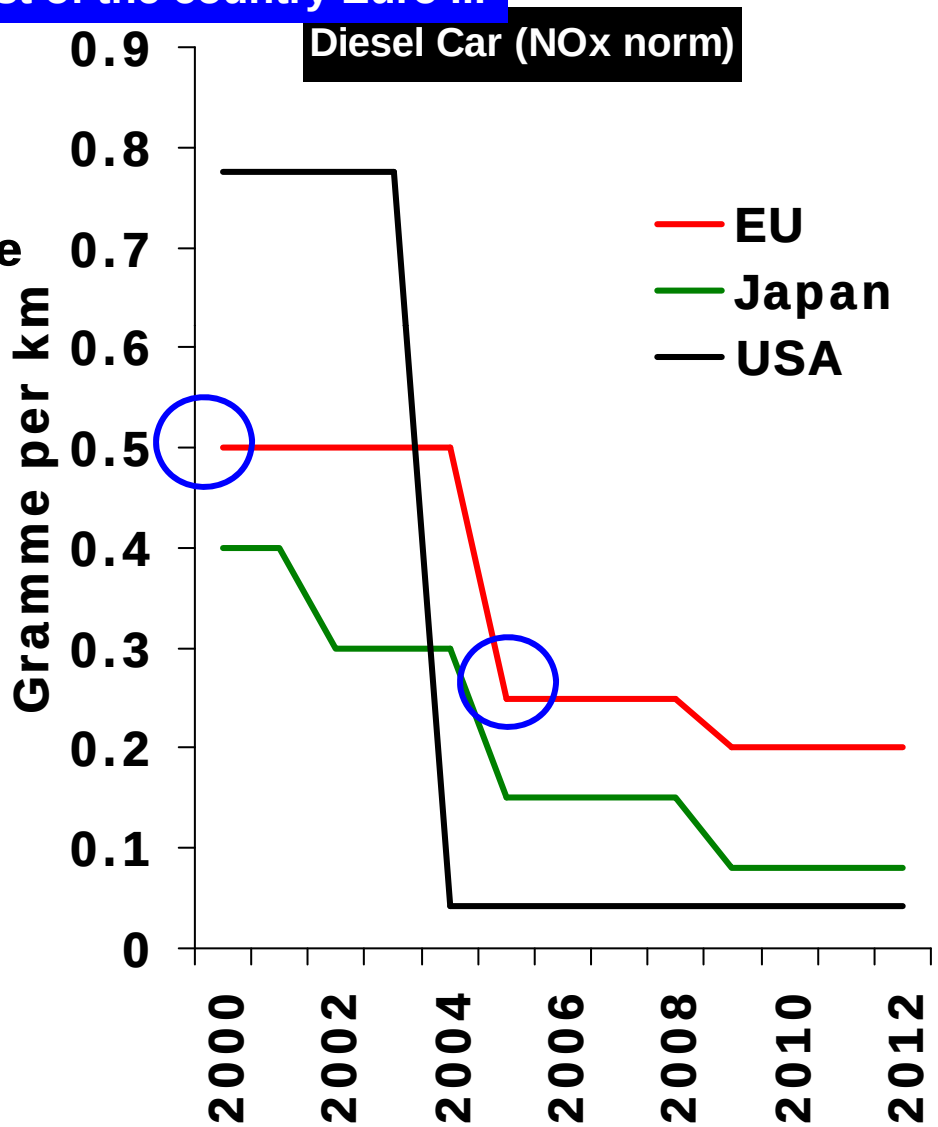
[a] Under consideration or discussion; uncertain.
[b] Nationwide supply of 50 ppm commenced in 2003 and for 10 ppm in 2005 due to voluntary goals set by the oil industry.
[c] Marketed.
[d] Mandatory.
[e] Voluntary standard of 500 ppm; however, the formal standard remains 2,000 ppm, and product in the 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

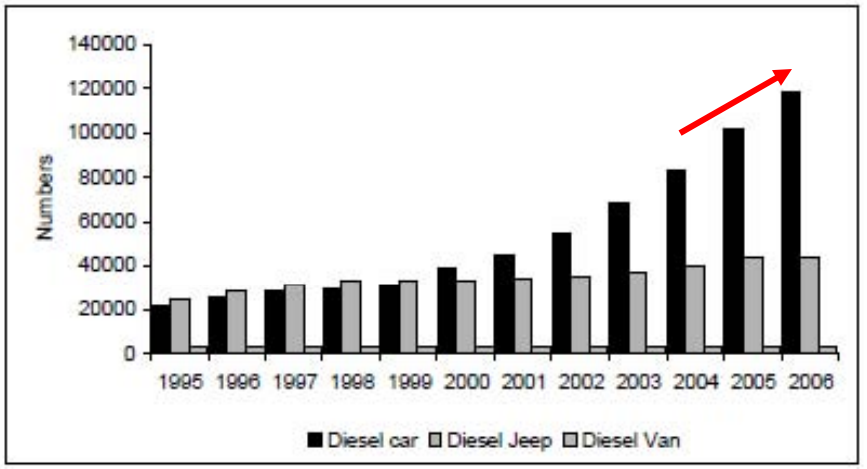
- Both countries need to tighten the in-use emission norm regime and in-use compliance to reduce in-use emissions

Threat of dieselisation

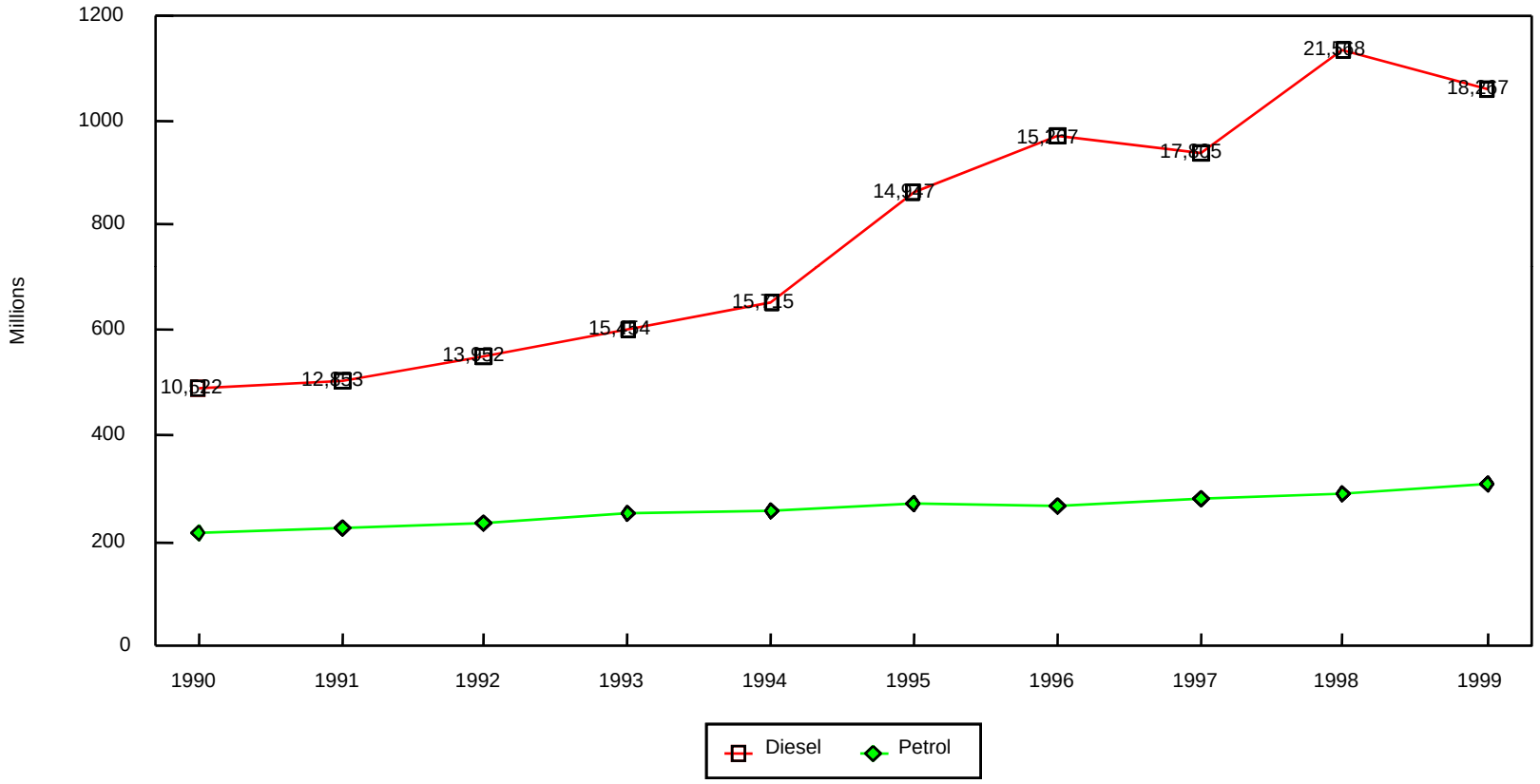
- **Indian cities:**
- Nationally, 30% of new car sales are on diesel. Nearly 65% of the Kolkata's vehicular population and nearly 99% of commercial vehicles are diesel-run
- Contribution of diesel fuel combustion to ambient PM2.5 can be as high as 23% in Delhi, 25% in Mumbai to an astounding 61% in 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.
- Distorted import policy also aiding dieselisation: Age limit for imported petrol cars is 3 years but that for diesel is 5 years. Effective tax paid for diesel vehicles lower than petrol vehicles.
- Import and use of reconditioned vehicles and

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



Diesel demand is galloping in Colombo (1991-2000)

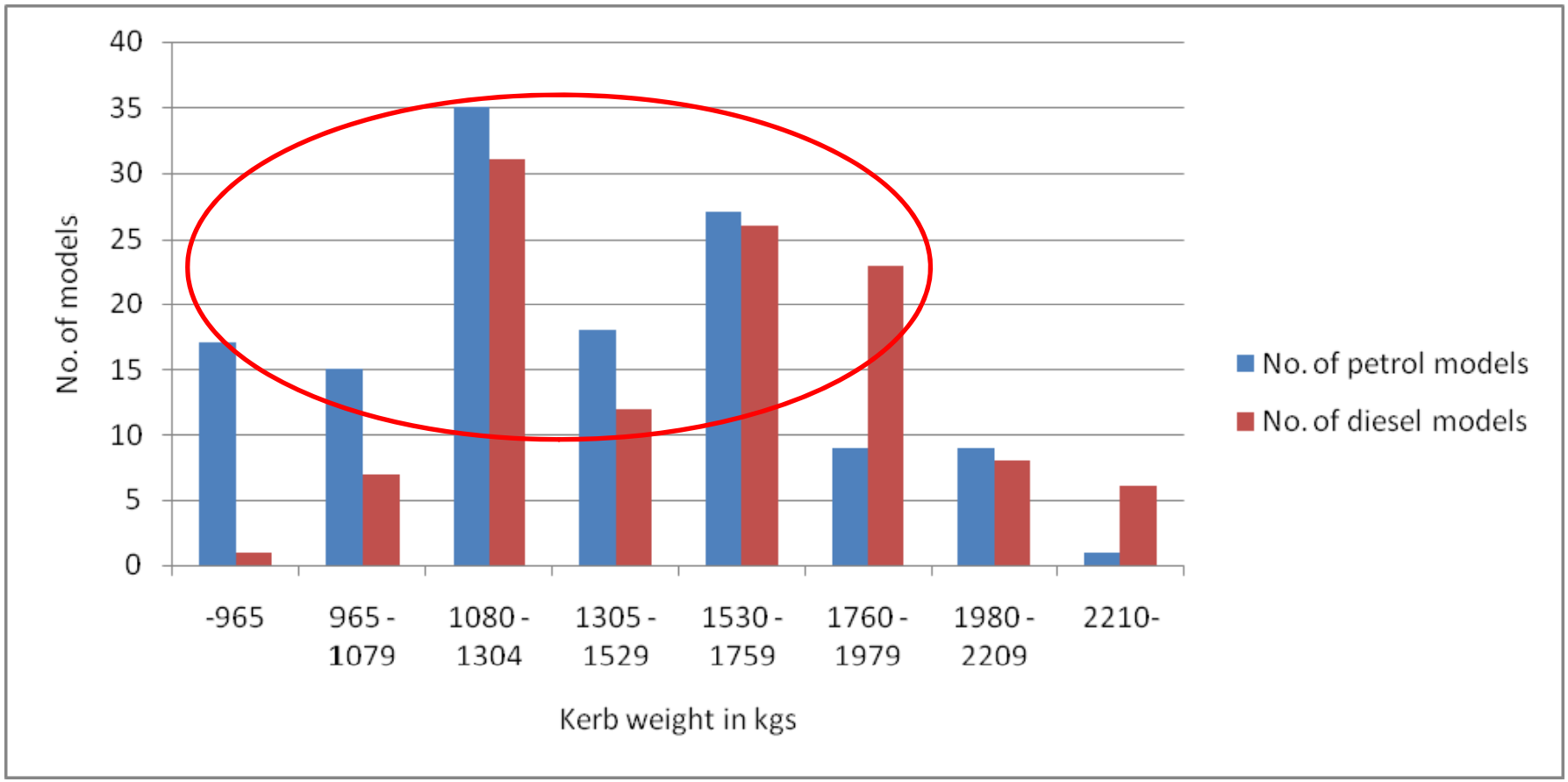


Source: Ministry of Transport, Sri Lanka

Check dieselisation of car segment

Diesel's increased market share is a reality in India

Number of cars (by fuel type) in different weight categories as given in fuel economy database

