Clean Air and Sustainable Mobility
Bhubaneshwar Dialogue

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-- Centre for Science and Environment

A joint Workshop:
Bhubaneshwar Development Authority
Centre for Science and Environment

Bhubaneshwar, August 20, 2013

Global Burden of disease: High impacts in India…….

December 2012:

Global Burden of Disease estimated by 450 scientists from 300 global organisations including WHO found –

-- About 65 per cent of these deaths occur in Asia.

–Air pollution is among the top 10 killers in the world

–Two-thirds of the death burden in developing Asia. South Asia most vulnerable…….

February 2013:

GBD findings for India:

-- 620,000 premature deaths a year. More than 18 million healthy life years lost due to air pollution. Air pollution triggers stroke, cardiovascular and respiratory diseases, cancer…..

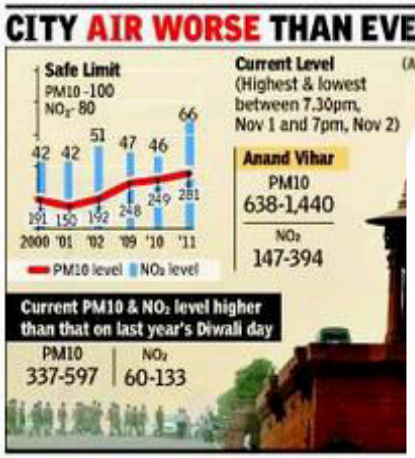
City enveloped in smog, back to pre-CNG levels

Gains Of Switch To Cleaner Fuel Frittered Away

Neha Lalchandani | TNN

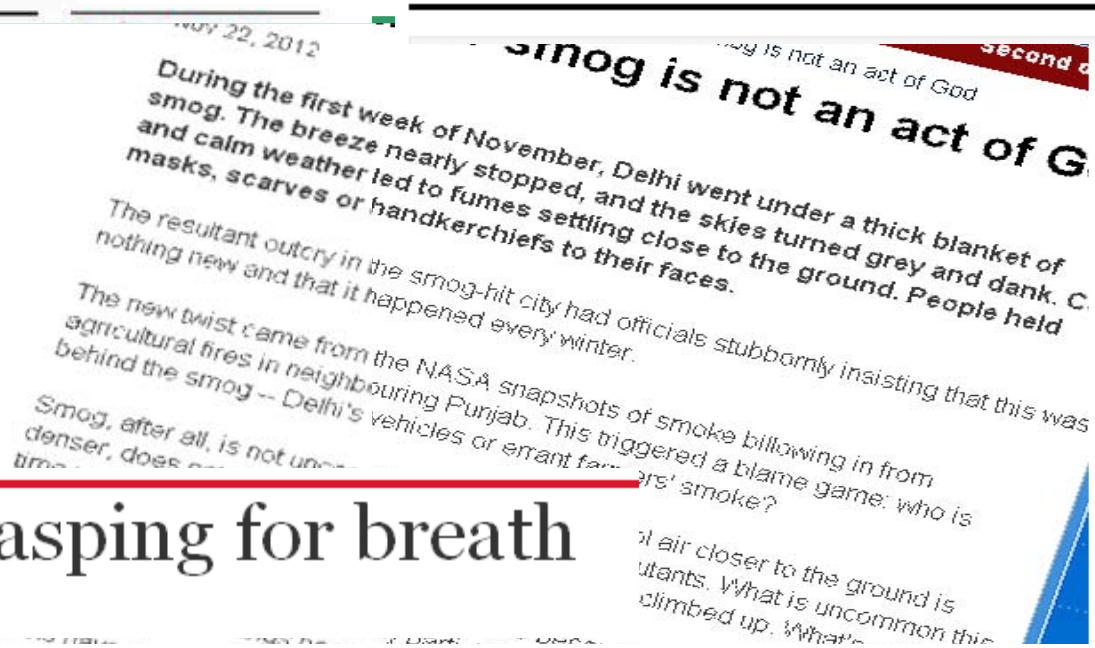
New Delhi: Delhi's air pollution has reached alarming levels. For proof, just look out of the window. The grey-white 'haze' that has been covering the city since October 28, say experts, is actually smog that is linked to the rapid rise in

▶High pollution, P 6



'सांसों' पर स्मॉग की 'स्याह' परतें

Updated on: Thu, 15 Nov 2012 02:00 AM (IST)



Smog leaves Delhi gasping for breath

TNN | Nov 3, 2012, 01.33 AM IST

poisonous gases". Not co- air quality, the judiciary (see graphic)

Smog delays Sheila Dikshit's flight to Punjab

Disadvantage Delhi: Smog here to stay

Darpan Singh, Hindustan Times
New Delhi, November 08, 2012

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email print 0 Comments Like 3 Tweet 0

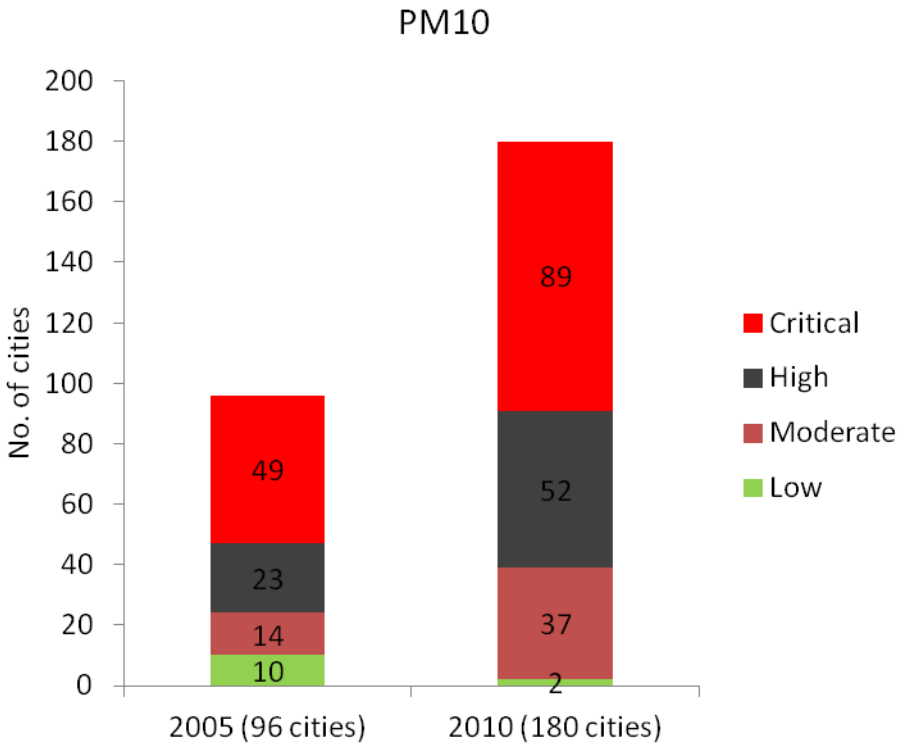
The Centre for Science and Environment (CSE), in its latest report, has delivere
The smog is here to stay. It has also warned that Delhi is in the grip of a multi-p

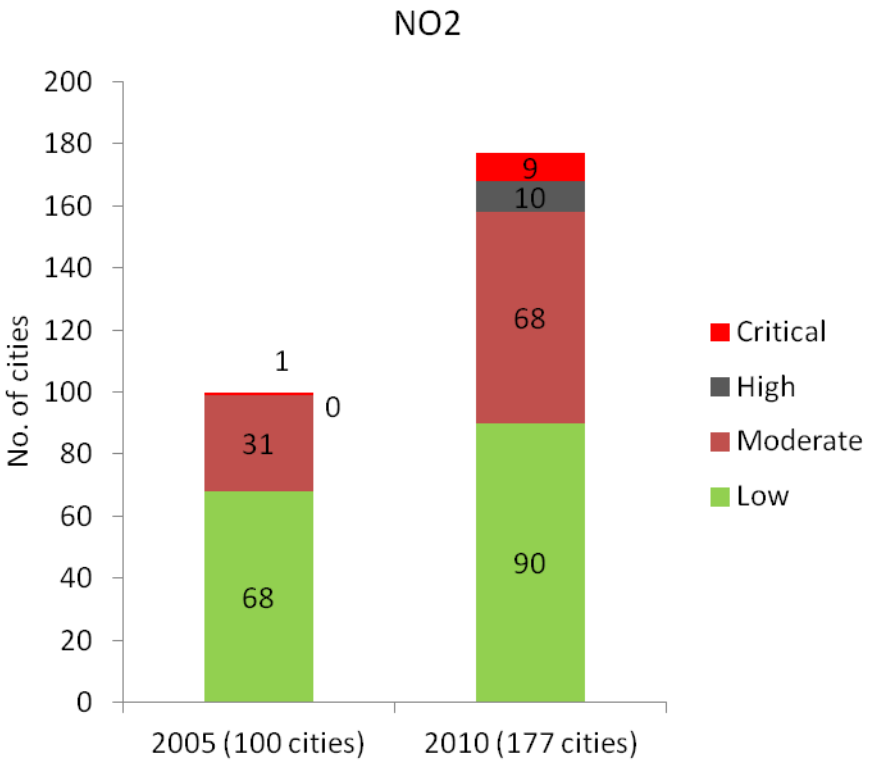
02.44 AM IST

| Punjab | NASA | flight | Flashpoint | Apex

udhiana trip by Delhi chief minister Sheila Dikshit in a chartered
telecom industrialist family became the flashpoint of the ongoing
Delhi and Punjab when the plane was delayed by nearly three hours

National crisis: More Indian cities in grip of pollution
Particulates and NO2 – major concern





Source: CSE based on CPCB air quality data

It is about people……

- Close to half of total urban population breath the air which exceeds the standard of PM10.