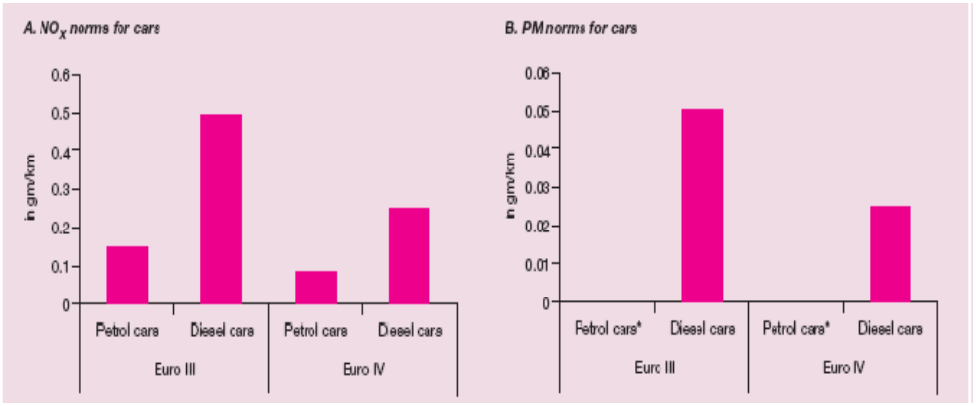


Why are we worried about dieselisation?
License to Pollute

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

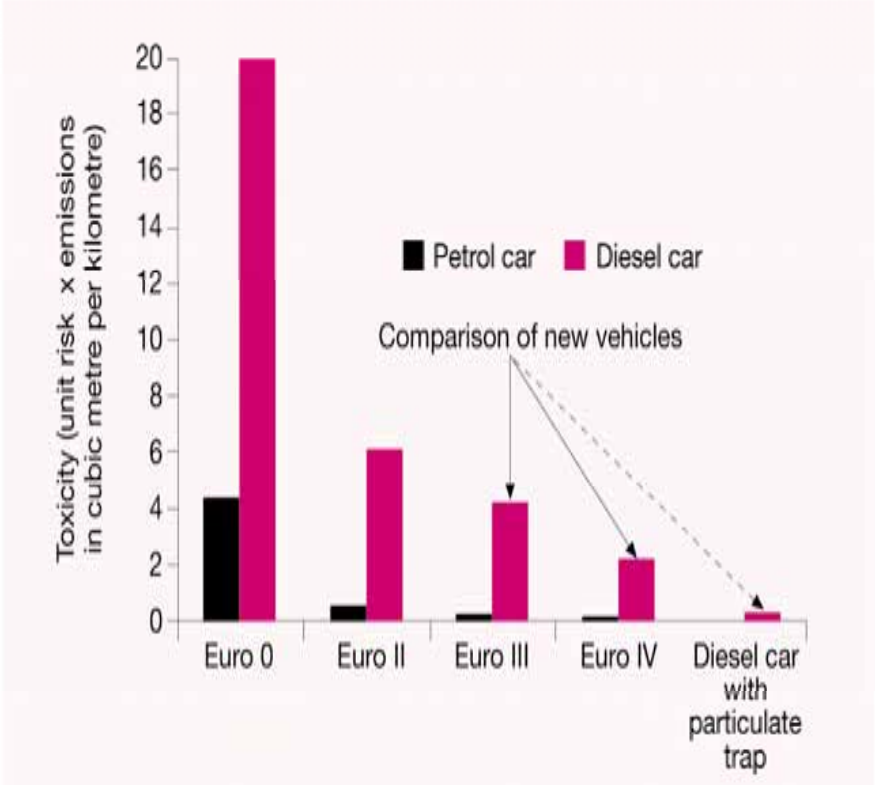
NOx norms for cars

PM norms for cars



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

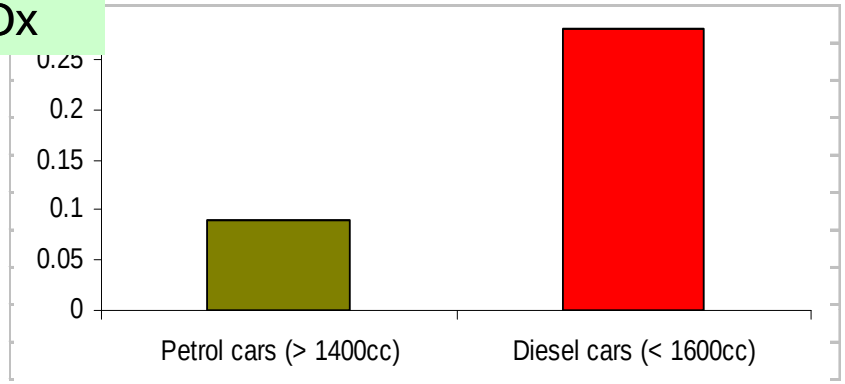
Toxicity of diesel emissions



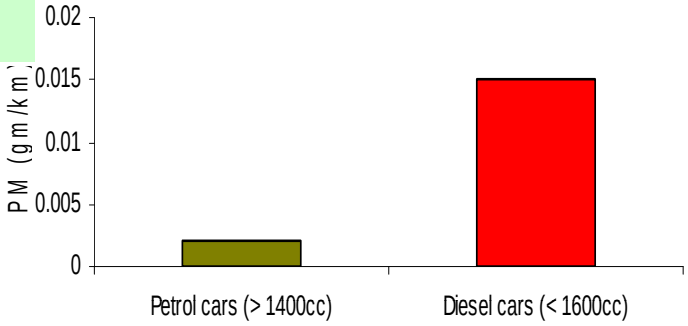
Source: MP Walsh

Toxic risk of diesel emissions

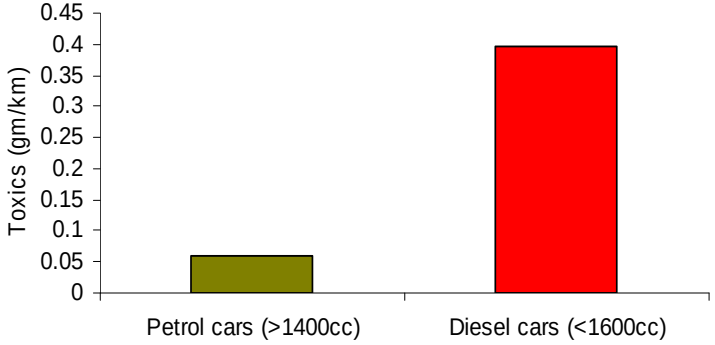
NOx



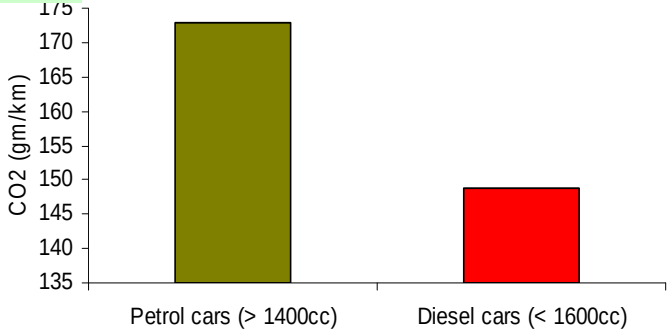
PM



Toxics



CO2



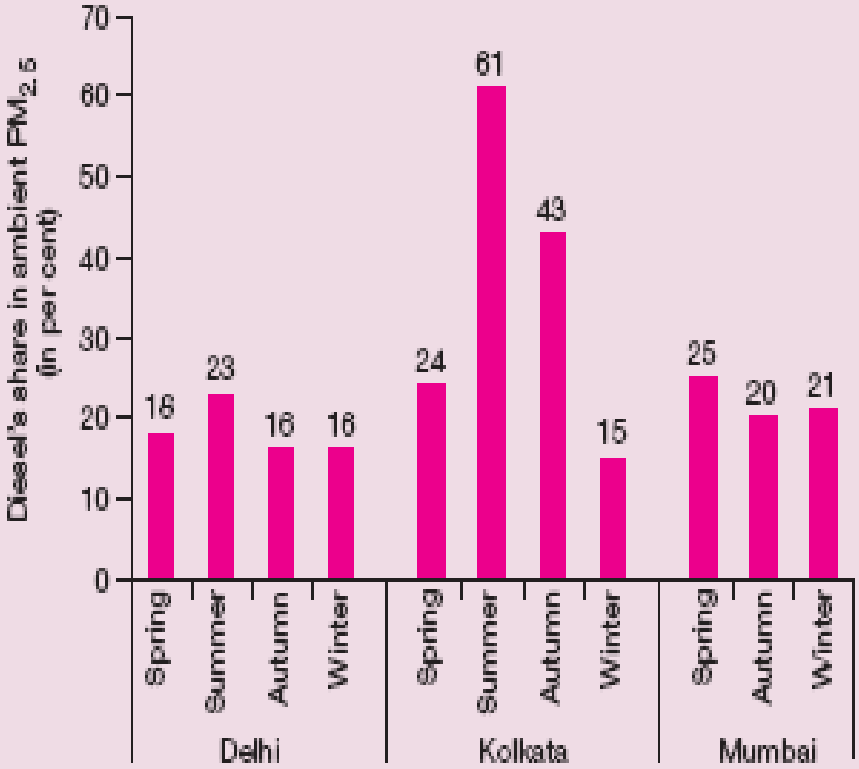
Emissions vs efficiency remains unresolved in India……

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



Breaking industry resistance with science

Convoluting science

"...(the) threshold for the onset of the health effects has not yet been detected for particulate emissions. This means that the safe levels have not yet been identified which is totally different from stating (as EPCA has done) that there is no safe level of particulate pollution."

—-Major automobile manufacturer, Supreme Court affidavit, October 99

WHO clarifies

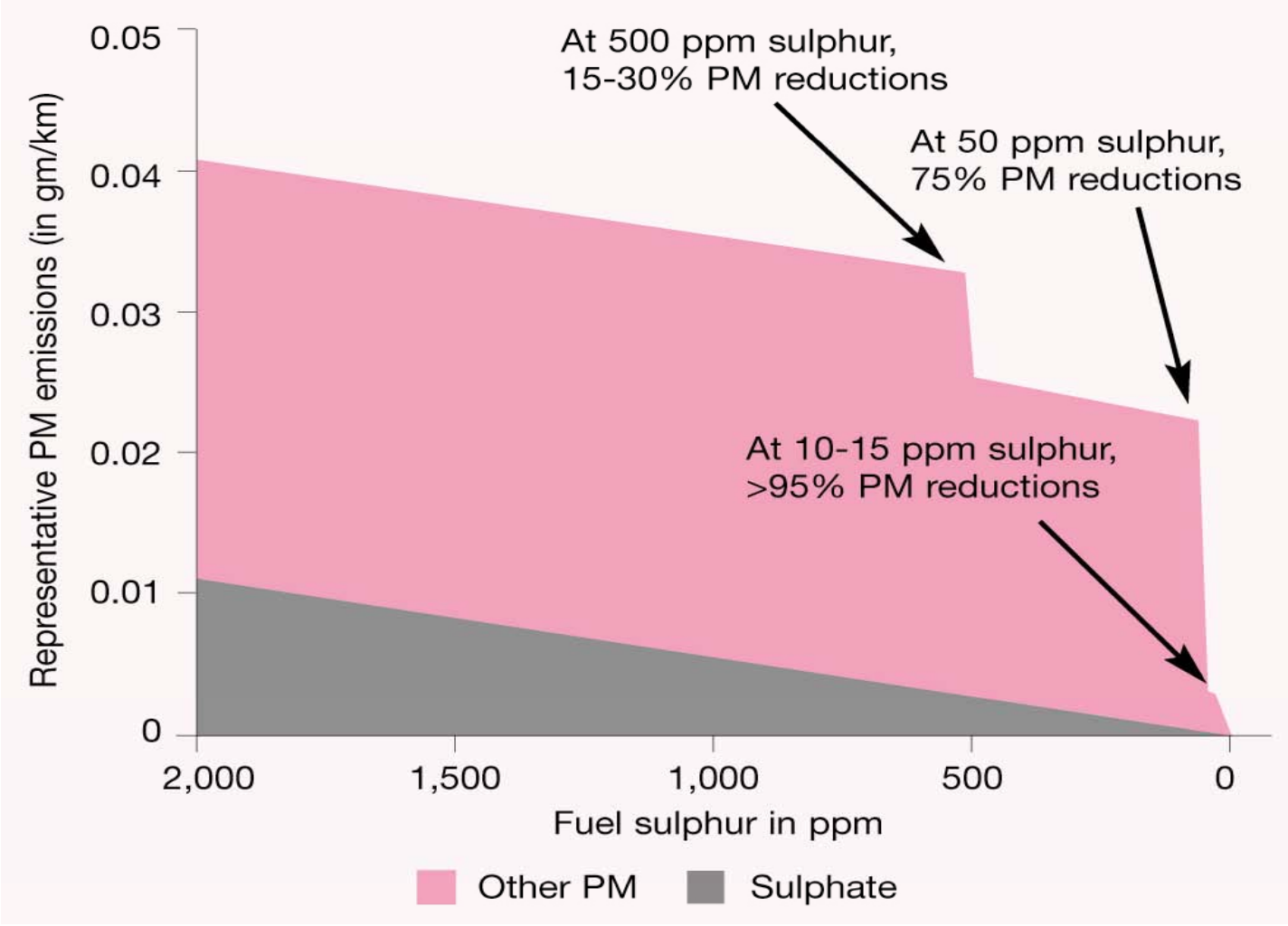
"This interpretation is certainly not correct. Effects occur at any concentration. There is no threshold for the onset of the effects meaning that for each concentration of particulate matter, there are already observed effects, starting from the lowest concentration of about 10 microgrammes per cubic metre and going to 150-200 microgrammes per cubic metre."

— WHO Expert, October 99

The challenge

Be on top of information to counter disinformation.

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

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.

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.


Finally, it's bye bye diesel buses

By Shubhajit Roy
Times News Network

New Delhi: It's the end of the road for diesel buses in Delhi. From Sunday, the city will have only CNG buses plying on its roads.

The last batch of about 400 diesel buses will be phased out on Saturday. There are about 7,400 CNG buses plying on Delhi roads.

As on December 1, the entire public transport fleet in Delhi will run on CNG. "Among 40 cities with CNG vehicles in the world, Delhi has the highest number of CNG vehicles," said Delhi state transport minister Ajay Maken. There are about 4,000 mini-buses, 15,000 taxis and 45,000 autorickshaws in the city.

GREEN RUN

- 280 diesel buses go off the road after November 30,2002
- In total 900 diesel buses will be phased out.
- 7,400 CNG buses are plying on Delhi road.
- 2141 CNG run DTC buses are plying in the city
- 1000 more CNG buses will be introduced by DTC by June 2003.
- About 4,000 mini buses, 15,000 taxis and 45,000 autos are running on CNG.

To curbed to reduce further pollution.

The phasing out of diesel buses has taken place over a period spanning the last eight months. After the apex court cracked its whip in April, the Delhi government reached phasing out diesel buses at the rate of 900 buses a month. In this manner, more than 6,000 buses were phased out since April.

Now, the owners of the last batch of buses will have to show a proof that they have bought a bus chassis. "Only after they produce documentary evidence, we will give them the permit to bring in buses in two months," said transport commissioner Bhaskaracharya Khuillar. It takes about 60 days to build the body of the bus over a chassis.

The victory of the clean air campaign

Source: Teri

SC refuses to extend deadline

Legal Corespondent

New Delhi

THE SUPREME Court on Thursday rejected applications of the Union Government and Maruti Udyog Limited (MUL) seeking an extension of the deadline for implementing stricter emission norms in private non-commercial vehicles in the National Capital Region (NCR).

A three-judge bench, comprising Chief Justice A S Anand, Justice B N Kirpal and Justice V facing many difficulties. He adde that though the apex court order required in the first place the com pliance with Euro-I standards from June 1, restrictions on the registration of the vehicles had been imposed from May 1 itself which in effect advanced the deadline.

Mr Raval pleaded that the apex court order meant sudden switch-over of technology but it could be implemented in a phased manner as authorised testing agencies were not equipped to approve prototypes of automobiles in a short pe-

Public debate….Media attentive

Delhi Govt wrong, there's enough CNG, says Centre

Vipul Mauthyal
New Delhi

THE UNION Government has pooh-poohed Delhi Government's contention that there is not enough gas supply or stations in the Capital to meet the demands of CNG-run vehicles currently operating in the city.

Claiming that CNG stations are "well equipped" to meet the demand, the Union Ministry of Petroleum and Natural Gas h argued that the queuing of veh cles at the filling stations is pr marily on account of autoric shaws.

"The demand of Commerc

Natural Gas for TSRs has increasingly gone up because of the pricing advantage, and not necessarily under the orders of the Supreme Court," the Union Ministry has submitted.

Since CNG turns out to be a cheaper option than petrol under the ongoing administered price control mechanism, autorickshaw owners prefer the gas and don't mind spending long hours waiting in queues to earn maximum profits in the city.

The Union Ministry has said that CNG-dispensing stations, set up as per the initial demand forecasts, are "well equipped to meet the demand" of CNG buses that are already plying in the city.

Outlining its plan to provide "the maximum relief possible" to both vehicle operators and commuters/passengers, the Union Ministry has proposed to strengthen the infrastructure

mode, and never attempted to do it at one go. The Delhi Government had, without conducting any survey or feasibility study, given an undertaking to the court that it was ready and willing to shift the entire public transport system to Only-CNG mode. Criticising the Delhi Government for its decision, the Union Ministry highlighted the fact that the European model of vehicular emission

emission needs to be considered."

"In the developed world, including Europe and North America, vehicular emission standards and auto fuel quality necessary to meet the standards alone are prescribed. It leaves the choice to manufacturers, owners and operators of motor vehicles to choose the vehicle type and the

must experience. "Because of higher initial and subsequent maintenance costs of CNG vehicles, the gas' lower energy efficiency (compared to diesel), non-competitiveness vis-a-vis liquid fuels in the market-determined pricing scenario, higher cost of distribution and dispensing, higher safety requirements and up

If your heart bleeds for this...

...these are the ones with blood on their hands

TRIPLESPEAK

RAM NAIK
Petroleum Minister

He has mastered the art of gobbledegook, often triplespeak. His views change by the week. He has been moving away from CNG, grumbling about shortage of gas, gas wells drying up. He has suddenly begun championing the cause of low sulphur diesel. In his latest buckmunch, he has argued the case of LPG. His contention: Single fuel is not the solution for Delhi.

NOT MY BABY

MAJ GENERAL B.C. KHANDURI
Minister of State for Road Transport

He is moving at a snail's space. His ministry has not yet enforced laws which would regulate CNG operators and ensure safety of vehicles. The legislation is in a limbo and awaiting approval in one of the Houses of Parliament. His ministry is tied in knots itself over the red tape around the CNG conversions.

I DON'T CARE

PARVEZ HASHMI
State Transport Minister

His important ties in separating his jurisdiction from that of the Centre. He shrugs and says his responsibility is over after ordering 1,000 buses for the Delhi Transport Corporation (DTC). Six months ago, the Delhi state Cabinet decided on subsidy support to private bus operators for buying new CNG buses. He was forgotten all about it.

BLACKMAIL

DELHI PRIVATE BUS OPERATORS FORUM

Their excuse is that they are caught between two governments. They are making most of this interim period between two timeframes. Not a single private bus has converted to CNG in the last four months. Their excuse: No technology available for conversion. They are crying about safety and are demanding back the advance paid to Anglo Technologies.

CSE releases report on pollution

THE CENTRE for Science and Environment (CSE) on Monday released a report blaming vehicular emissions for the Capital's pollution-related woes. Titled "Slow Murder: The Deadly Story of Vehicular Pollution in India", it pegged the amount of pollution from the vehicles at 64 per cent. CSE Director Anil Agarwal said, "Polluting industries can be shifted out, but the city is stuck with its vehicles whose numbers continue to grow at an alarming rate." To better inform the citizens of the evils of vehicular pollution, the CSE will also launch an exhibition at the National Museum for Natural History, Tansen Marg.

CSE blames Naik for CNG crisis

BY OUR CORRESPONDENT

New Delhi, Aug. 9: The Centre for Science and Environment, a city-based NGO, has accused Union minister for petroleum and natural gas Ram Naik for the CNG crisis in the city.

CSE chairman Anil Agarwal said the crisis had been built up slowly and deliberately over the last six months.

CSE flays Mashelkar report on roadmap to achieve clean air

Pioneer News Service

New Delhi

CRITICAL OF the Mashelkar report on the roadmap for cleaning the air of vehicular pollution, an environmental group feels that the Union is enough evidence of people's health falling victim to critical levels of pollution, the NGO feels.

The policy says that most of the cities it targets will get Euro III standards, which are incrementally better than Euro II, in 2010. The CSE feels

available."

On the issue of alternative fuels, the Central Government's roadmap laid no time-bound action plan, despite the Supreme Court's directive to develop national action plan. "The roadmap pays a mere lip service to en-

Fuel adulteration on the rise: CSE

NEW DELHI, Nov 15 (UNI): Motorists in the satellite towns of Delhi face the risk of damage to their car engines due to a shockingly high level of adulteration in the fuel used by them.

period due to rampant adulteration led the companies to conduct a study on the level of fuel adulteration.

At the initiative of the car companies, when the research and development

problem of fuel adulteration in Delhi.

According to the CSE, lax fuel standards that allow a wide range can easily cushion some amount of adulteration. It is possible to adulterate 'intelligently'

Pollution checks bogus, says CSE

HT Correspondent
New Delhi, April 8

DESCRIBING THE current pollution test procedures for securing Pollution Under Control (PUC) certificates as a farce, the Centre for Science and Environment (CSE) has lambasted the Union Government for failing to put in place an effective system to test polluting vehicles.

At a press conference in the Capital, CSE functionaries said that the current standards and

WORTHLESS?

- Only Carbon Monoxide levels are checked in petrol vehicles. This can easily be lowered by adjusting the air-fuel mixture to a lean range
- For diesel vehicles, PUC operators asks drivers to press the accelerator very lightly thus lowering emission levels
- Same standards are followed for all vehicles regardless of age and technology

Action on in-use vehicles…..

- **Move to upgrade in-use vehicle inspection in Delhi**

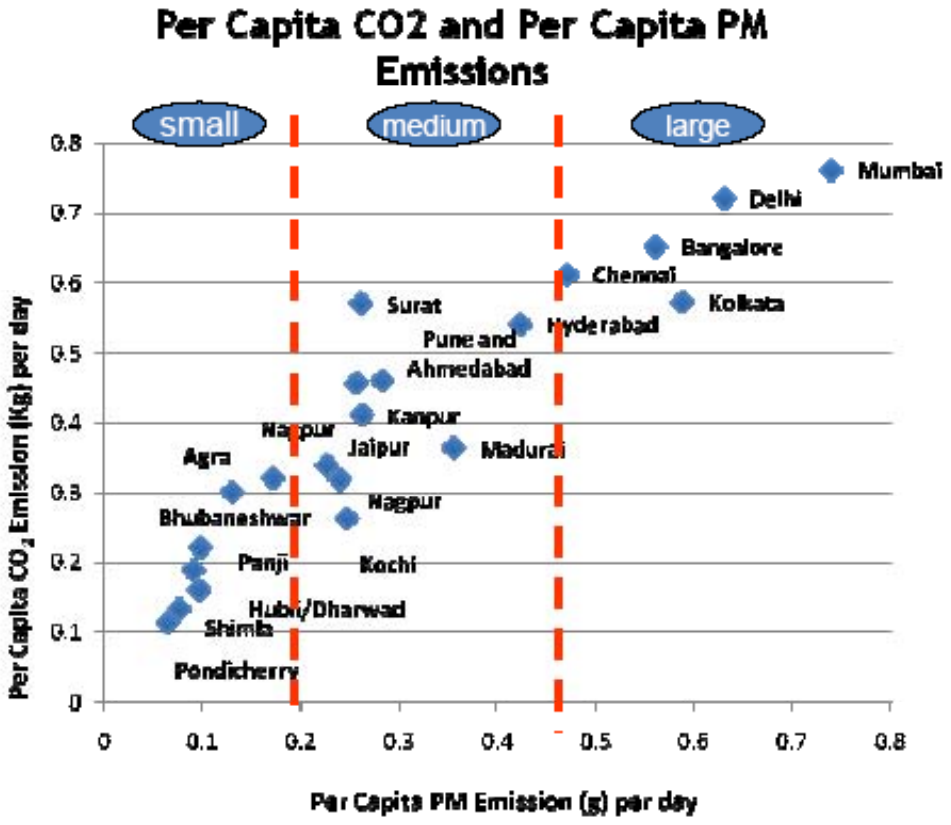
- System upgrades and norms revisions
- Lambda implemented
- Audits networking
- Specially designed inspection of CNG buses
- High volume centralised test centres for commercial vehicles
- Check malpractices
- Diesel vehicle testing needs upgradation

Colombo has 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

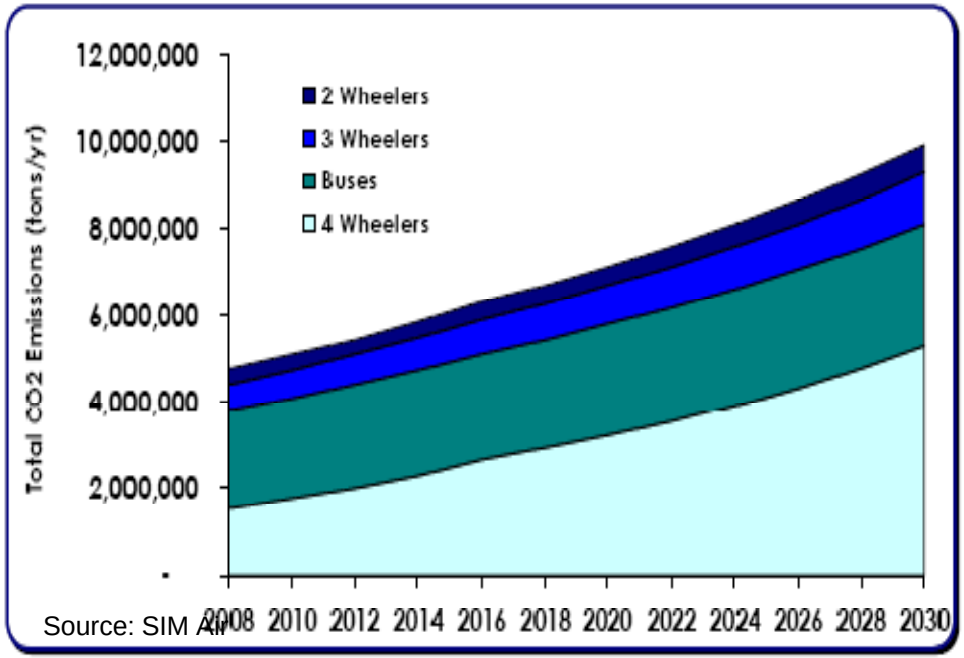
- Indian cities show strong correlation between emissions of air pollutants and GHGs
- As cities grow in size, transport emissions increase
- Importance of catching cities early before they start to grow.

Source: KCAI ASIA 2008

Vehicles threaten energy security in India

--If the dependence on personal vehicles continues to increase in India, transport oil consumption will increase thrice by 2030 with largest increase expected from four wheelers.

Total vehicular CO2 emissions by categories in Kolkata



Source: SIM Air

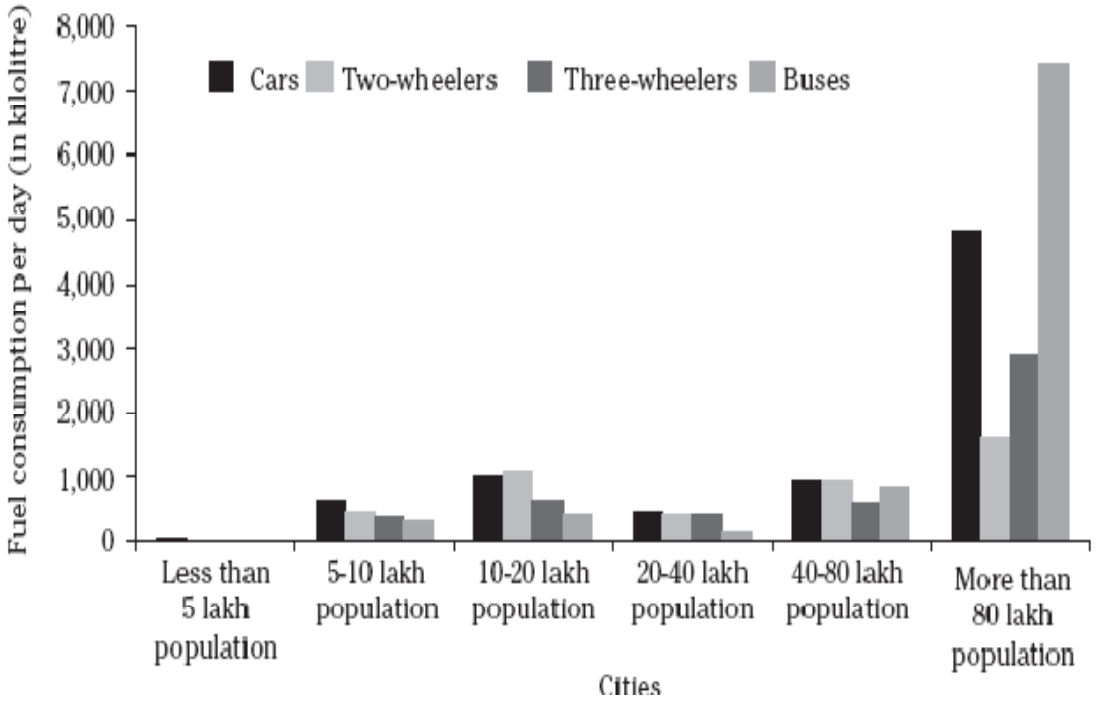
Car centric growth encourage fuel guzzling

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

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

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

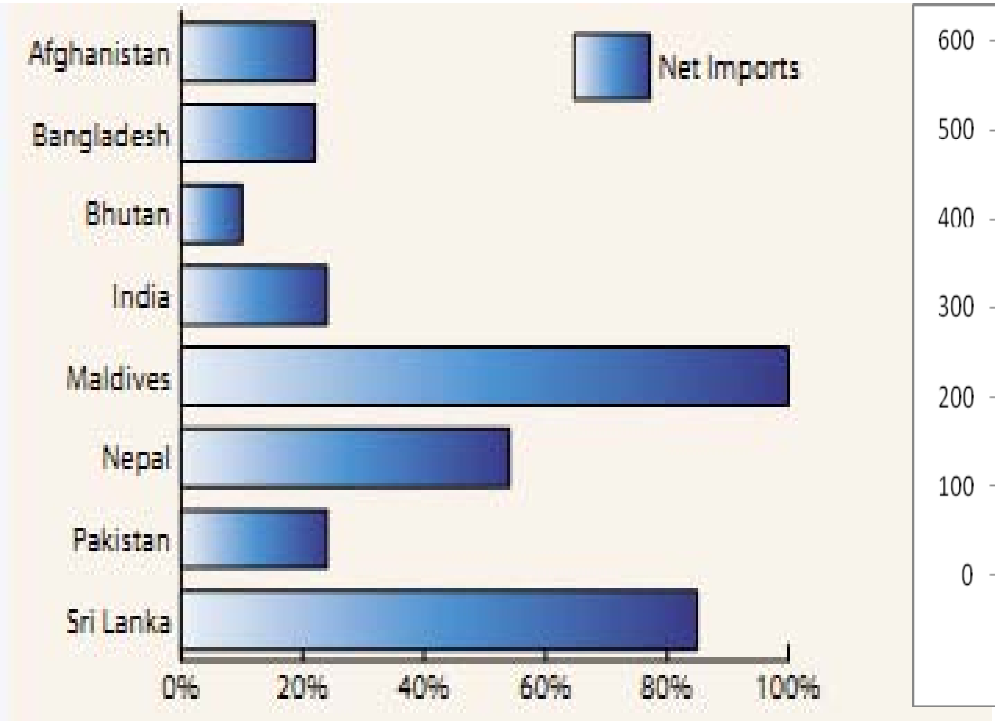
Fuel consumption per day in different classes of cities



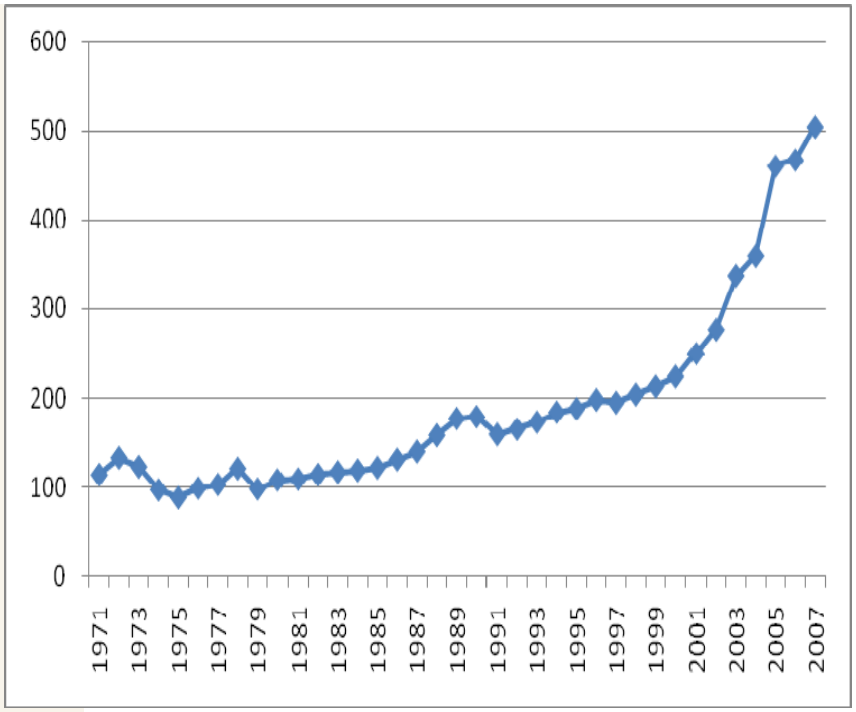
Source Based on Wilbur Smith 2008

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

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

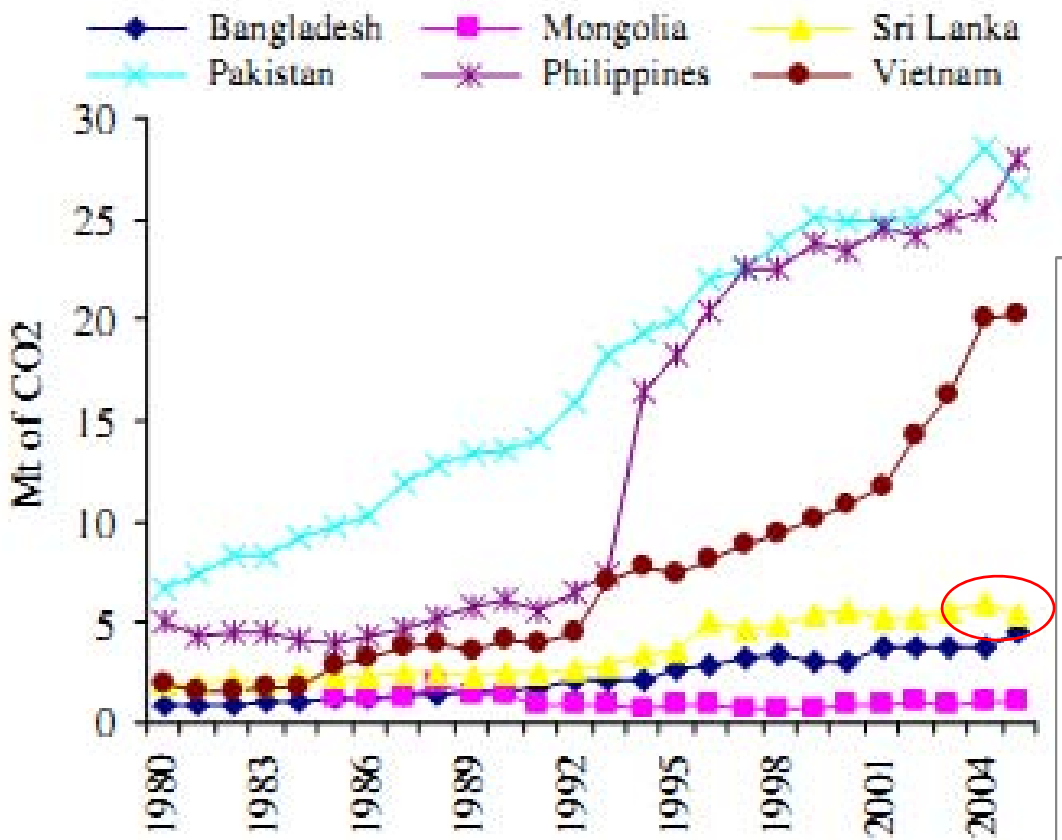


Sri Lanka - road sector petrol fuel consumption (kt of oil equivalent)



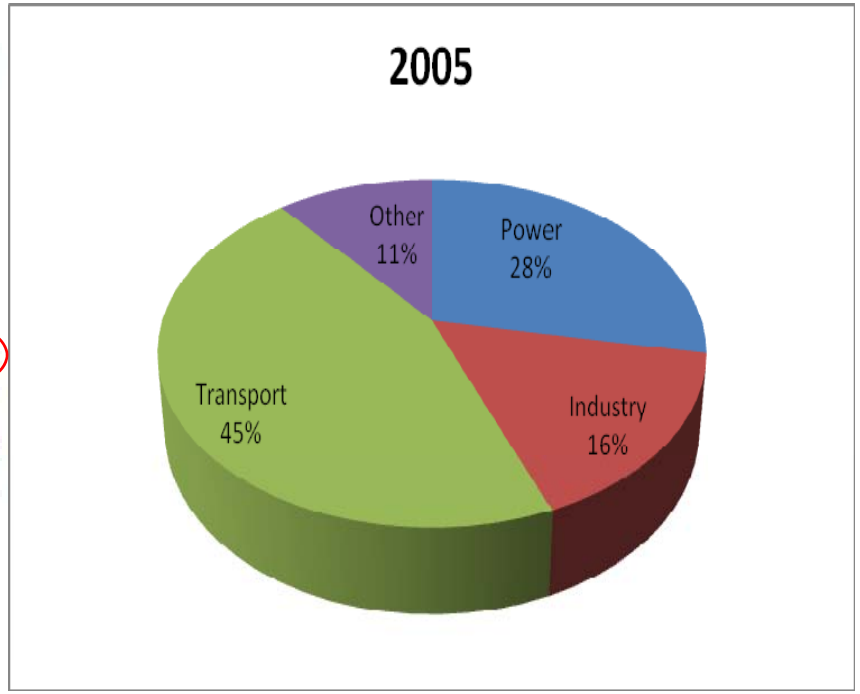
Source: *Source: International Road Federation, World Road Statistics and electronic file and IEA*

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



The subtle link between local air pollution and warming….