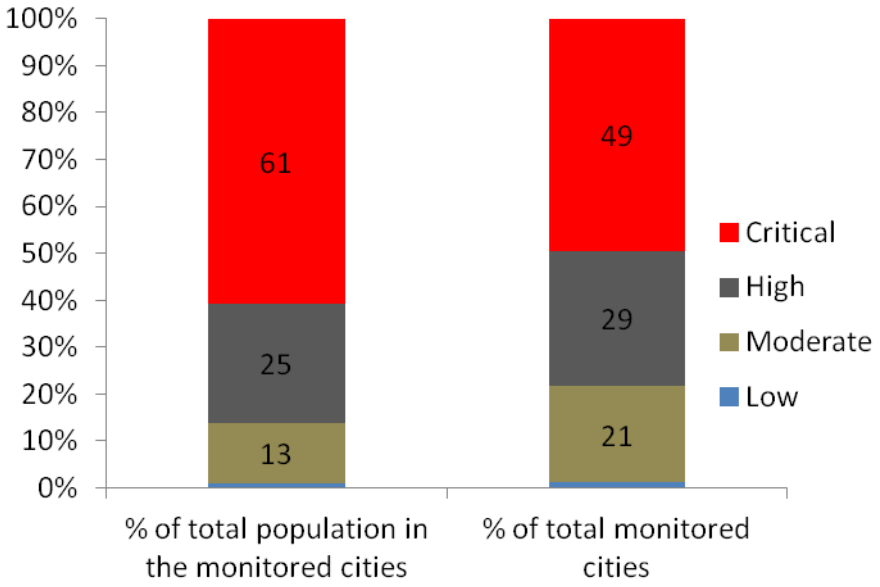
- One third of urban population live in cities with PM10 levels classified as critical.

10% of total urban population breathes the air which exceeds the standard of NO2.

Need national action: Hotspot approach is not adequate -- Cannot have two classes of citizens

50% of cities monitored are critically polluted for PM10

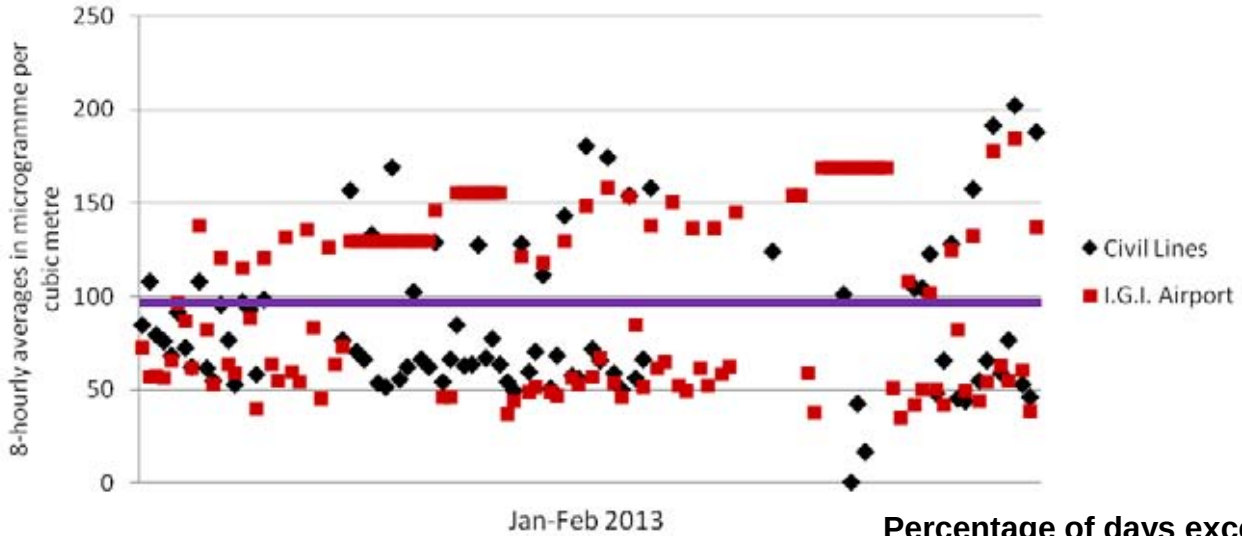
…… But 60% of people in monitored cities live in areas with critical PM10 levels



Source: CSE based on CPCB air quality data and Census population data

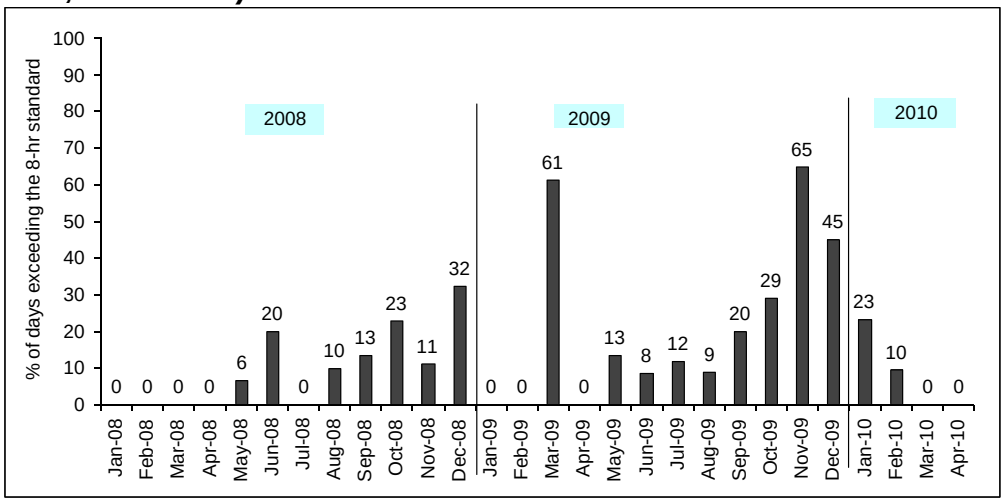
Emerging threat: ozone

Ozone levels in Delhi



Source: Based on DPCC air quality data

Percentage of days exceeding hourly Ozone standards (Siri Fort, 2008-2010)

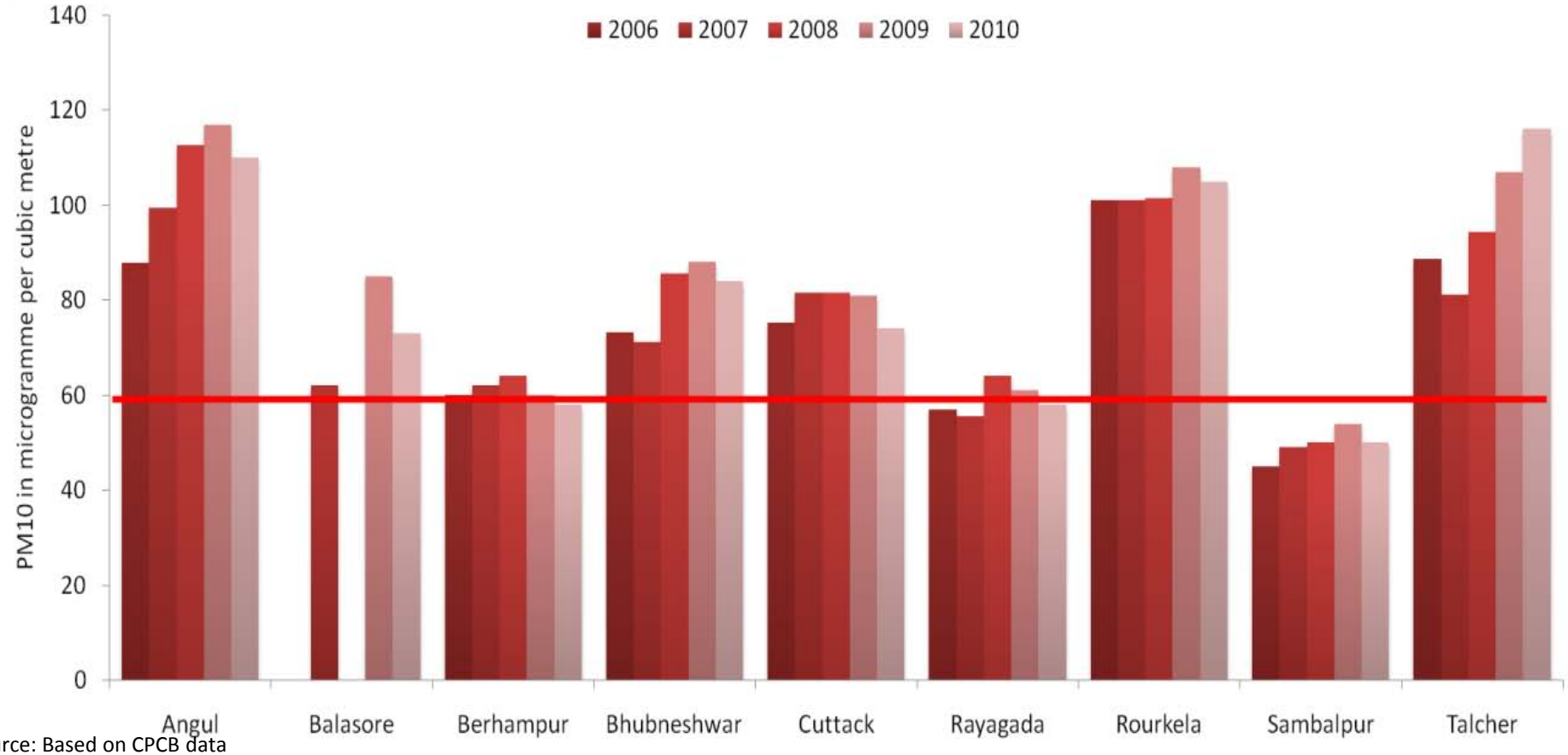


Source: CSE based on DPCC air quality data

- Imperatives of the regional dialogue……..