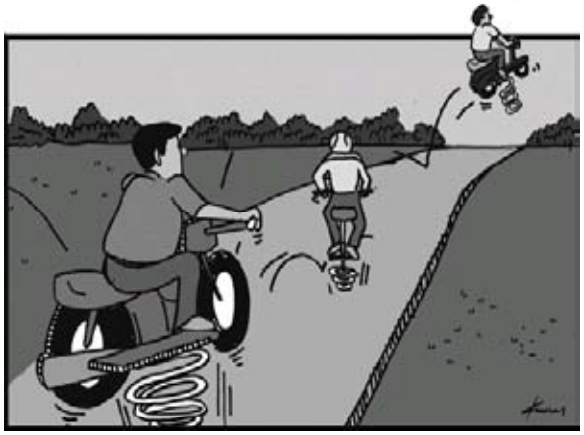
- **Local pollution can enhance the warming effects….Eg,** HC + NOx lead to regional ozone but also to background hemispheric ozone; CO becomes CO2 but consumes OH radicals along the way increasing CH4; Diesel PM increases PM10 & PM2.5 & ultrafine PM but also black carbon

- **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)

Diesel cars can also make us more energy and climate insecure. How?

- Cheaper diesel fuel encourages bigger and more powerful cars. Eg, --
  - Due to higher gasoline prices 85% of the gasoline cars sold in India have less than 1200 cc engines
  - But 64 % of diesel cars are just under 1500 cc and the rest above.
- Diesel fuel has higher carbon content than petrol. If more diesel is burnt encouraged by its cheaper prices and more driving, more heat-trapping CO2 will escape.
- Black carbon emissions from diesel vehicles are several times more heat trapping than CO2 and this nullifies fuel efficiency gains.
- Europe has found that with increased demand for diesel energy consuming refining process will expand to increase the share of diesel from each unit of oil refined. CO2 emissions from the upstream refining process will increase. This negates the benefit of shift from petrol to diesel cars.
- European Commission has calculated the difference in lifetime pollution costs of Euro IV compliant diesel car and petrol car. Total pollution cost of a Euro IV diesel car is 1195 Euros vis a vis 846 Euros for a petrol car. This nullifies the marginal greenhouse gas reduction benefit of diesel car and costs higher to the society.

Two-wheelers: Asian dilemma

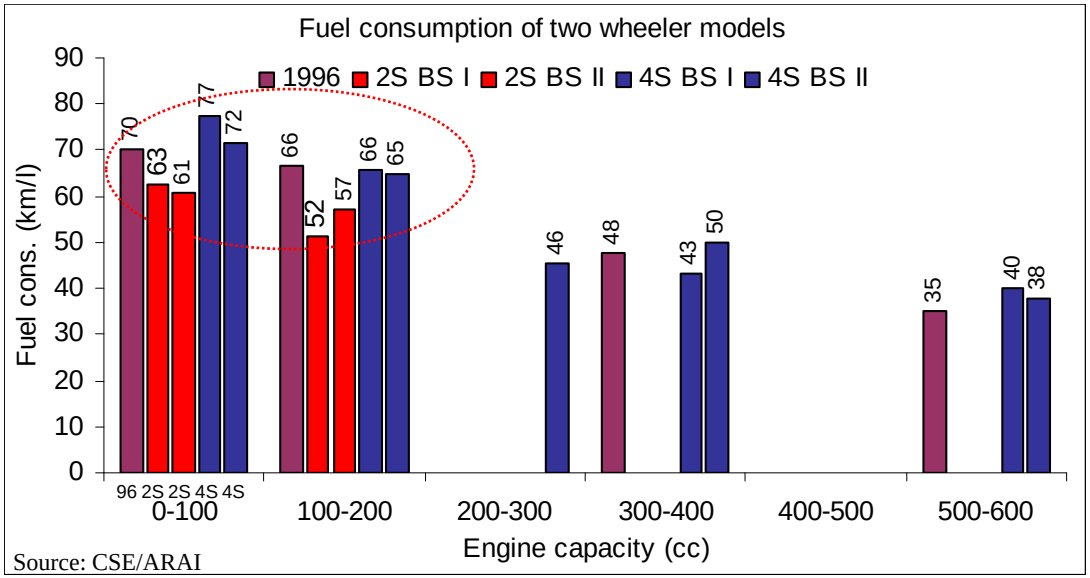


Today two-wheelers are more polluting than cars

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).



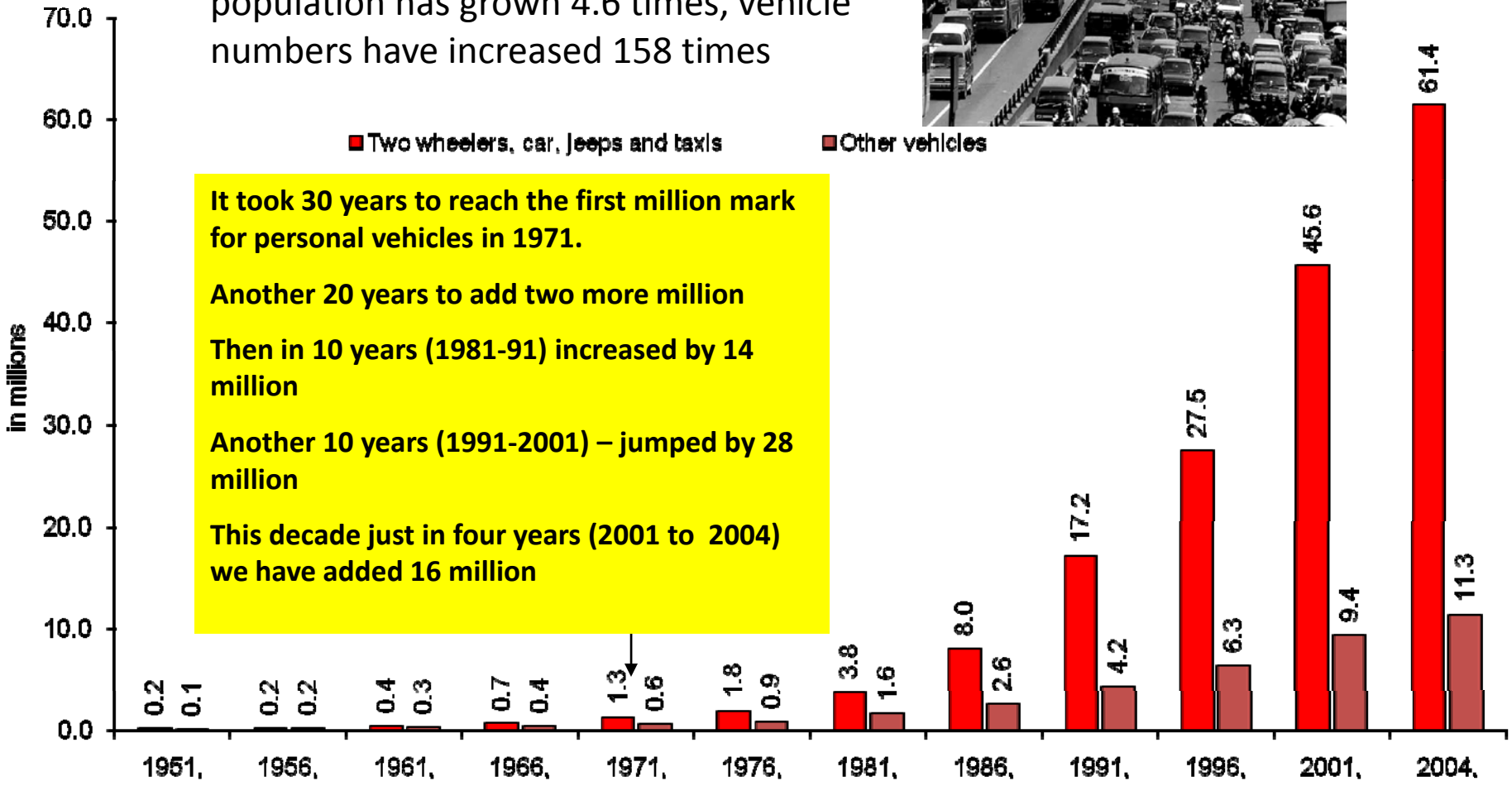
Source: CSE/ARAI

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



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

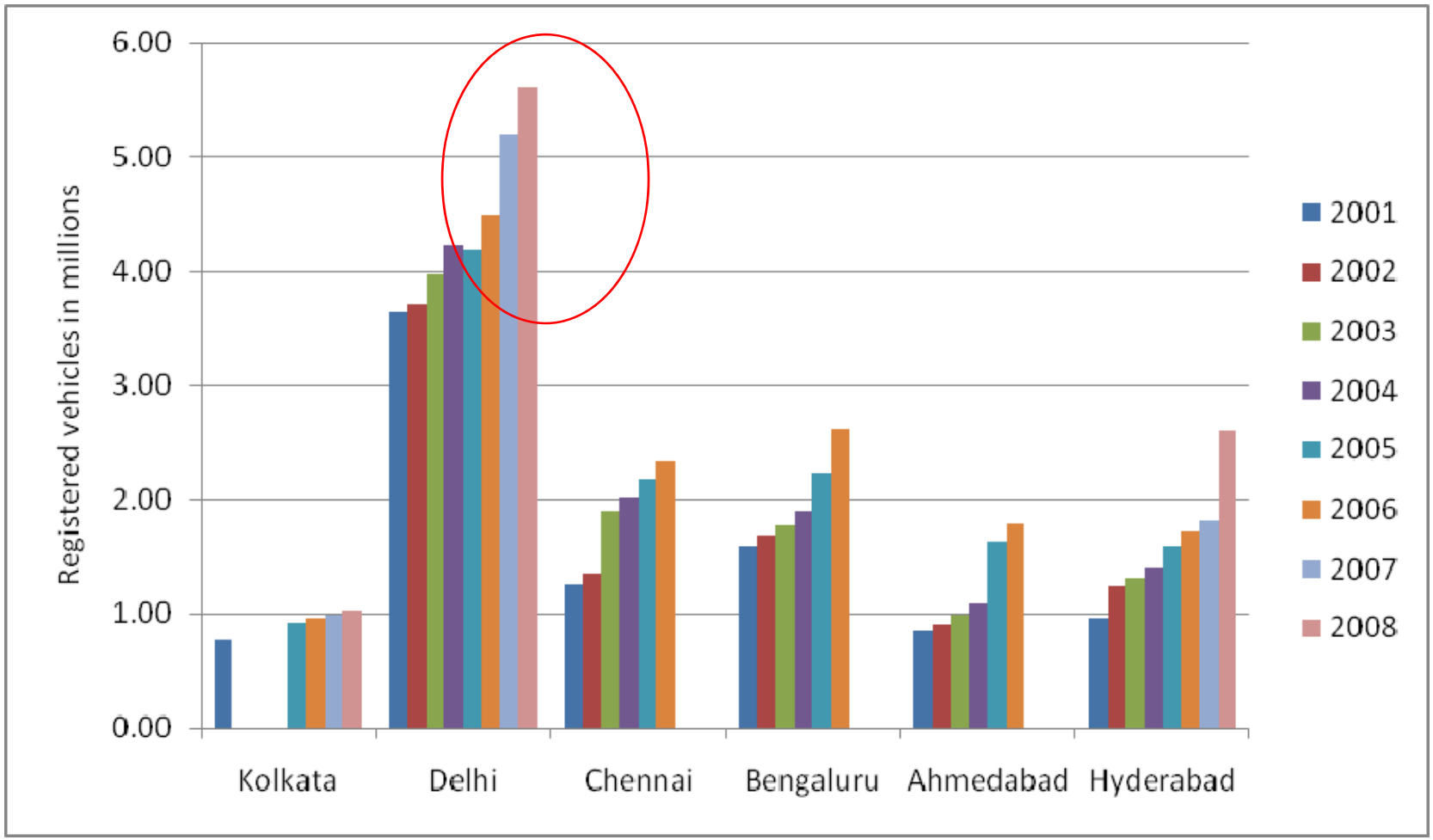
Another 10 years (1991-2001) – jumped by 28 million

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

Galloping vehicle numbers in Indian cities

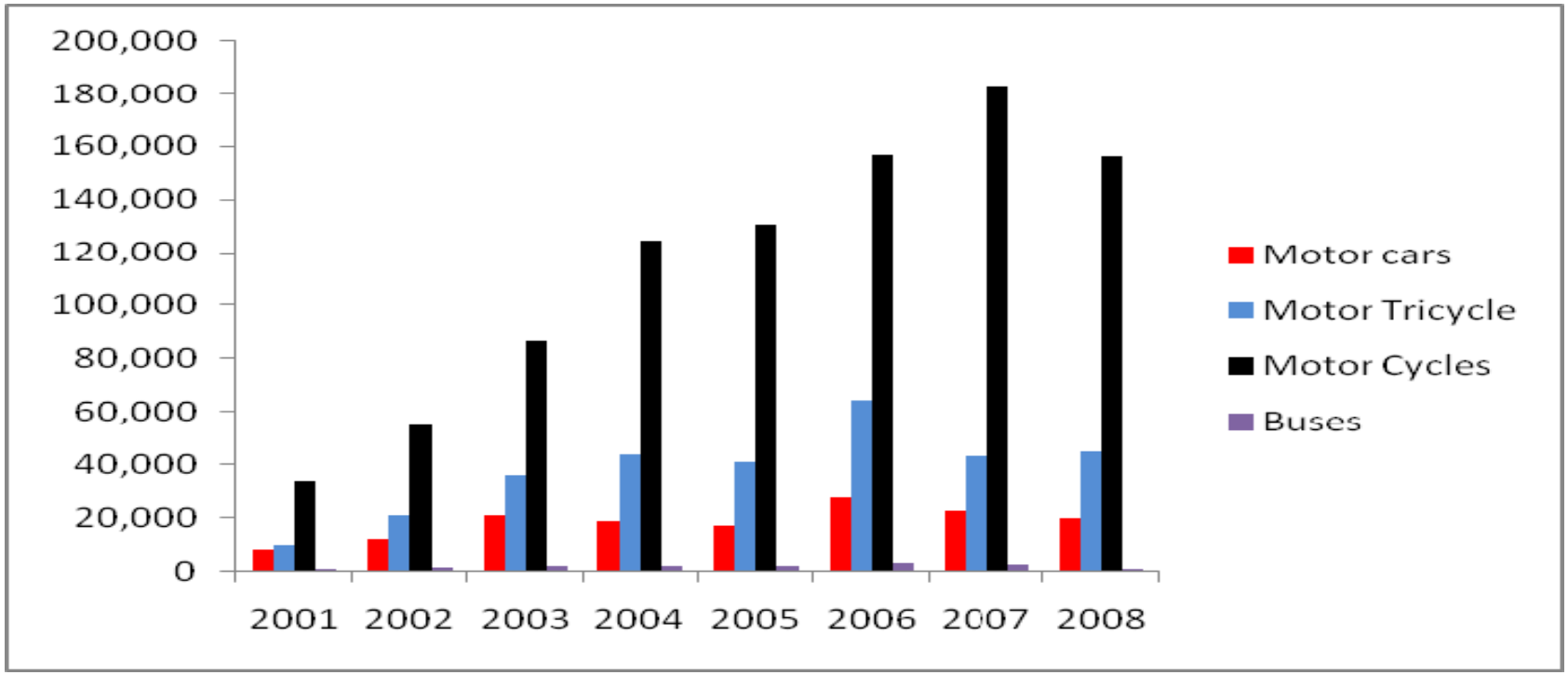
Vehicle registration in selected cities



Source: Compiled from statistics by transport departments and Road transport year books of Ministry of road transport and highways, Delhi

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

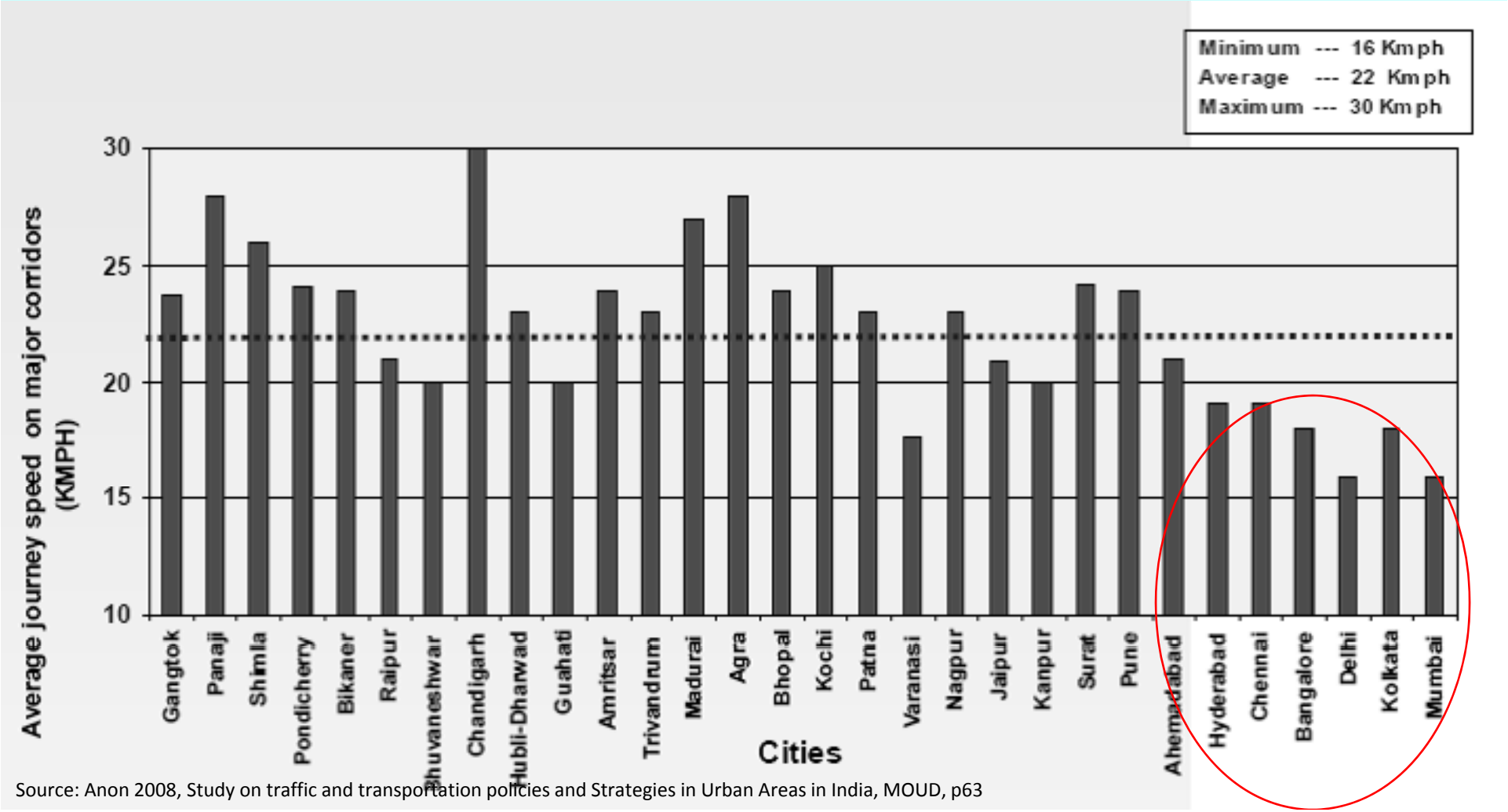


Source: Department of Motor Traffic, Colombo

Indian cities are paralyzed

The Crawling Traffic

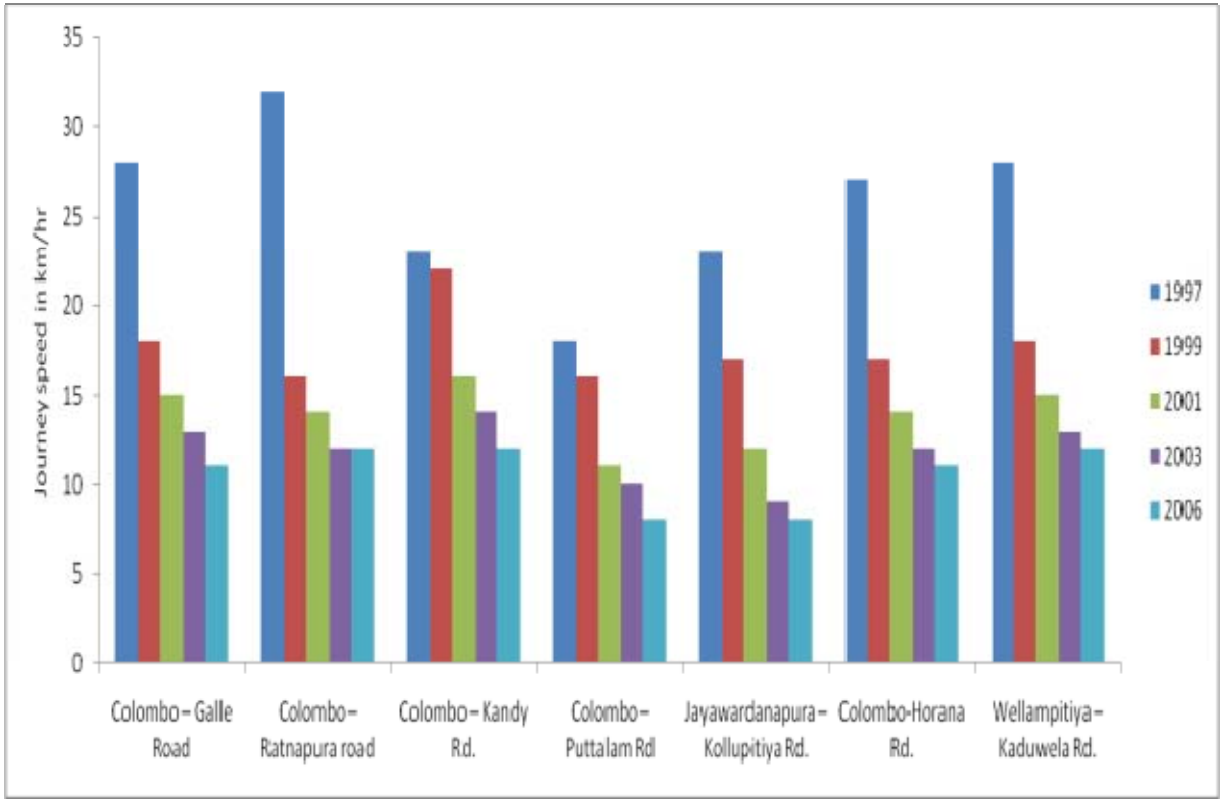
The average journey speed in Delhi (16 km/hr), Mumbai (16 km/hr) and Kolkata (18 km/hr): Abysmally poor compared to smaller cities



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

Speed (kilometer per hour)	Autos Change in emissions with speed (gm/km)			Buses Change in emissions with speed (gm/km)		
	CO	HC	NOx	CO	HC	NOx
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, Earthscam Publications Ltd, London