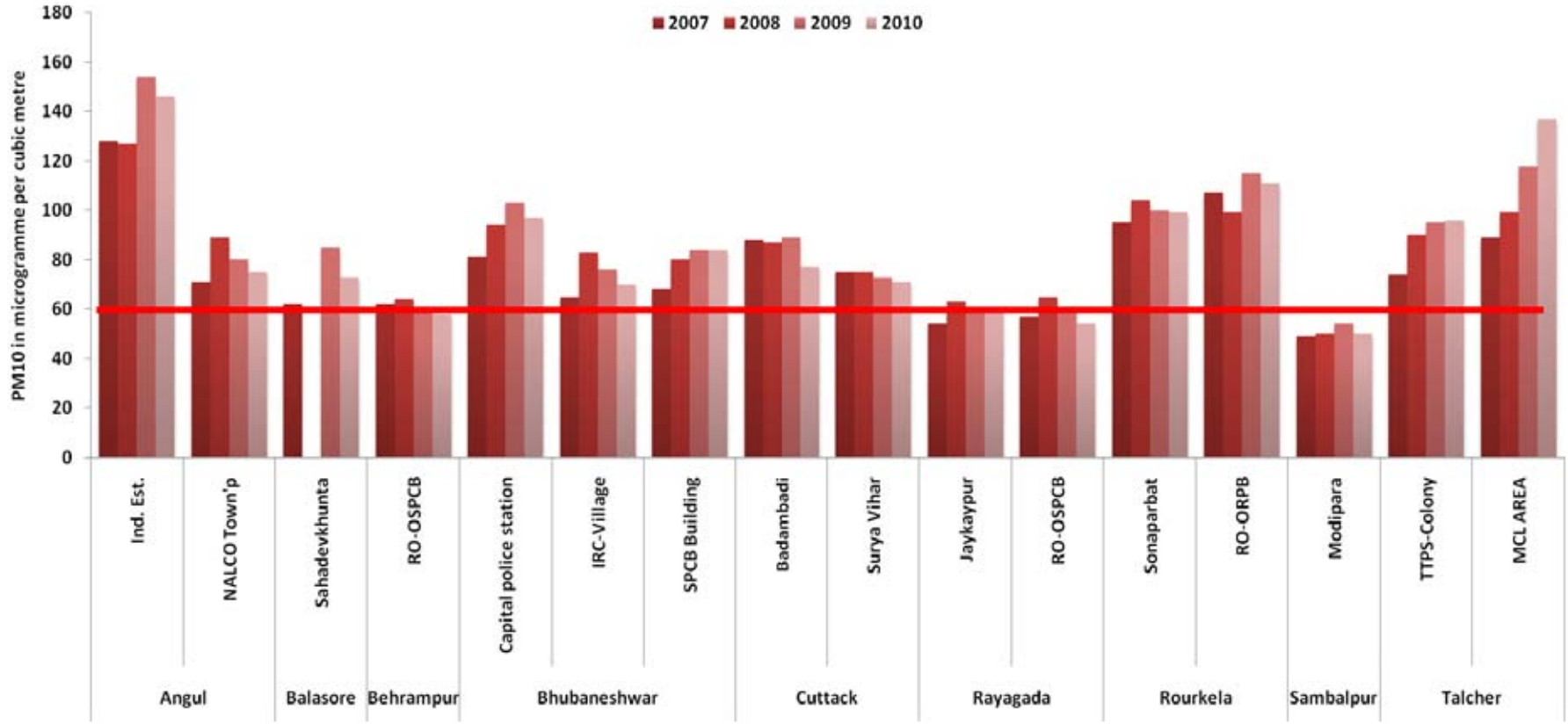
Odisha: PM10 air quality status in different cities and locations

- Berhampur, Rayagada, and Sambalpur meet the standard and have moderate levels.
- Angul, Rourkela and Talcher have critical levels
- Bhubaneshwar, Cuttack, Balasore have high levels.
- Bhubaneshwar, Angul and Talcher show increasing trend.