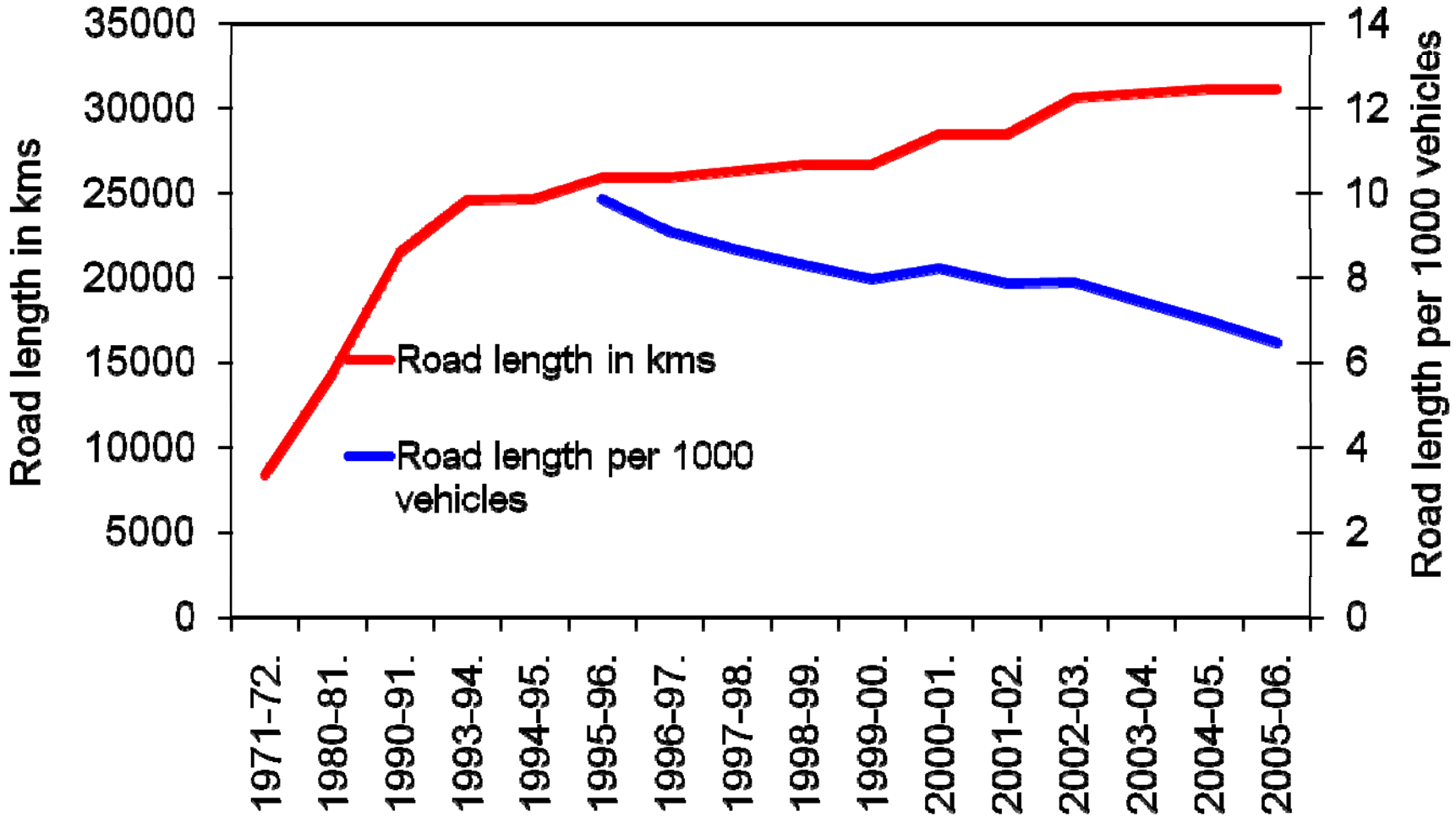
Vehicle Emissions vis-à-vis Speed

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

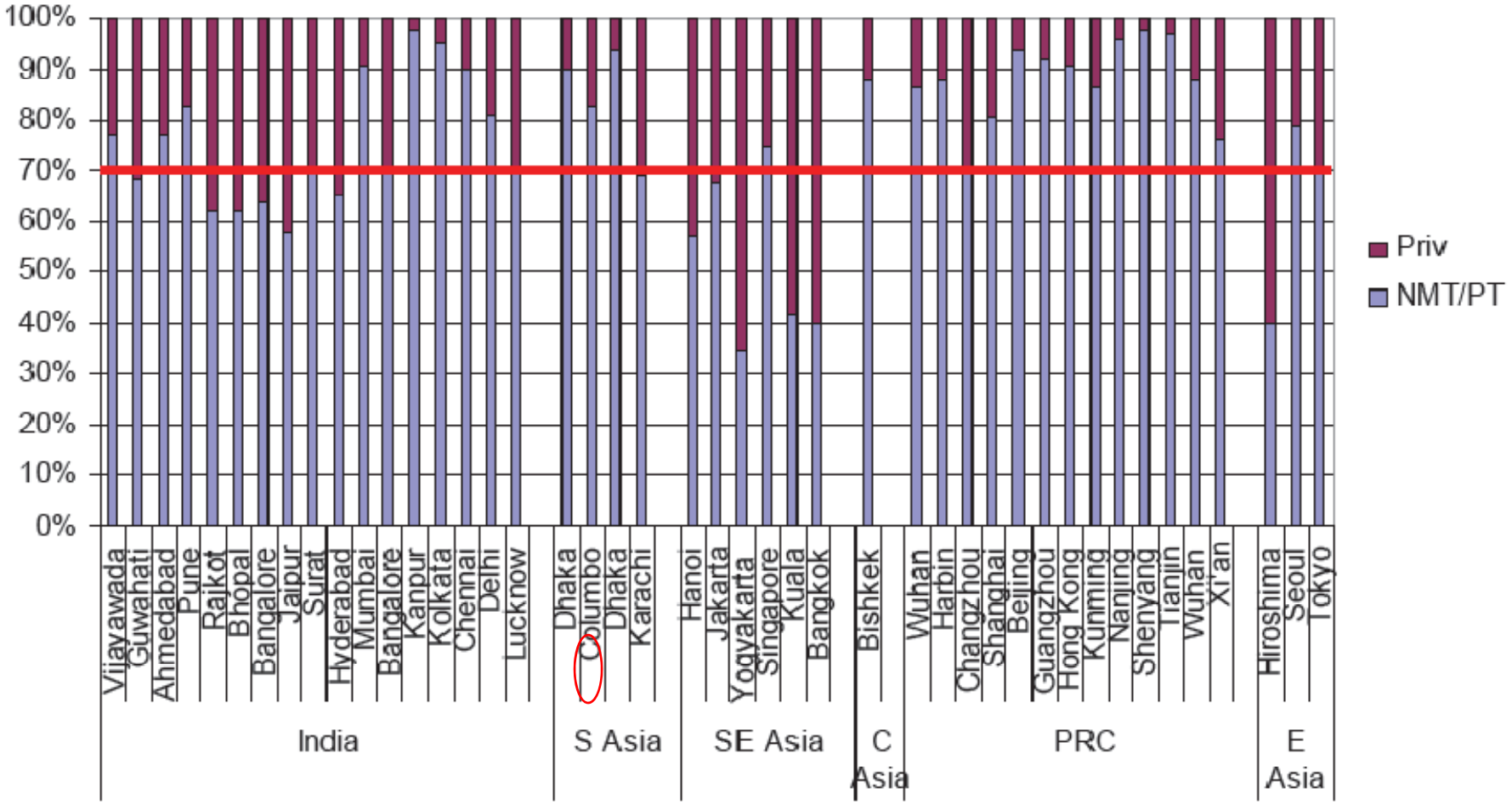
…… We can never build enough roads



Source: On the basis of Economic Survey, Delhi Govt

The second generation challenge ……

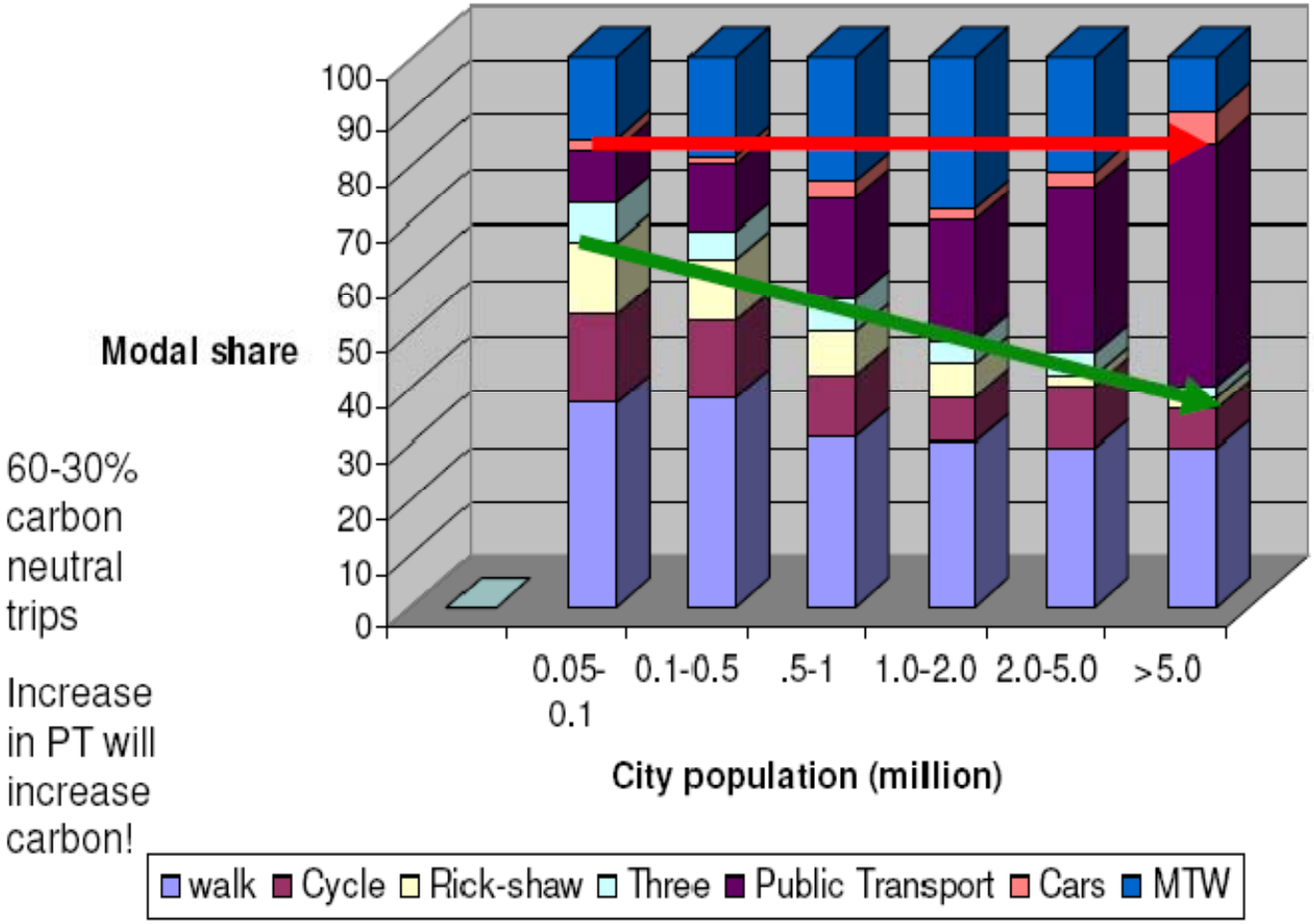
Understand the advantage of South Asia



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

Urban Mobility

PT and NMV based, MTW majority personal vehicles



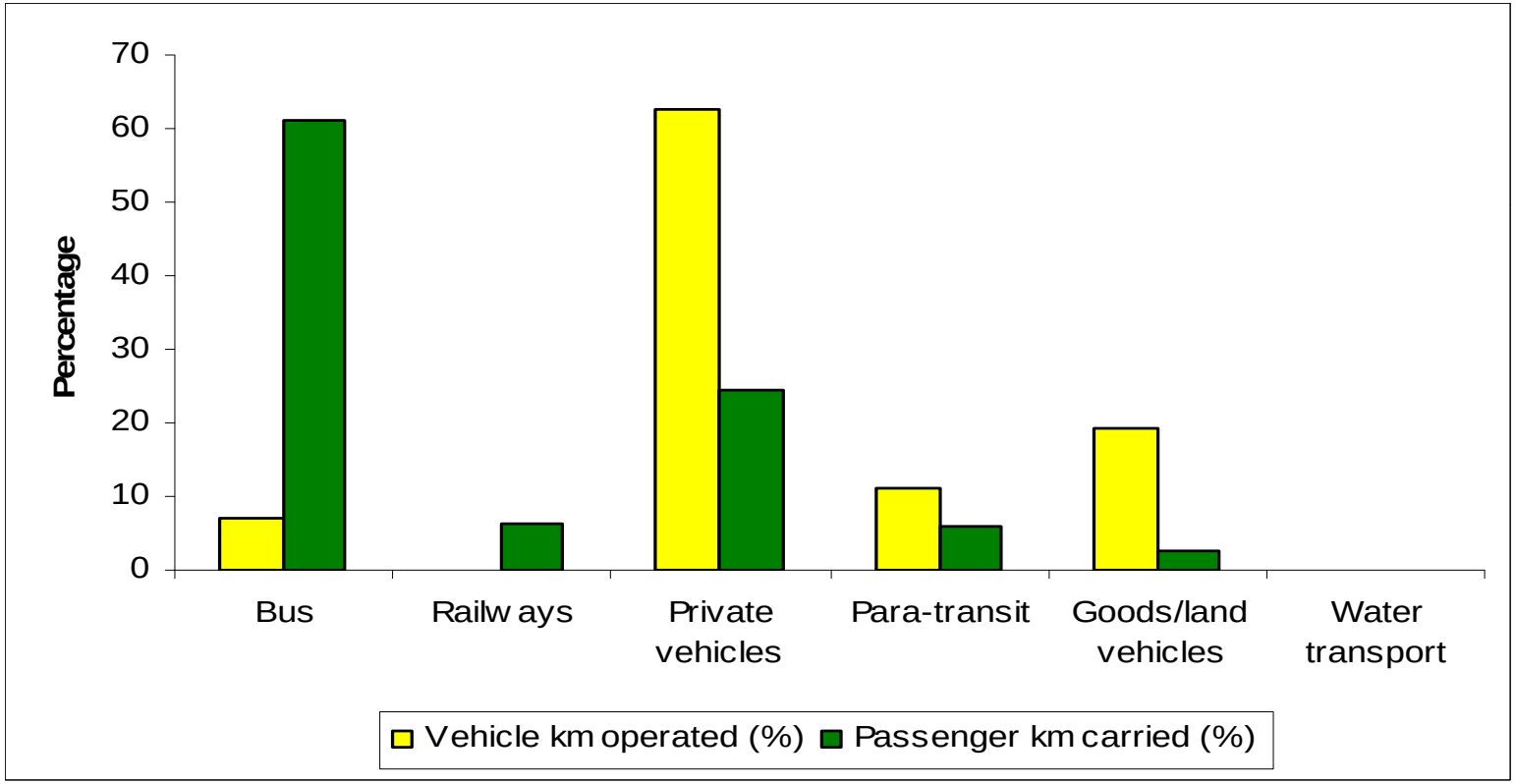
60-30% carbon neutral trips

Increase in PT will increase carbon!

Source TRIPP, 2010

Transport modal share in Sri Lanka (2007)

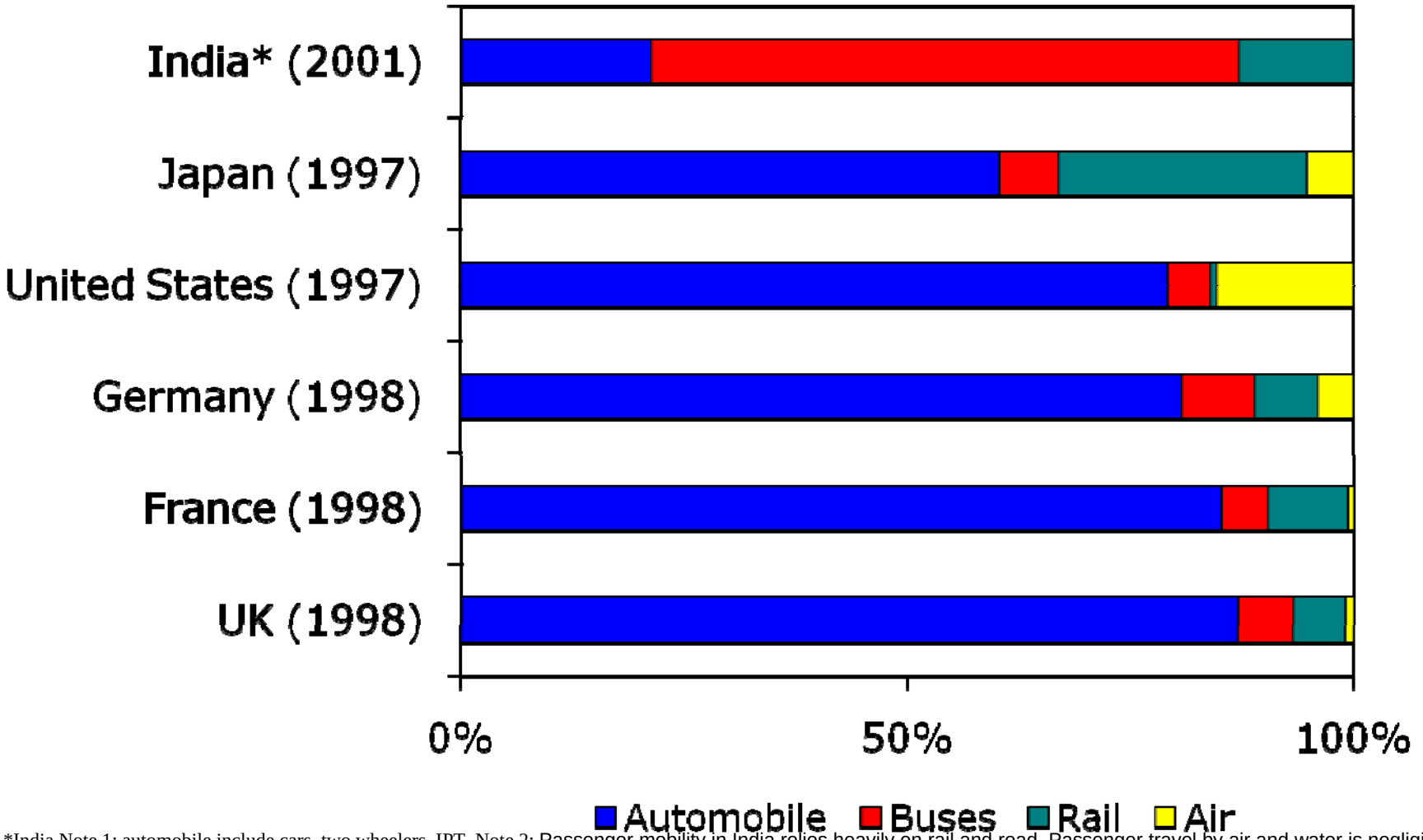
Bus is less than 10% of the vehicles kms but carries 60% of the passenger km



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

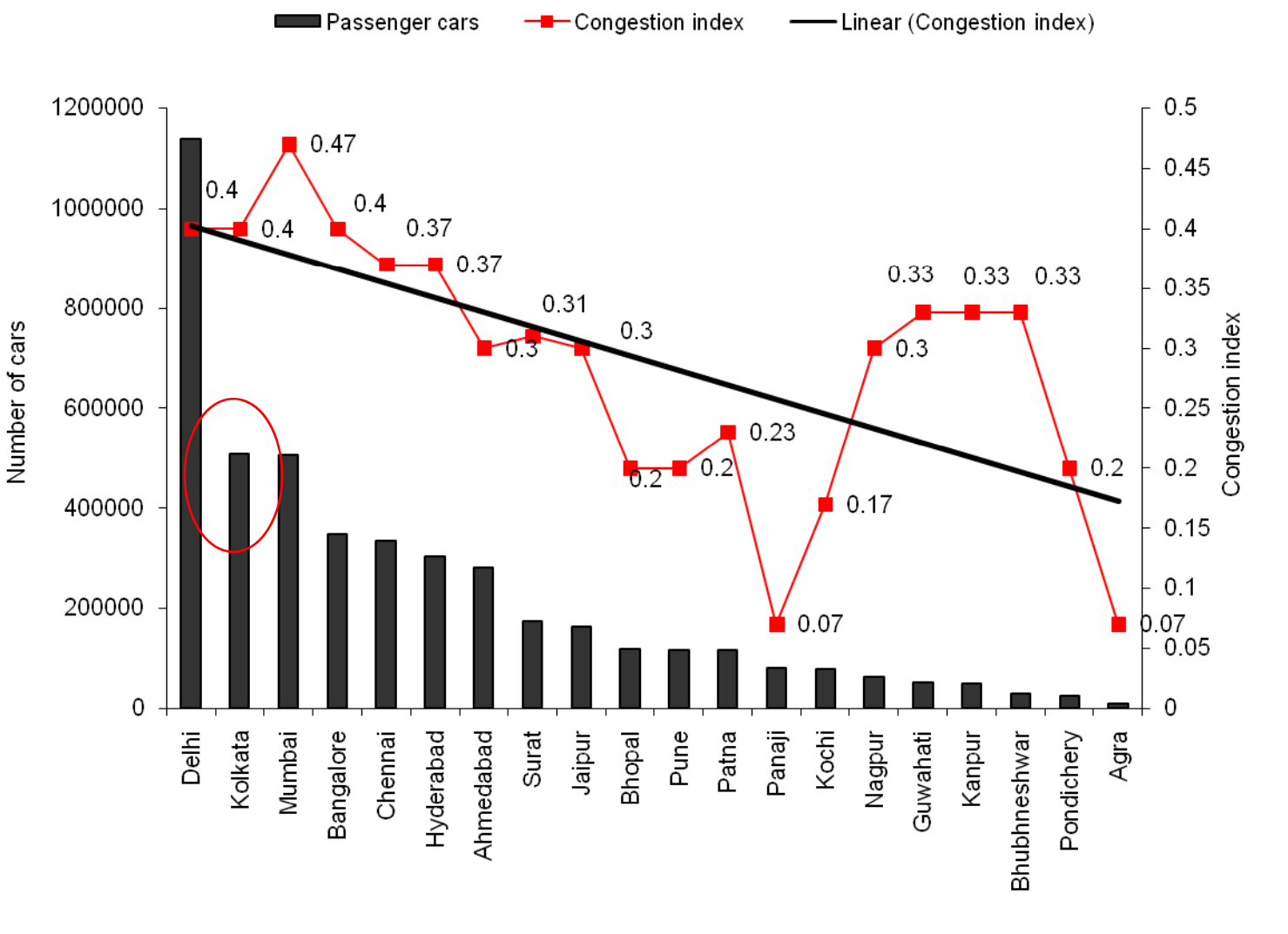


*India Note 1: automobile include cars, two wheelers, IPT. Note 2: Passenger mobility in India relies heavily on rail and road. Passenger travel by air and water is negligible in comparison to rail and road.

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

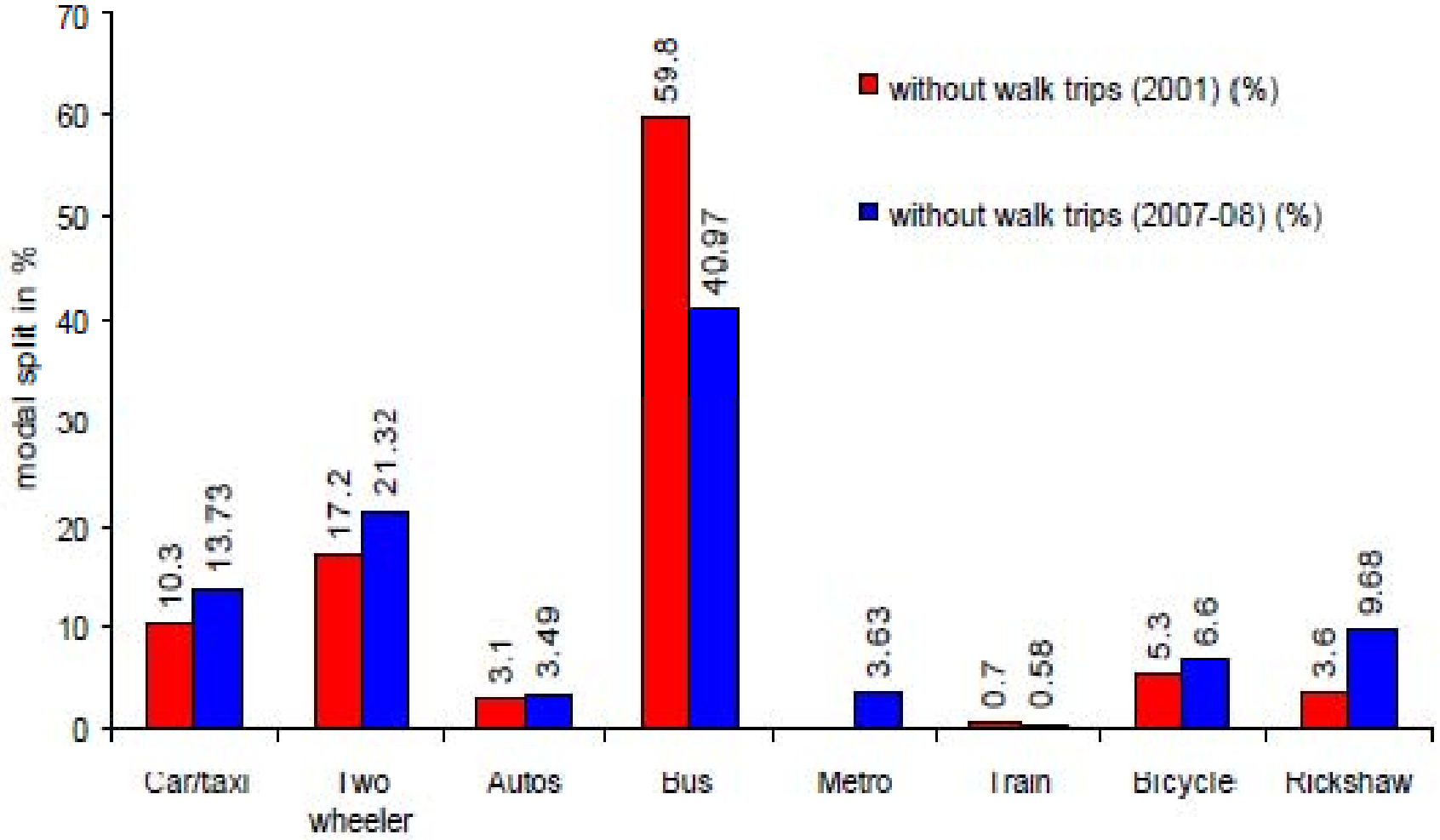
London

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

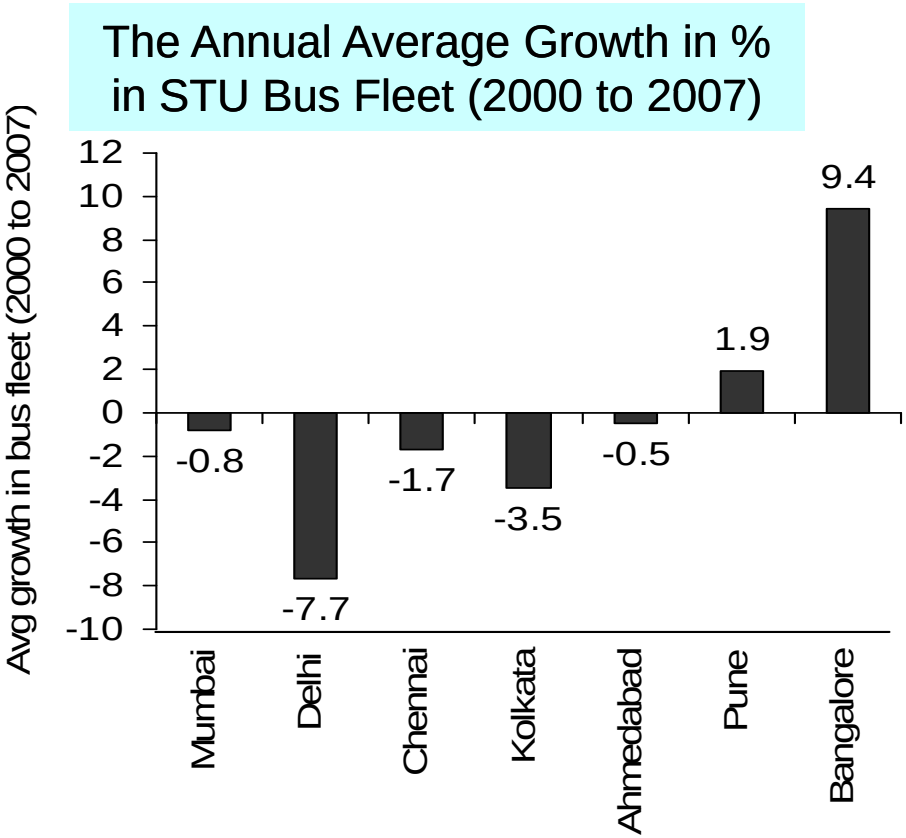


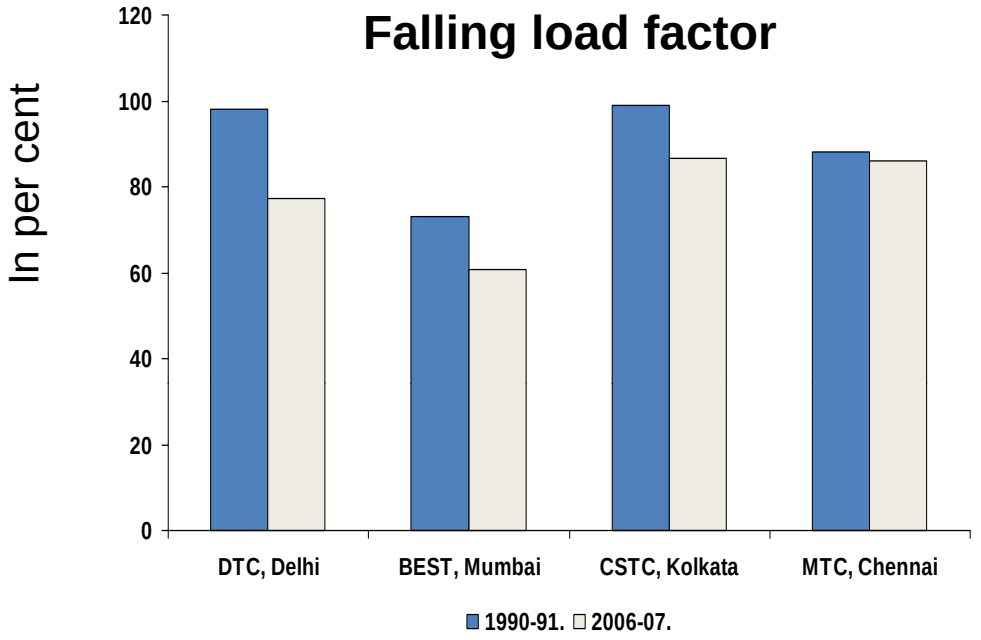
Source: Anon 2008, transport demand forecast study: study and development of an integrated cum multi modal public transport network for NCT of Delhi, RITES, MVA Asia Ltd, TERI, September

Challenges of rebuilding public transport

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

Reality Check….





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

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

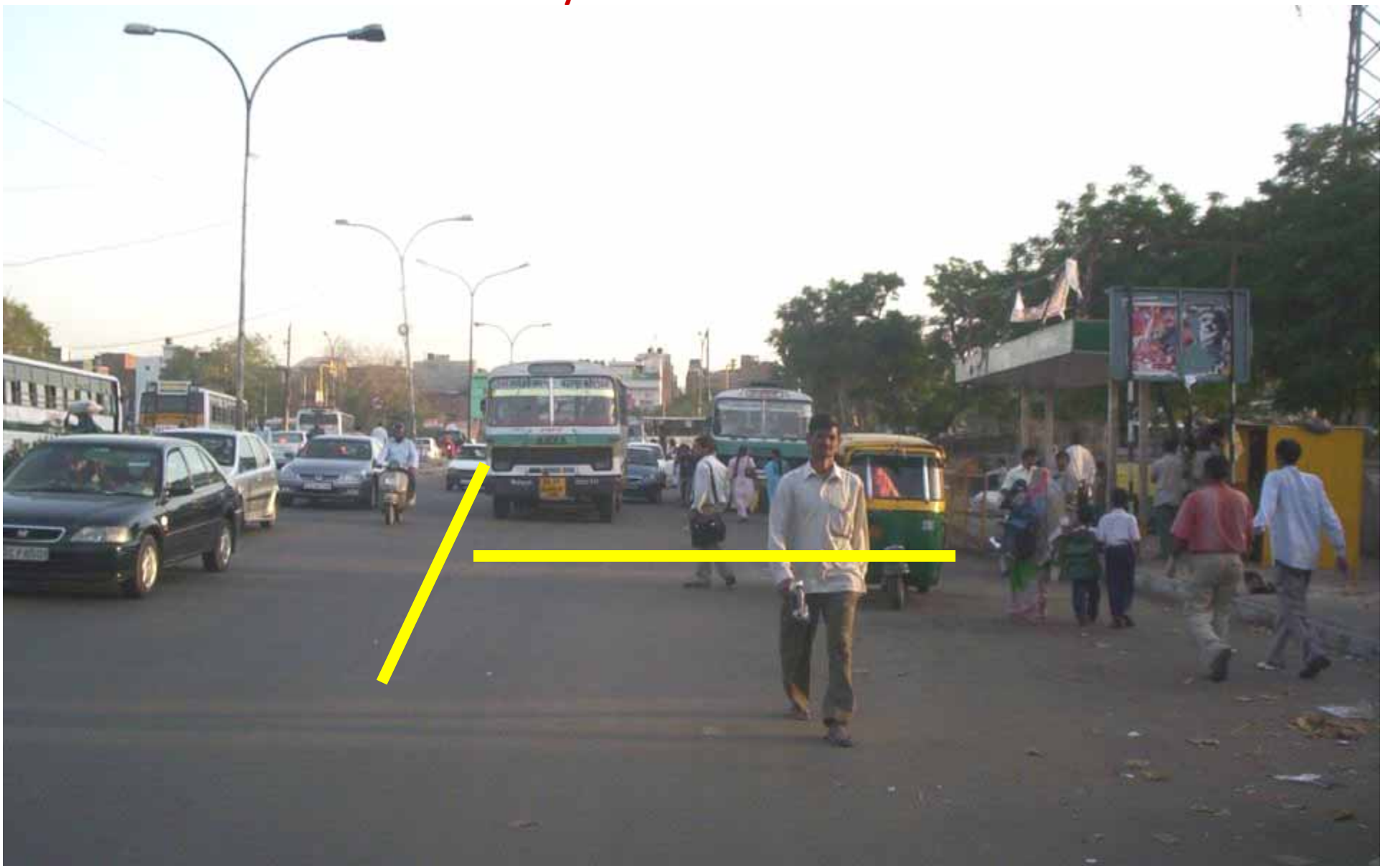
Bus transport can make a big difference…

- **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.**

- **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…..

Build public understanding
What were we reading in the newspapers?

- "Colossal inconvenience.."
- "Loss of trees…"
- "Bumper to bumper…"
- "Taking away lanes from private vehicles…."
- Bus karo…traffic in narrow lanes, snarled up, honking, hooting..
- "Weapon of mass dementia…"
- "Scrap BRT…"

But public opinion is changing

- Often the same newspapers also reported traffic jam in other roads -- But did not make the connection between the problem and the solution

City wastes Rs 11.5cr in traffic jams daily

Consumers Lose Rs 10cr: Study

Megha Suri Singh | TNN

New Delhi: Traffic jams in the city cost Delhiites Rs 10crore and the government exchequer Rs 1.5 crore per day, reveals a survey by Centre for Transforming India (CTI). With nearly 1,000 new vehicles being added to Delhi roads every day and the capacity of roads already stretched, experts feel the only way to bring down congestion levels is to develop a sound public transport system that commuters can shift to.

The traffic assessment study reveals that on any given day, one-third of the 60 lakh vehicles registered in the city are on the roads. Each of these, on average, wastes 1.6 litres (2.5 litres for cars and 0.75 litres for two-wheelers), which works out to a total wastage of 30 lakh litres of fuel.

"Our surveys have revealed that traffic jams consume a massive 90 minutes of commuter time on an average every day and about Rs 10 crore worth of fuel. As there is a 15% government subsidy on petrol and diesel, the waste results in a subsidy loss of about Rs 1.5 crore for the state exchequer daily," said Pankaj Sharma, chief trustee, CTI.

▶Cars lose 2.5L fuel daily, P 8

How Snarls Bite

▶Average time spent daily in congested traffic: 90 mins

▶Fuel a car wastes in jams: 2.5 litres (0.75 litres for two-wheelers)

▶Cost of fuel wasted by cars a day: Rs 7.5cr

▶Cost of fuel wasted by two-wheelers: Rs 2.5cr

▶Govt subsidy on wasted fuel

Cops gear up for fe

With Diwali rush leading to increase in traffic, police to impose an extended duty (from 5p to prevent jams. The high-vol expected to continue till Satu

Breakdowns trigger jams

Megha Suri | TNN

New Delhi: Two trucks and a bus broke down on Ashram Flyover on Ring Road on Tuesday morning bringing movement of traffic to a complete standstill. Despite the fact that traffic was thin on Tuesday morning as several offices remained closed, the jam lasted till several kilometres and scores of motorists were caught in it.

The worst hit were those going towards Noida and Sarai Kale Khan from south Delhi's Moolchand side's. Said Monnet Mahesh, an engineer headed to her workplace in Noida: "I left a bit late assuming there will be less traffic but ended up getting stuck in the jam after Ashram Flyover for over an hour. Two trucks and a bus were stranded in the middle of the road and there rest of the traffic was held up because of that." Strangely, one of the trucks was apparently carrying tomatoes, which were strewn around the main road.

Regular commuters complained that this is common on the Ring Road route, where jams caused by truck breakdowns are a daily affair. "We get stuck in jams in the morning every other day because of some truck or the other which has broken down. But this jam was particularly bad because there were multiple breakdowns. Why are these trucks allowed at all when they are not to be driven on roads," questioned Suraj Chadha, a businessman.

The traffic police said that the curse of Tuesday jam was a truck, which took time to be removed. "The truck couldn't just be wheeled away from the road. Every morning, several trucks which come into the city at night break down on main roads like Ring Road and Outer Ring Road causing jams. We try and remove them as soon as possible, but there are problems. Some trucks need to be offloaded before they can move and others have problems like broken axles so we need to call in special cranes to pull them over to the side," said a senior traffic police official.

Industry estimates that over 30% of the trucks entering the city are overloaded and this is one of the main causes for breakdowns. Despite regular jams and accidents, the government has been unable to rein in the menace and the problem continues.

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

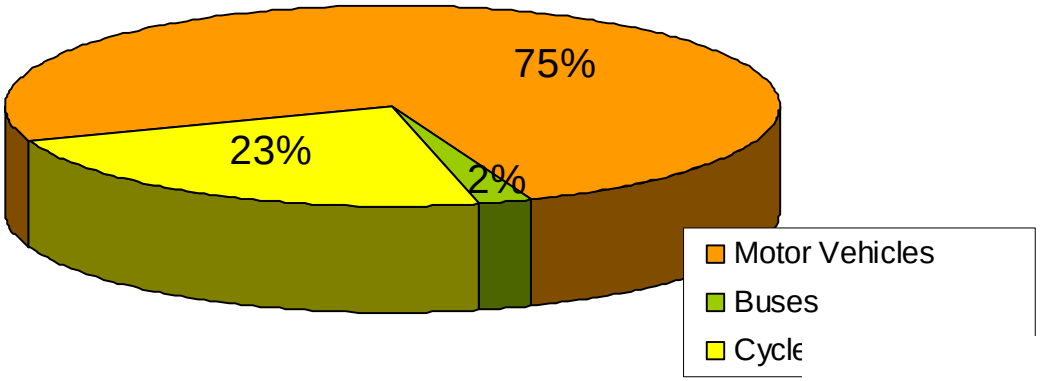
Understand the BRT corridor in Delhi….