Source: Based on CPCB data

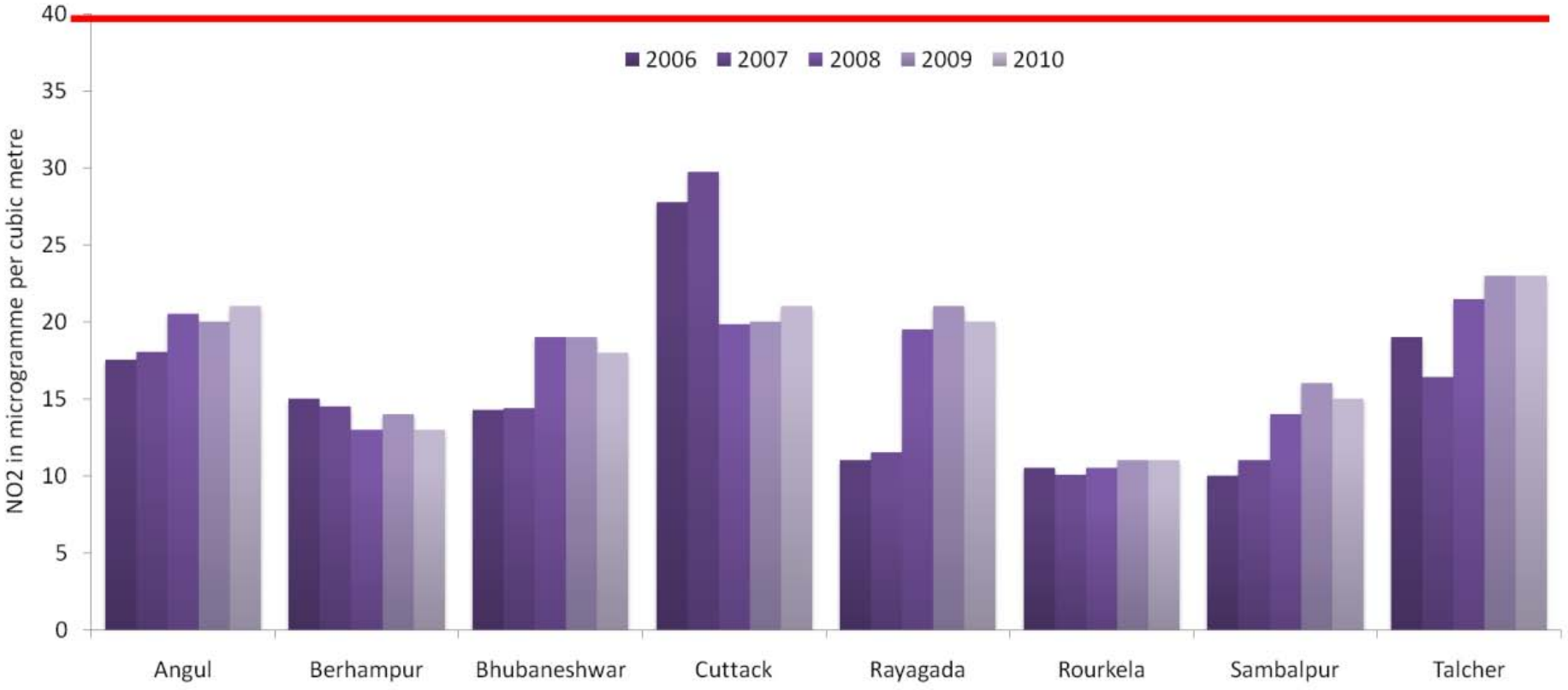
Pollution hot spots inside cities



Source: Based on CPCB data

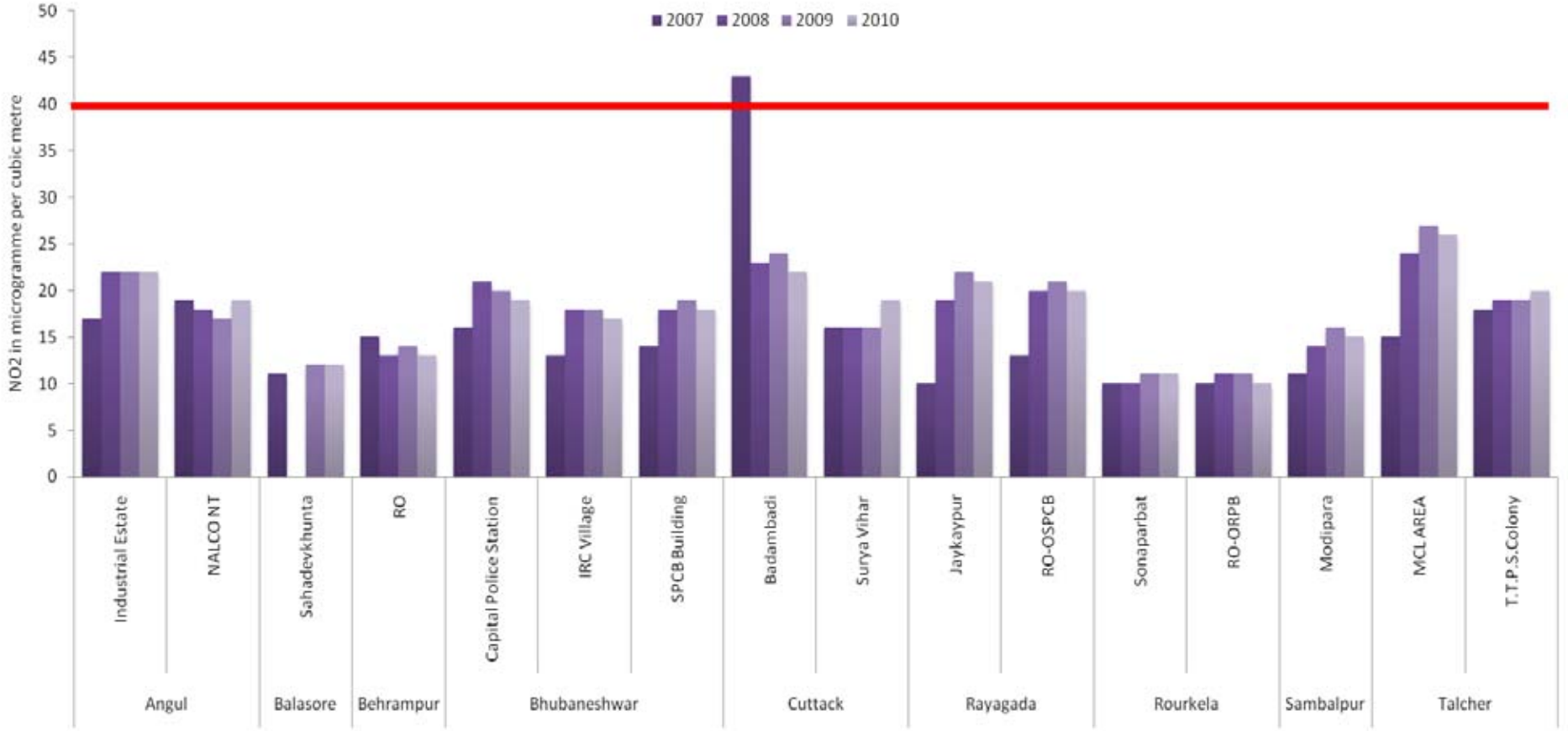
Odisha: NO2 air quality status in cities

- Angul, Cuttack and Talcher have moderate levels.
- All cities are within the standard, however almost all cities show an increasing trend



Source: Based on CPCB data

Odisha: NO2 hot spots in cities



Source: Based on CPCB data

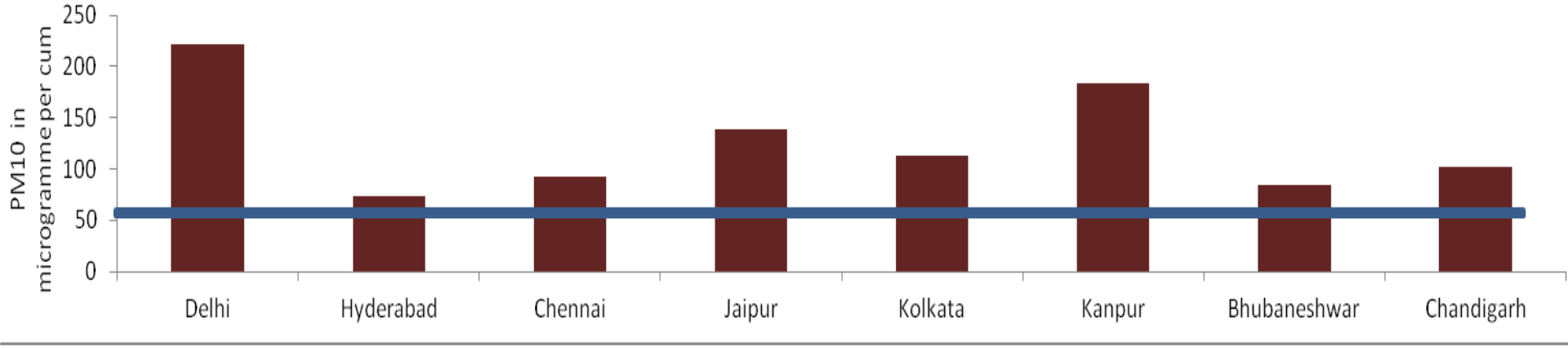
PM10 status of different locations of cities

Cities	Locations	PM10 Annual average in 2010	% exceedence (24 hourly)
Angul	Industrial Estate	Critical	69
	NALCO Township	High	13
Balasore	Sahadevkhunta	High	5
Berhampur	Regional Office Orissa SPCB	Moderate	12
Bhubneshwar	Capital Police Station	Critical	39
	IRC Village	High	15
	SPCB Building	High	28
Cuttack	Roof of Traffic Tower, Badambadi	High	22
	R.O. Cuttack Office, Surya Vihar	NA	24
Rayagada	Regional Office Orissa SPCB	Moderate	0
	LPS High School, Jaykaypur	High	0
Rourkela	Regional Office, ORPB	Critical	82
	IDL Police Out-post, Sonaparbat	Critical	42
Sambalpur	Filter Plant, PHD Office, Modipara	Moderate	0
Talcher	Coal Field Area / MCL AREA	Critical	82
	T.T.P.S.Colony	Critical	38

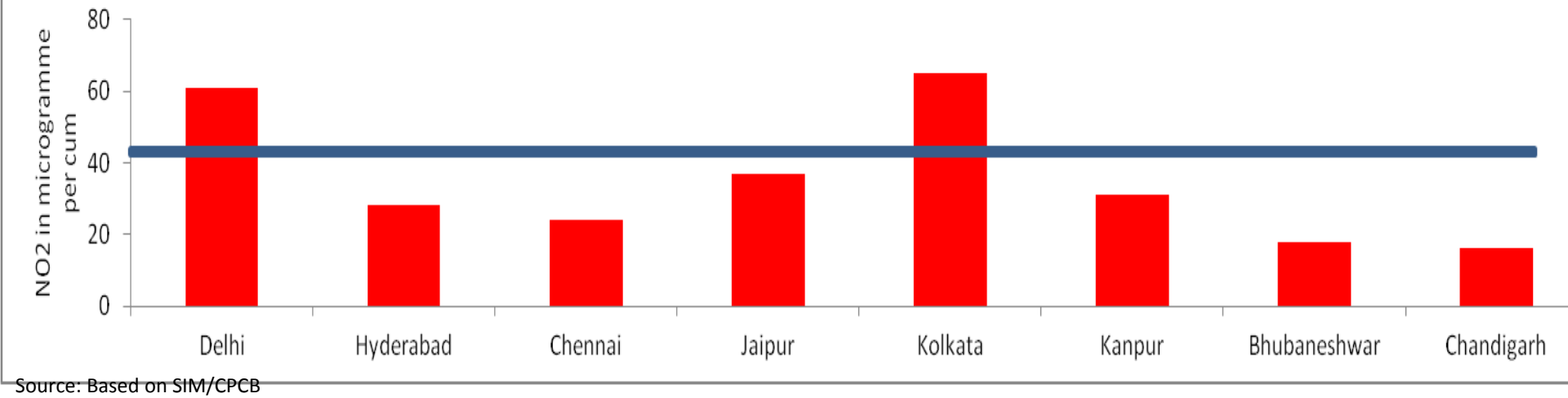
Source: Based on CPCB data

Comparison of PM10 and NO2 levels in different selected cities

Ambient levels of PM10 in 2010/11

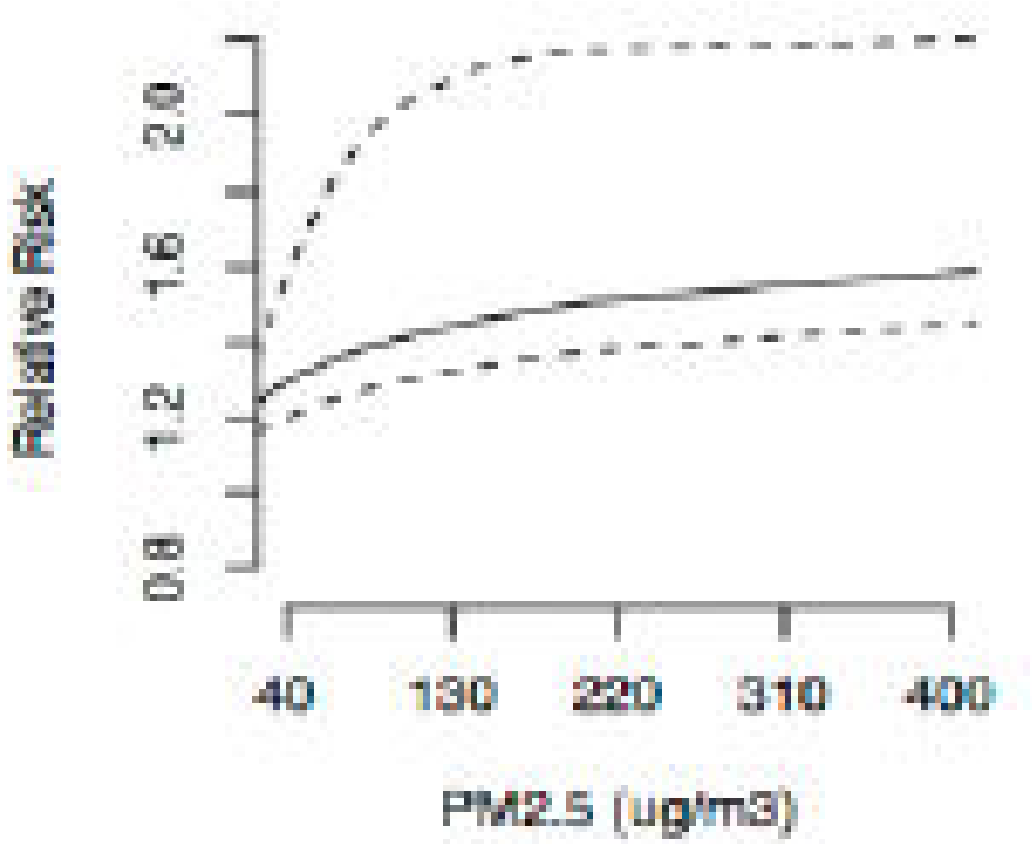


Ambient levels of NO2 in 2010/11



Source: Based on SIM/CPCB

Even at comparatively lower pollution levels health impacts can be large. Most of the health effects occur at much lower levels. Need to meet tighter targets.



Integrated Exposure-Response function for Ischemic Heart Disease

HEI Global Burden of disease, 2013

Emerging threat: Ozone

Emerging research evidences on ozone:

•High peak daytime ozone mixing ratio. It was found to be high during the winter months with highest mixing ratio during January ~85 ppbv.

•Ozone build-up was calculated to be highest (~27 ppbv) during pre-monsoon as compared to annual average of ~22 ppbv

•Monthwise variation of daytime ozone mixing ratio - significant

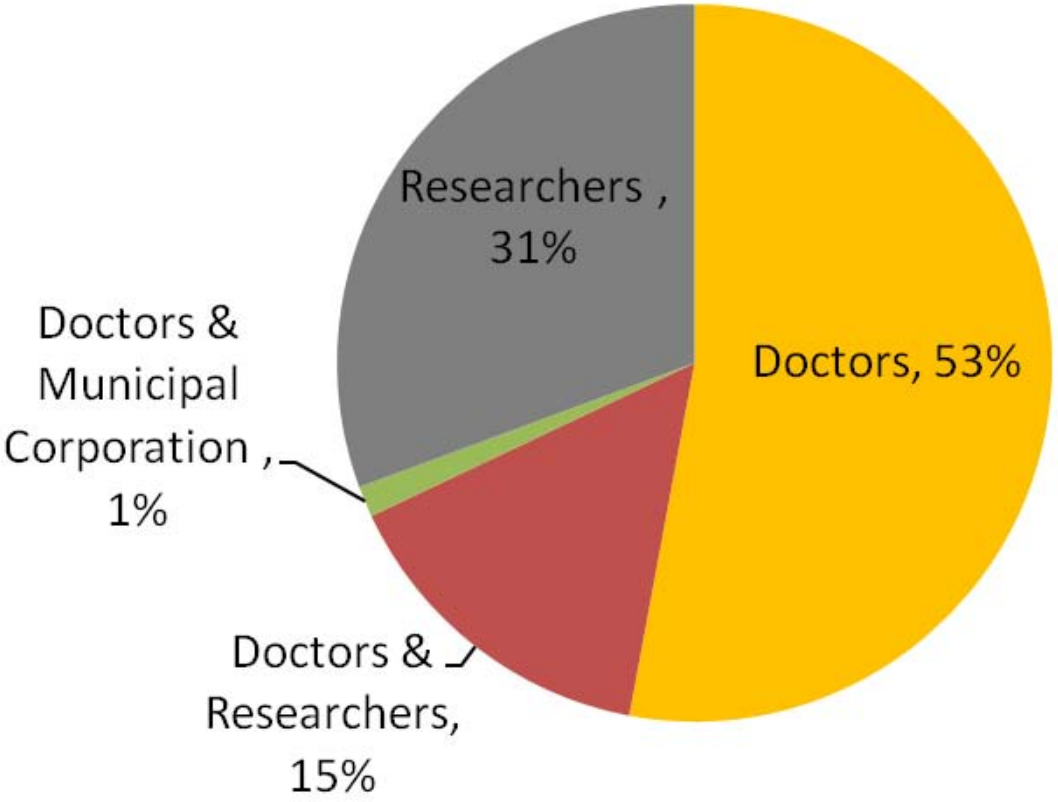
•

Study: P. S. Mahapatra et al 2012, Surface ozone variation at Bhubaneswar and intra-corelationship study with various parameters, *J. Earth Syst. Sci.* 121, No. 5

- Our health matters……..

Most studies done by doctors themselves…….

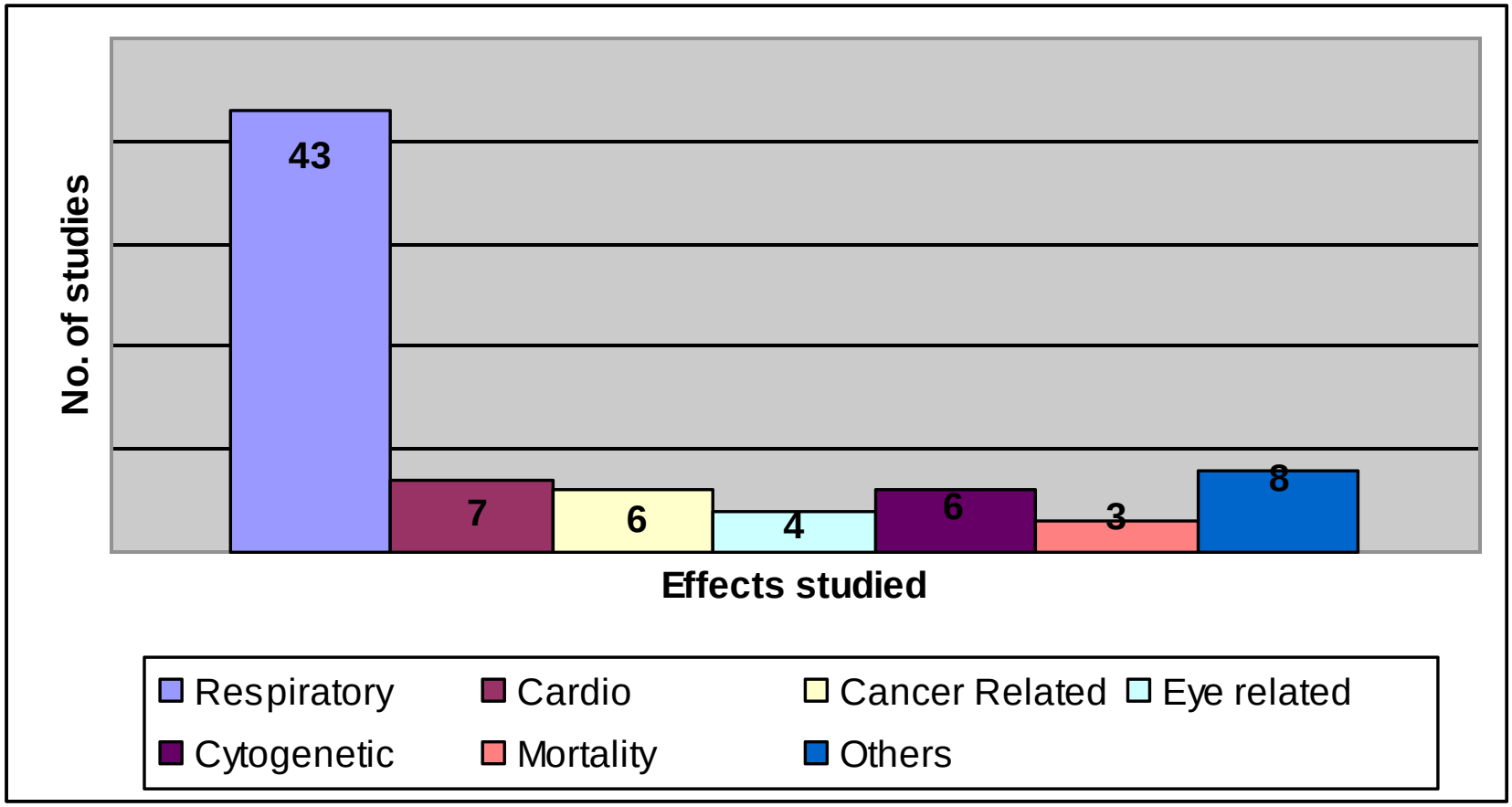
Who has done the studies?