-- -- **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

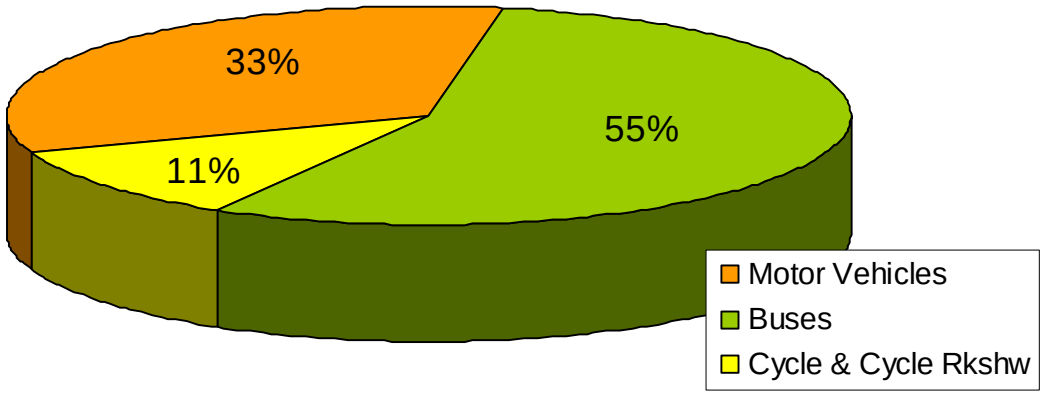
Morning Peak Hour

AK to MC

4,916 Vehicles

11,480 People

Distribution of People - By Mode



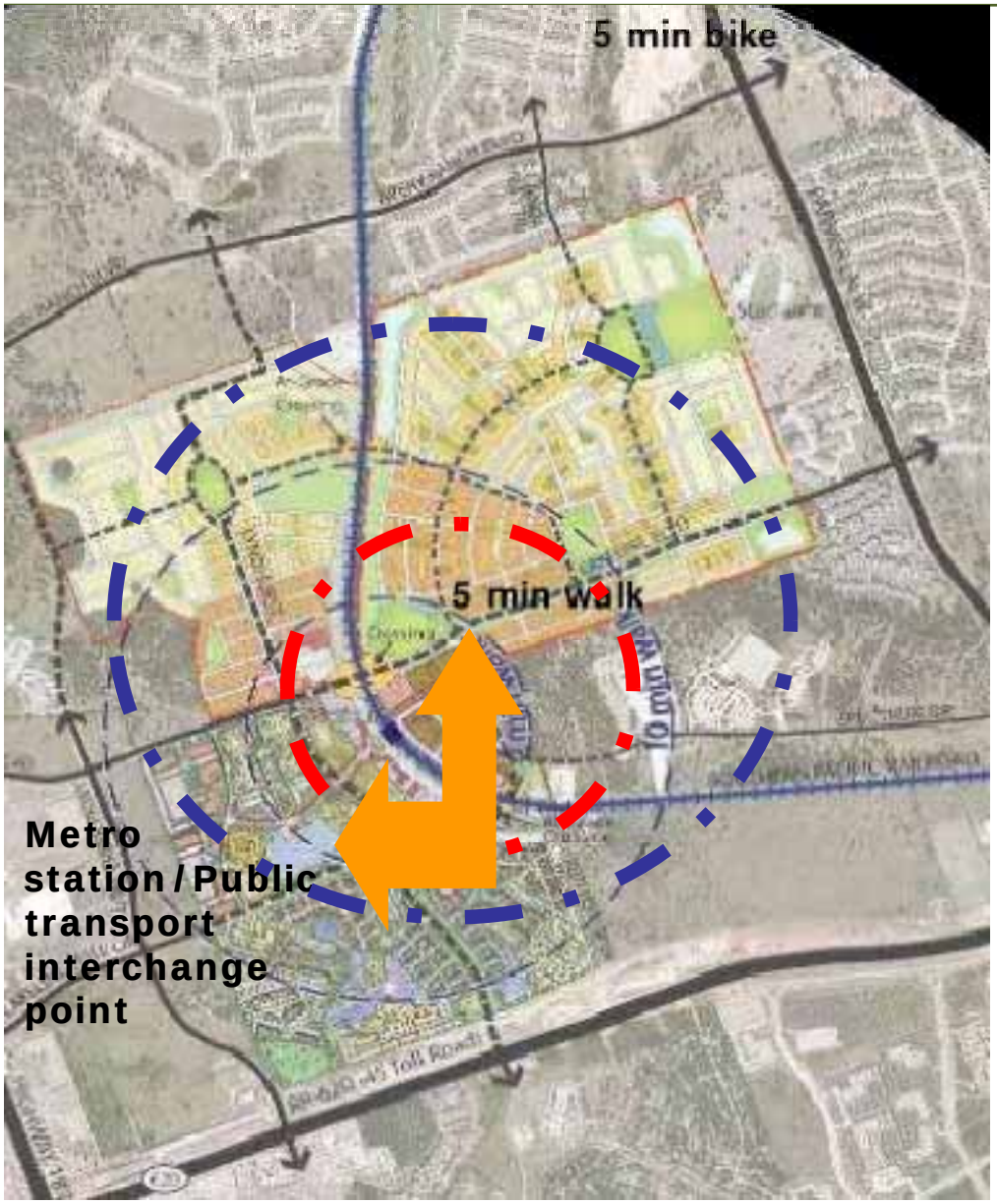
Source: Dario Hidalgo study for CSE, 2008 Mimeo

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.

Uniqueness of the public transport in South Asian cities….

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

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

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

Mixed traffic – cycle rickshaws, tempos, auto-rickshaws, buses … but environmentally sustainable.

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)

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

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

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

Highly encroached walkways

Don’t let cars take over walkways…..

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**

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

Source: Times of India

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

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% tn 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

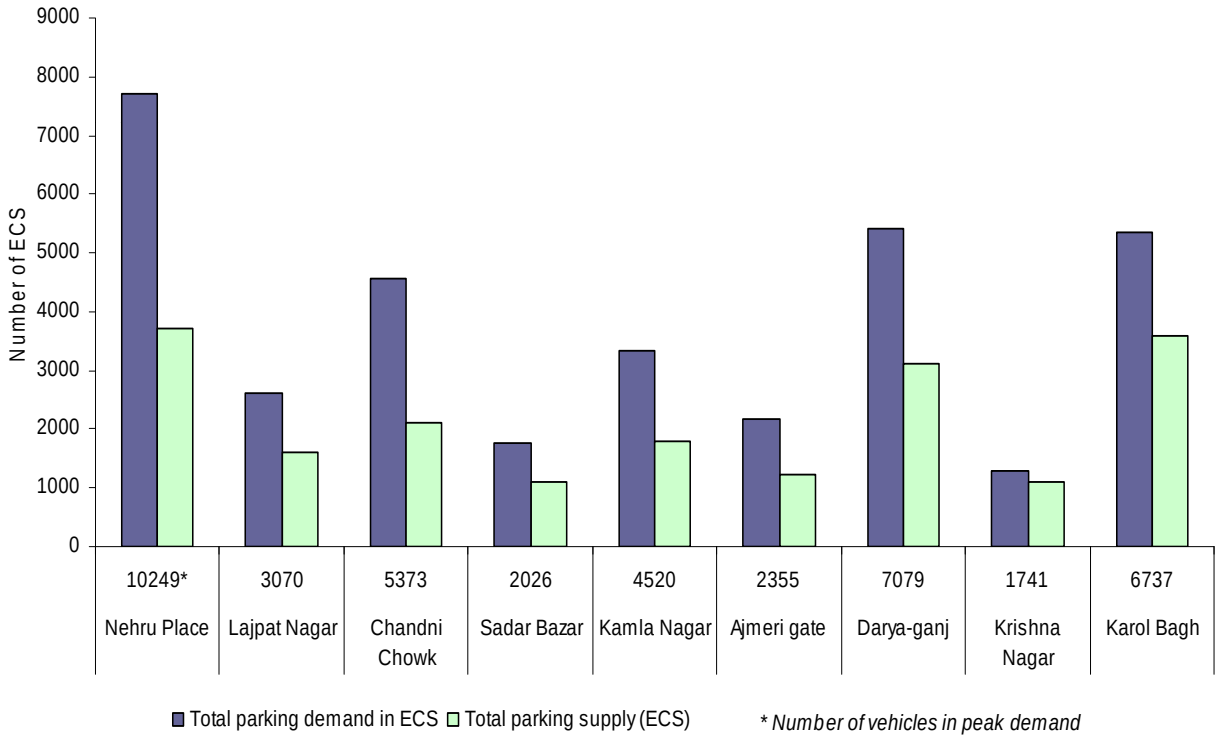
Use parking policy to reduce demand for parking and cars. Influence commuter choice

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

International experience shows just he 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 1000people 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

	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.

Need parity of rates between structured and surface parking

Lesson from Mumbai: Discrepancy in rates can lead to underutilisation of parking structure

INOX the multiplex in Nariman Point

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

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

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

Poor utilization of multi level lot

Situation in INOX Parking area on 5th May 06 – a weekday at peak time of 11:am

Source: Mumbai Environmental Social Network

Principles that must guide parking pricing

Graded parking rates according to Peak hour, duration of stay; commercial importance of areas; Weekdays when demand is high and weekends when low.

-- Fix parking rates at a level to influence commuter choice

-- Higher rates at convenient places than the inconvenient places

-- Limit parking duration for short term users. This can lead to higher customer turnover

-- Free parking for cycles and cycle rickshaws and reduced/free rates for battery operated vehicles and public transport vehicles.

-- Parking rates should be higher for big cars and SUVs

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.

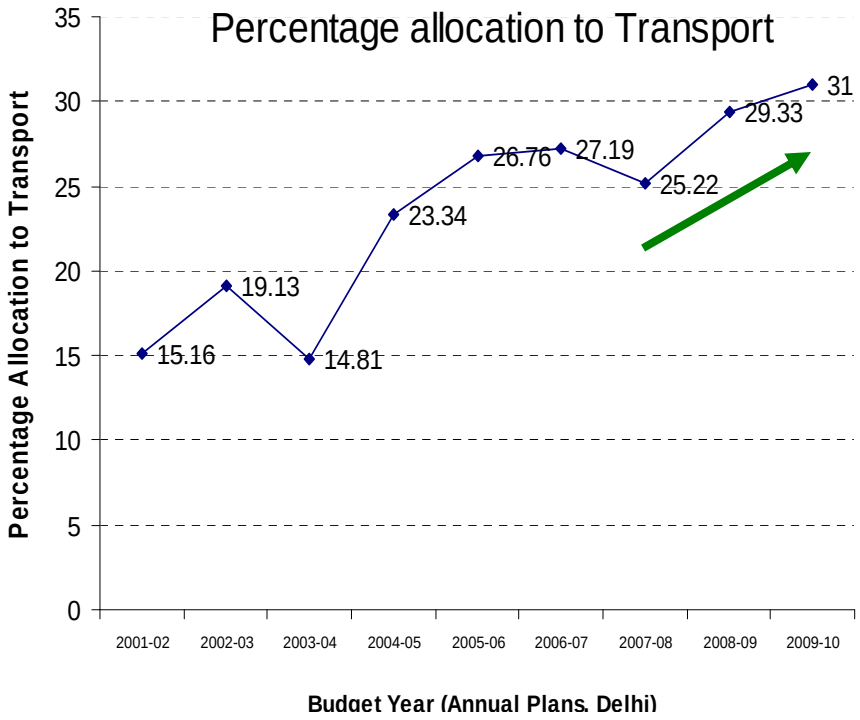
Globally, customers agree to pay high parking charges if they get good shopping and pedestrian environment. This also improves business.

The affordability challenges of mobility transition……..

Are we spending on sustainable options adequately?.....

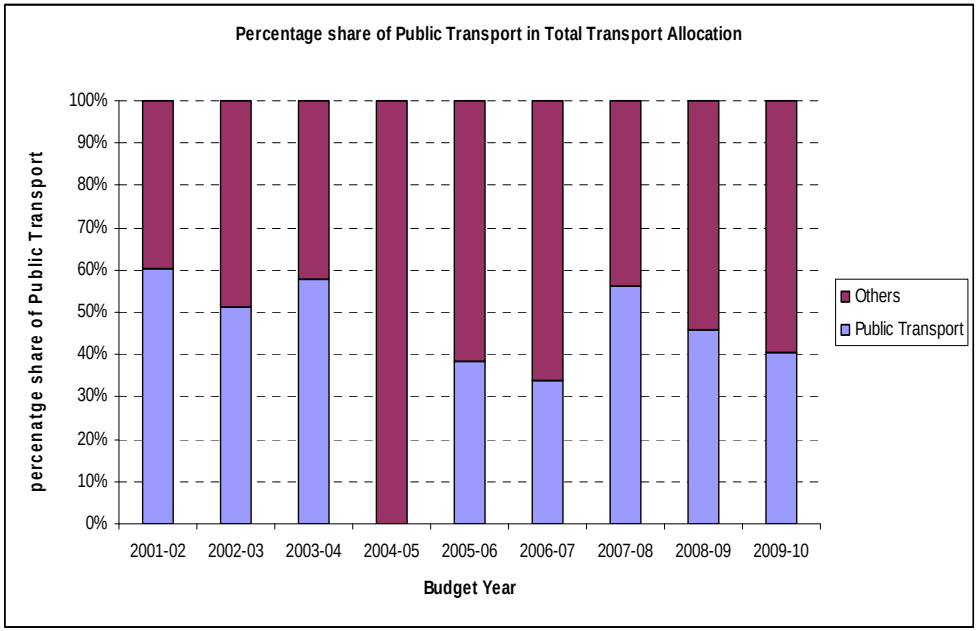
Delhi: Do we see any inconsistency here?

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.

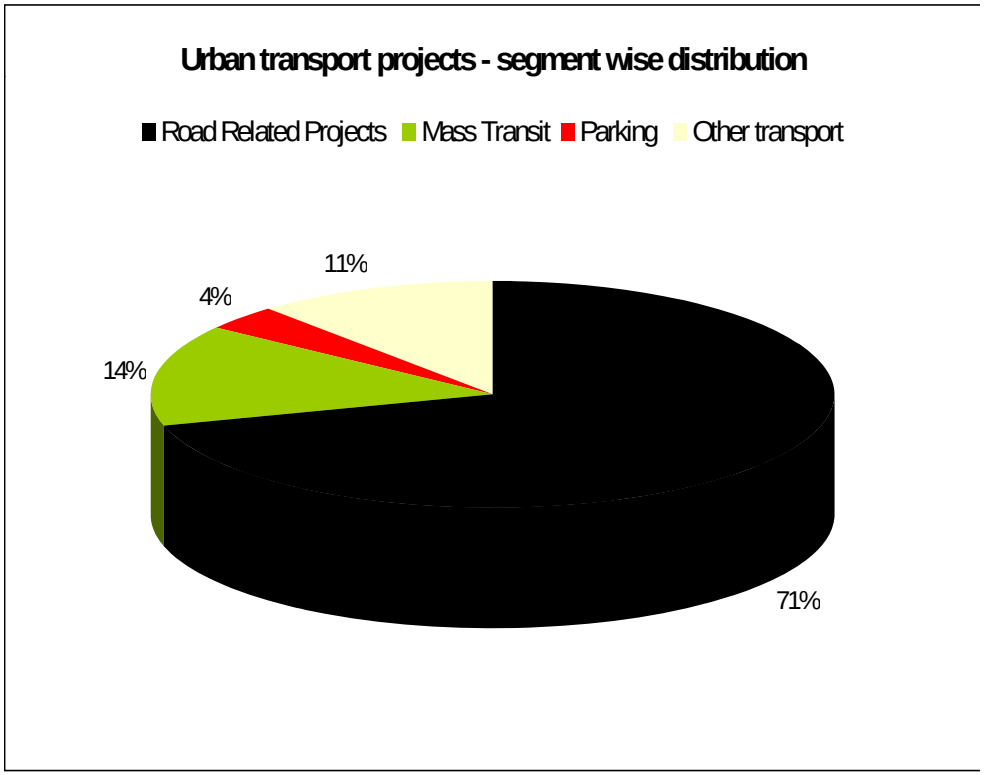
But…..

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

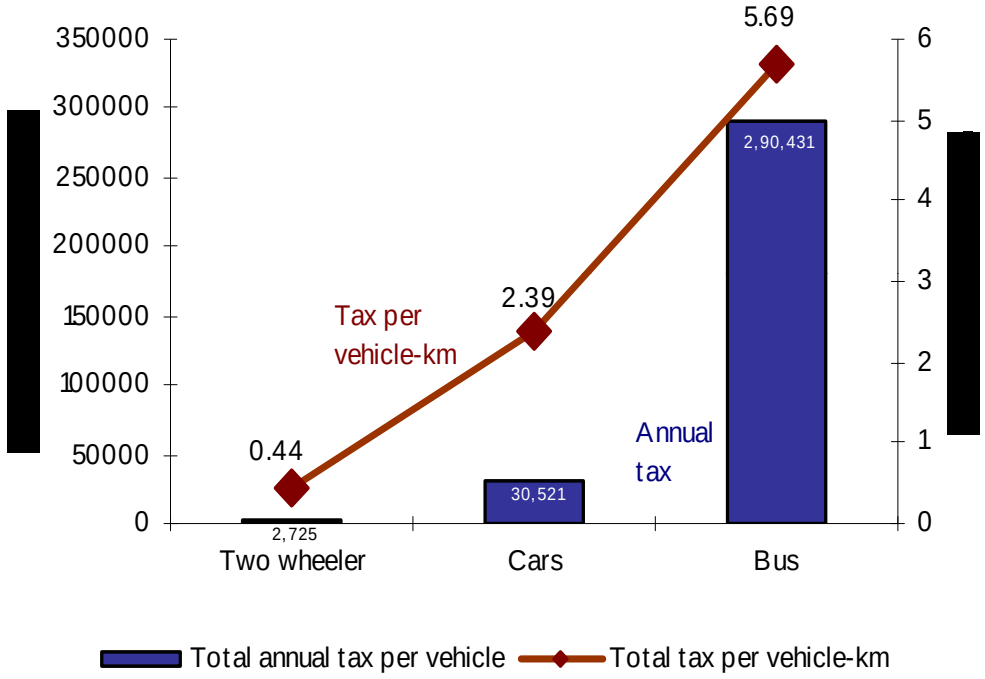
We tax our public transport more than cars…

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

Make informed and sustainable choice

Criteria	Bus rapid transit system	Light railway	Metro
Passenger carrying capacity (peak hour peak direction trips)	10,000 to 25,000 More flexible	2,000 to 20,000 Fixed lines	More than 40,000 Fixed lines
Speed in km per hour	18 to 26	19 to 29	29 to 36
Capital costs per route kilometer (in Rs)	9 to 45 crore	45 – 135 crore	180 – 405 crore
Operating costs (Rs per passenger km)	3.6 to 5.4	5.4 to 6.75	6.75 to 10.35

In Delhi, Metro 1-1.5 million passengers/day (2010), Buses carry ~ 9 million passengers / day (2008)

Source: Report of the Committee on Sustainable Transport, Government of Delhi, 2002

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 proj

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...