Source: CSE

Studies looking at a more diverse health end points….

Predictably respiratory health symptoms dominate….
Broadens to other health end points – cardiovascular, eye disorders, cellular changes, cancer, premature deaths….



Source: CSE

Global studies ….

Looking beyond lungs ……

Diabetes: First large-scale population-based study links diabetes with air pollution. Increase in insulin resistance in lab test …. and an increase in markers of inflammation (which may contribute to insulin resistance) after particulate exposure.

Strong and consistent association between diabetes prevalence and PM2.5 concentrations. For every 10 µg/m3 increase in PM2.5 exposure, there was a 1 percent increase in diabetes prevalence. Counties with highest versus the lowest levels of PM2.5 pollution had a more than 20% increase in diabetes, which remained after controlling for diabetes risk factors. (Diabetes Care 2011)

Heart:

Acute Effects of Fine Particulate Air Pollution on Cardiac Arrhythmia:Conclusion: PM2.5 exposure within approximately 60 min was associated with increased PVC counts in healthy individuals. (He F et al 2011The APACR Study. Environ Health Perspect)

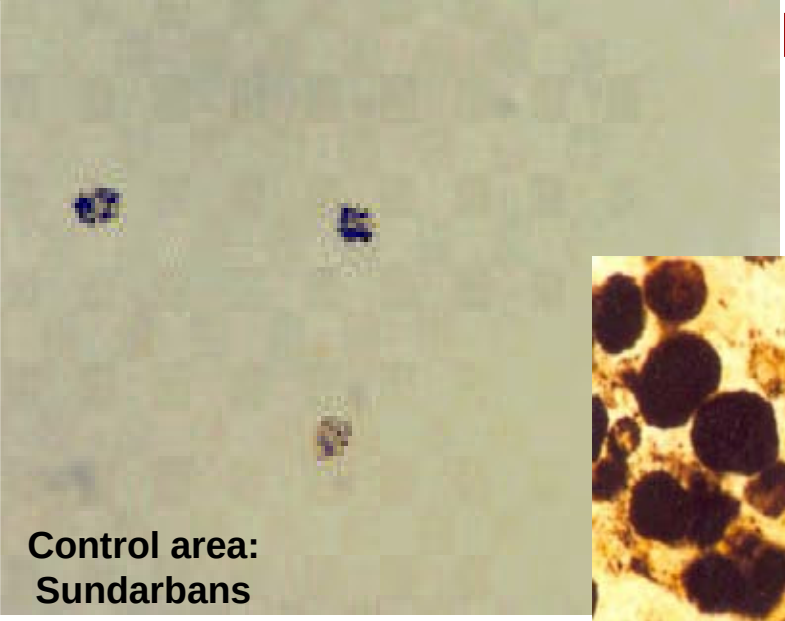
Blood pressure

Traffic-related Air Pollution and Blood Pressure in Elderly Subjects With Coronary Artery Disease**:** Found positive associations of systolic and diastolic BP with air pollutants. The strongest associations were with organic carbon, multiday average exposures, ect. (Delfino, Ralph J.a et al 2010,, Epidemiology, May 2010)

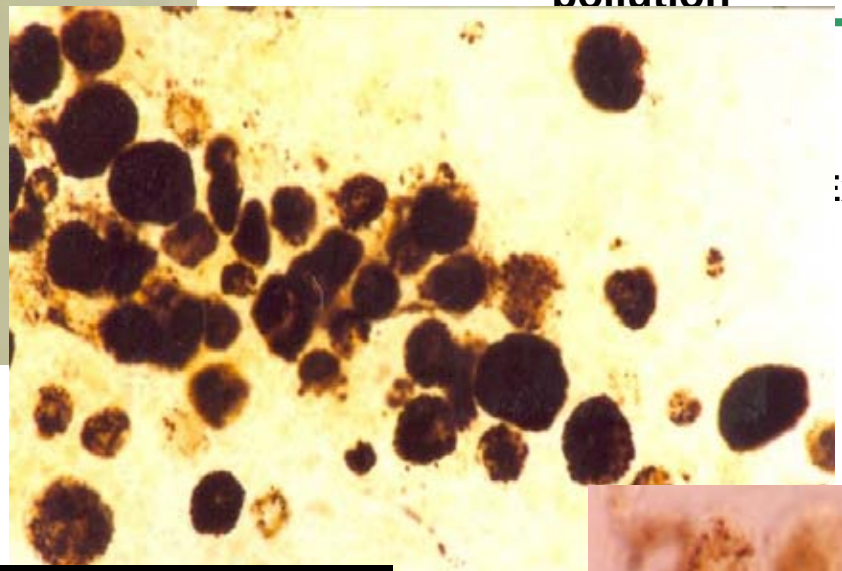
Effect on foetus: Studies have shown damaging impact of PAH on even fetus

Emerging evidences of health impacts in India……

Alveolar macrophage - biomarker of air pollution

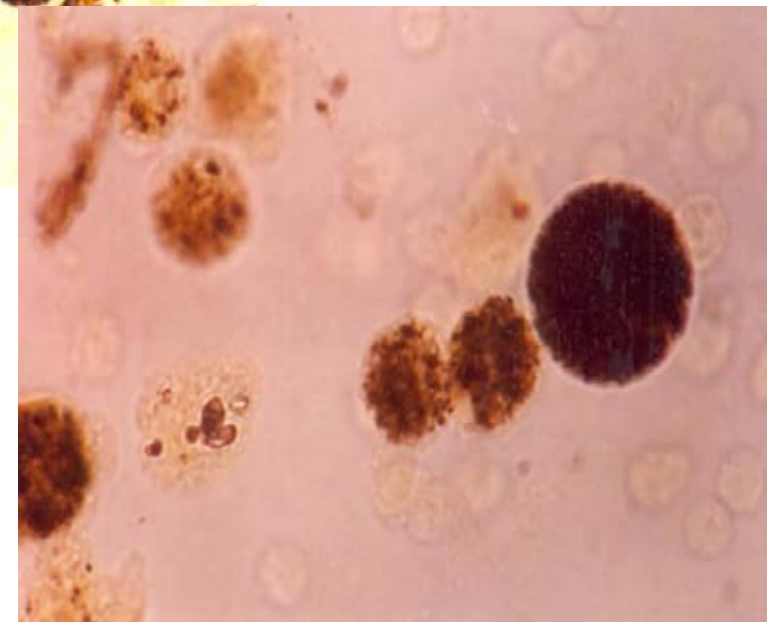


Control area: Sundarbans



Exposed group; Kolkata taxi driver

Increase in AM number



Worrying

Vehicles are of special concern

High exposure to vehicular fume need special attention

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

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.

Some of the deadliest air toxics, also carcinogens, are related to vehicular emissions.

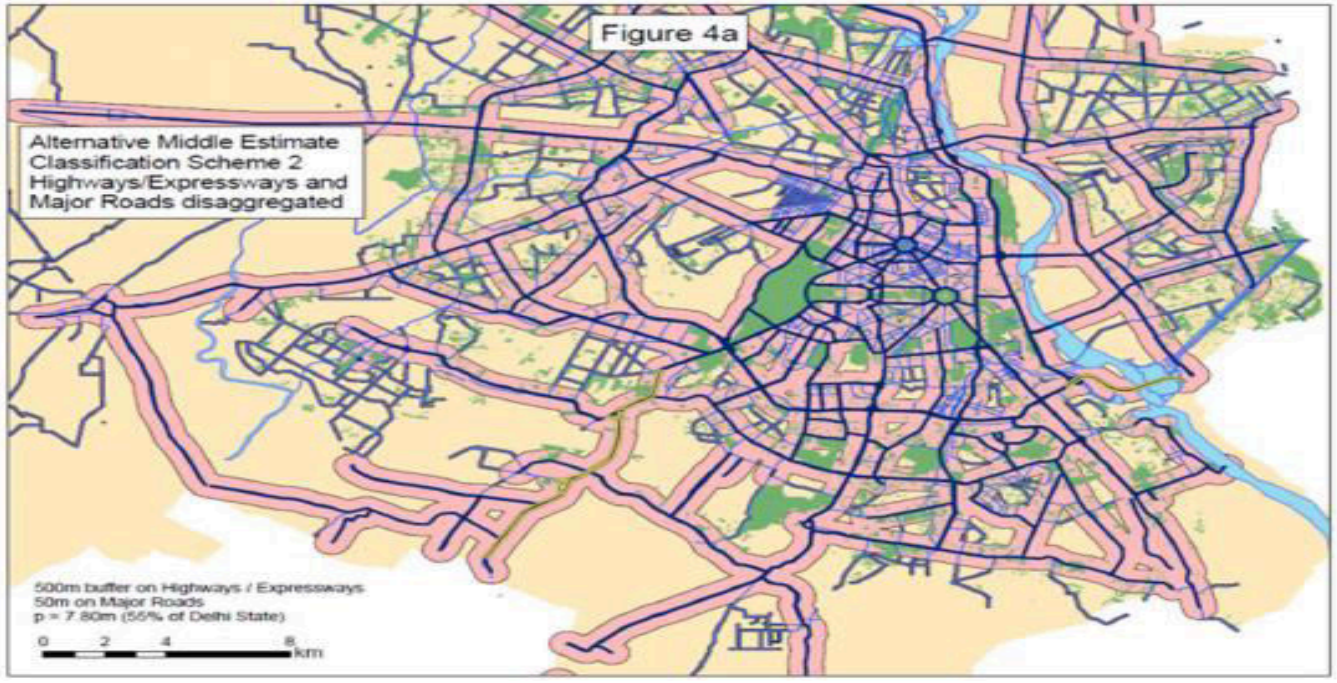
Poor have a higher prevalence of some underlying diseases related to air pollution and proximity to roadways increases the potential health effects.

Focus on mitigating high exposure

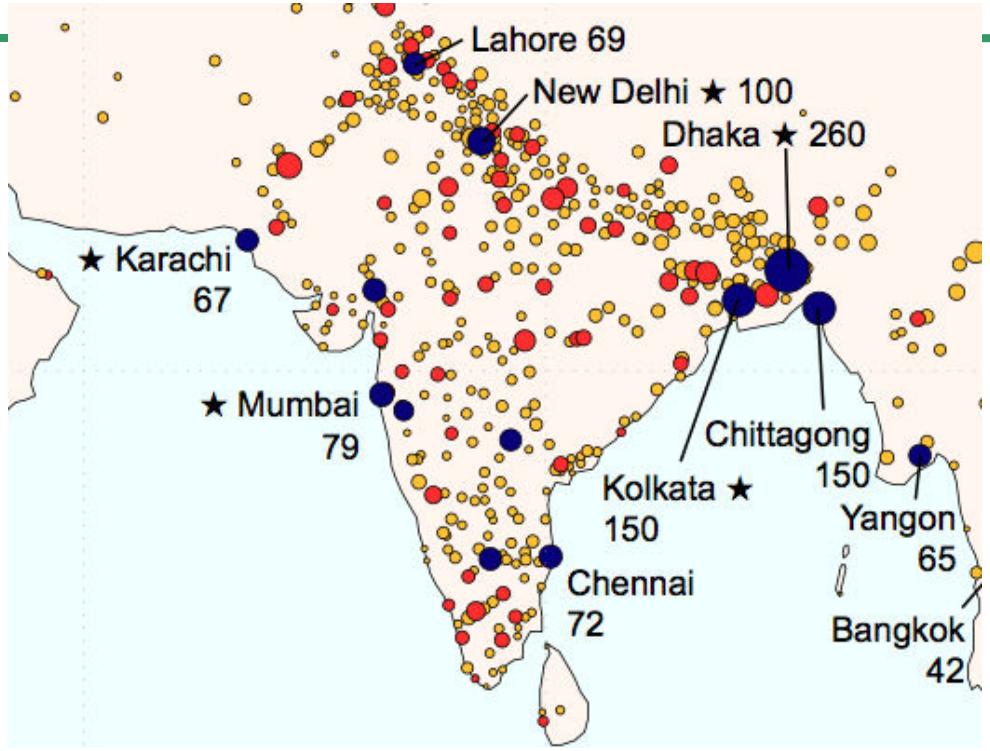
In densely-populated cities more than 50 – 60% of people live or work near roadside where levels are much higher.

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*



Exposure to Vehicle Emissions



Exposure (iF) is the population-weighted intake fraction, or the grams of vehicle pollution inhaled per grams of vehicle pollution emitted.

Location	Exposure (iF)*
United States	21
World	39
China	45
India	51
Hyderabad	63
Bangalore	68
Ahmedabad	69
Chennai	72
Mumbai	79
Delhi	100
Kolkata	150

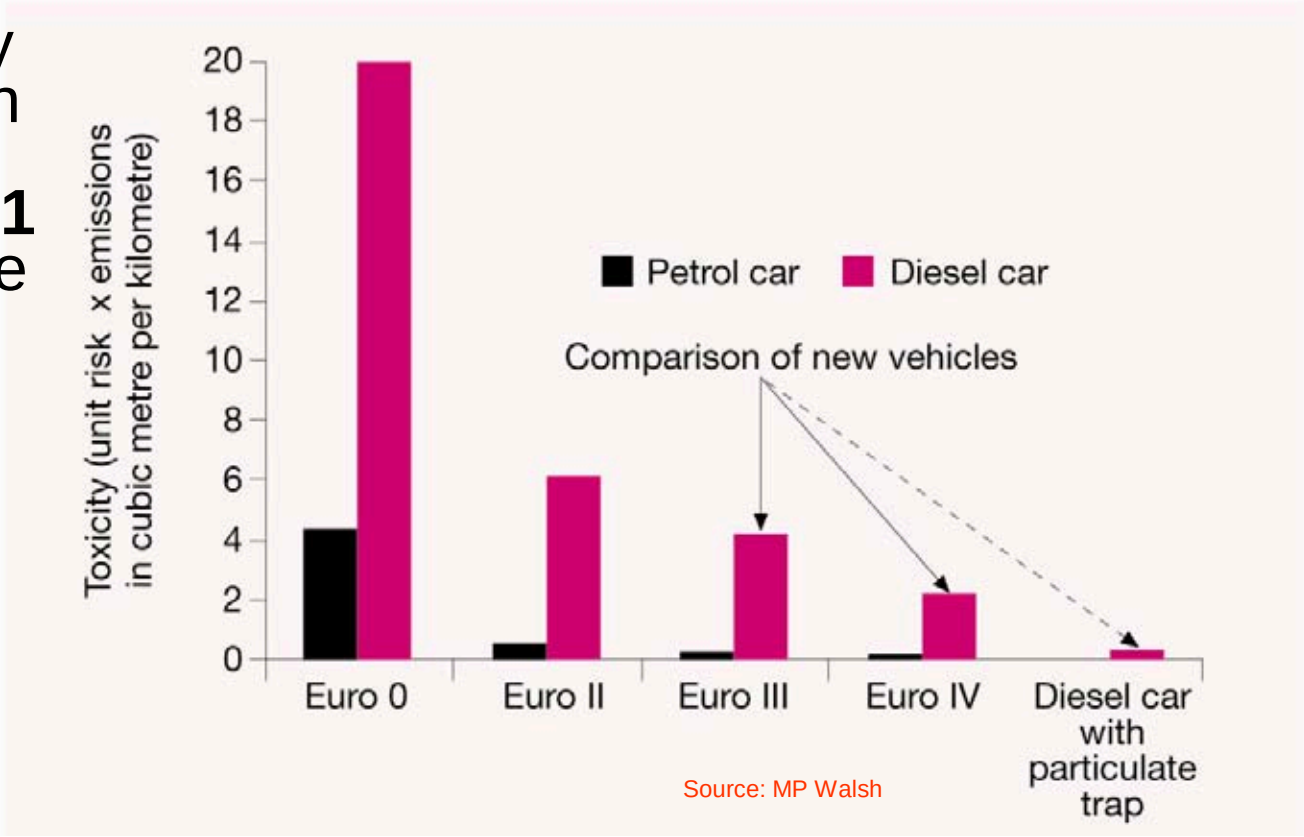
Estimates from Apte, J. S., Bombrun, E., Marshall, J. D., & Nazaroff, W. W. (2012). Global Intraurban Intake Fractions for Primary Air Pollutants from Vehicles and Other Distributed Sources. *Environmental Science and Technology*, *46*(6), 3415–3423.

The shocker: Cancer risk of diesel

June 2012

The WHO/ International Agency on Cancer Research reclassify diesel emissions as **class 1 carcinogen**, -- same class as tobacco for its strong link with lung cancer.

But India is dieselising very rapidly



- Impact of first steps….

What has Delhi achieved?

On vehicle technology and fuel quality

Enforced Euro II emissions standards in 2000, five years ahead of schedule, Euro III in 2005, Euro IV in 2010

Mandated pre-mix petrol to two- and three-wheelers

On alternative fuels

Implemented largest ever CNG programme

Largest ever public transport bus and three-wheeler fleet on natural gas

Other measures related to vehicles

Capped the number of three-wheelers

Phased out 15 year old commercial vehicles

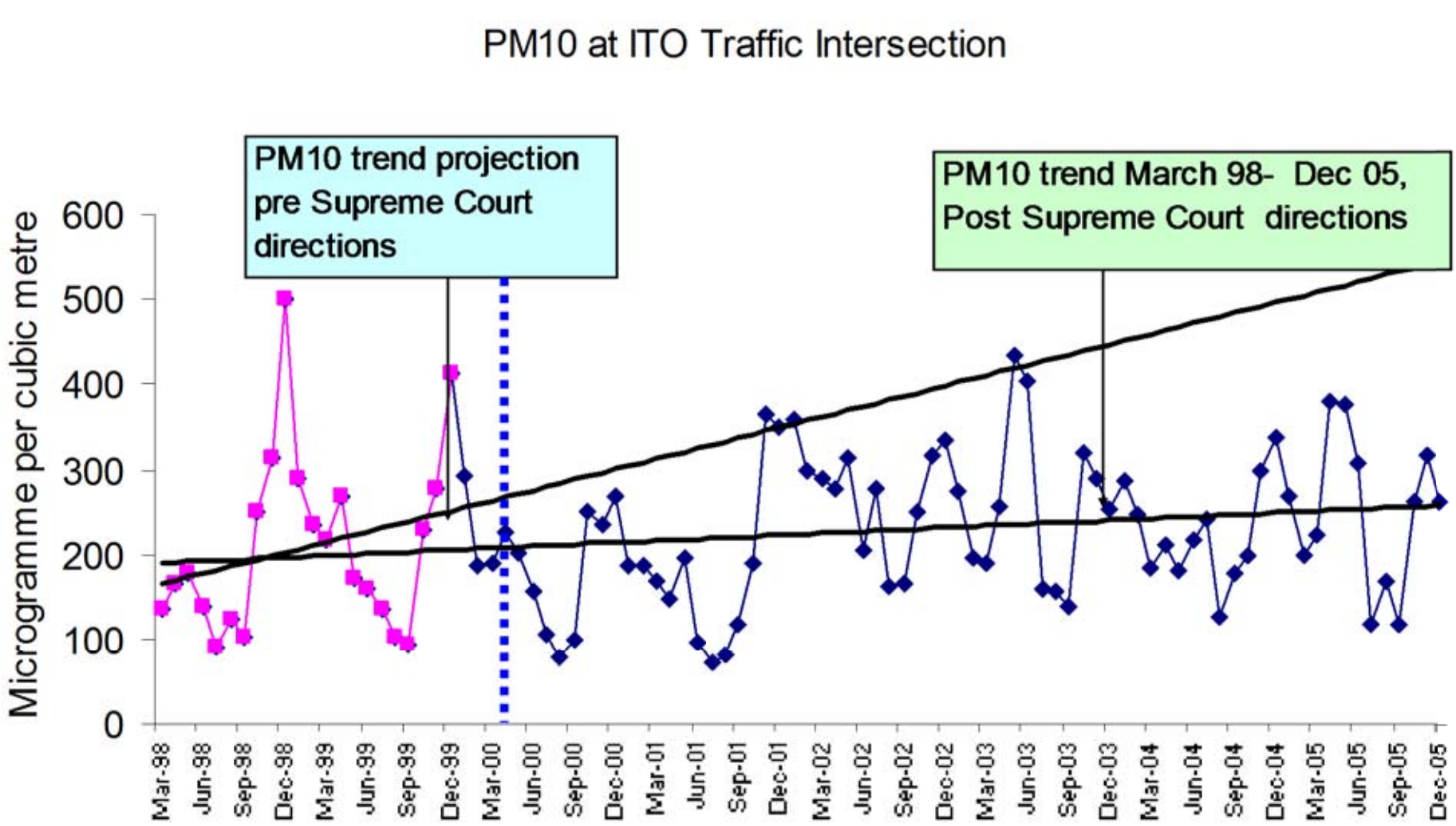
Strengthened vehicle inspection programme (PUC)

Efforts made to bypass transit traffic

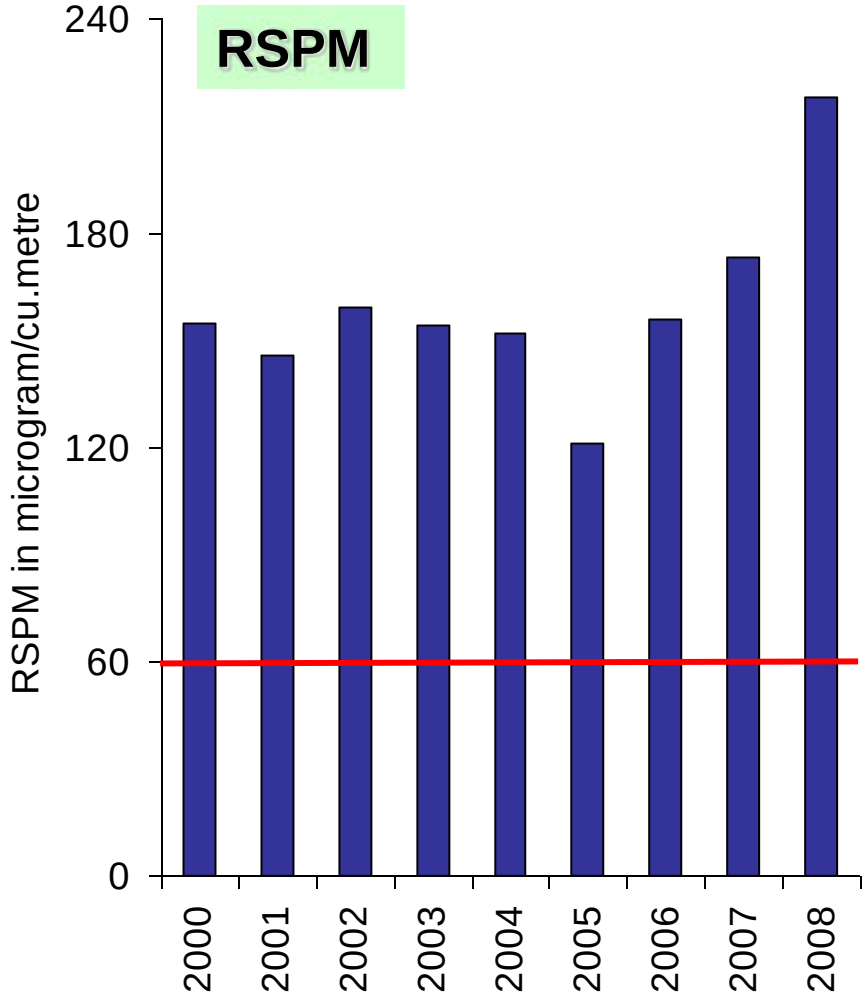
Relocated polluting industry. Stricter action on power plants

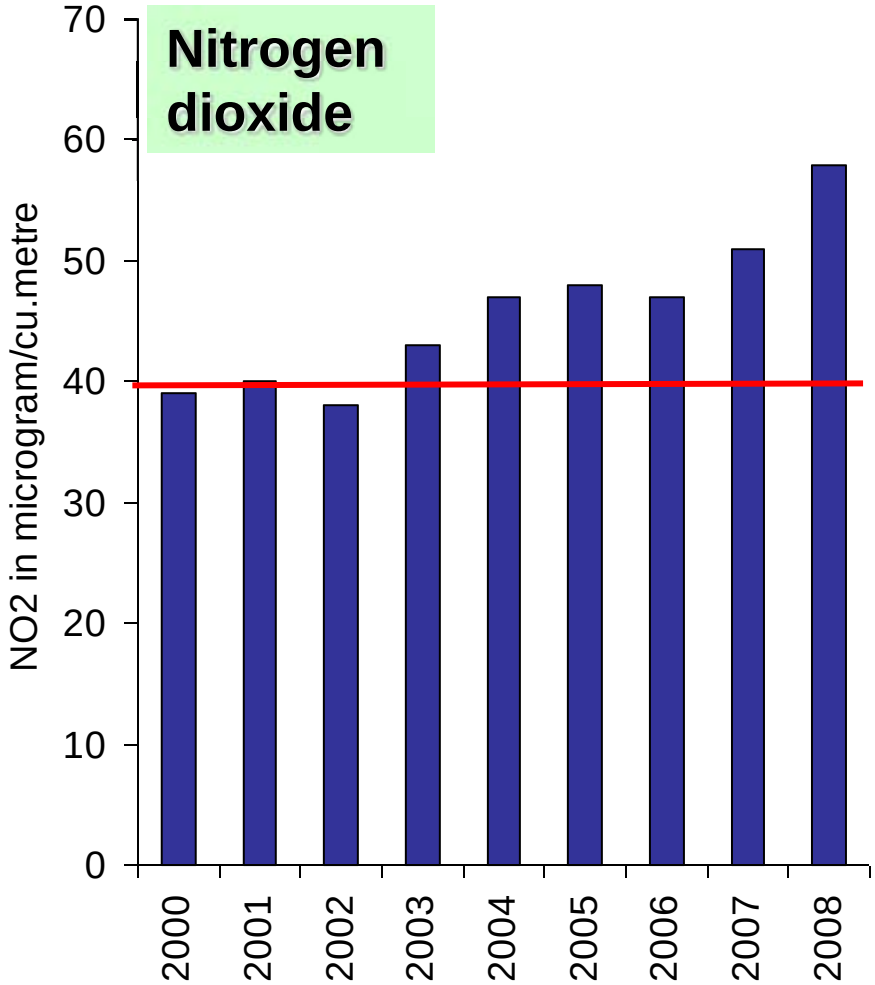
Other major Indian cities have also begun to implement clean air action plans nearly patterned along the same line….

Delhi got cleaner air: it avoided pollution



Delhi has lost its gains. After a short respite pollution curve turns upward – story of several other cities too…





Based on CPCB data

- **Second generation challenge……**

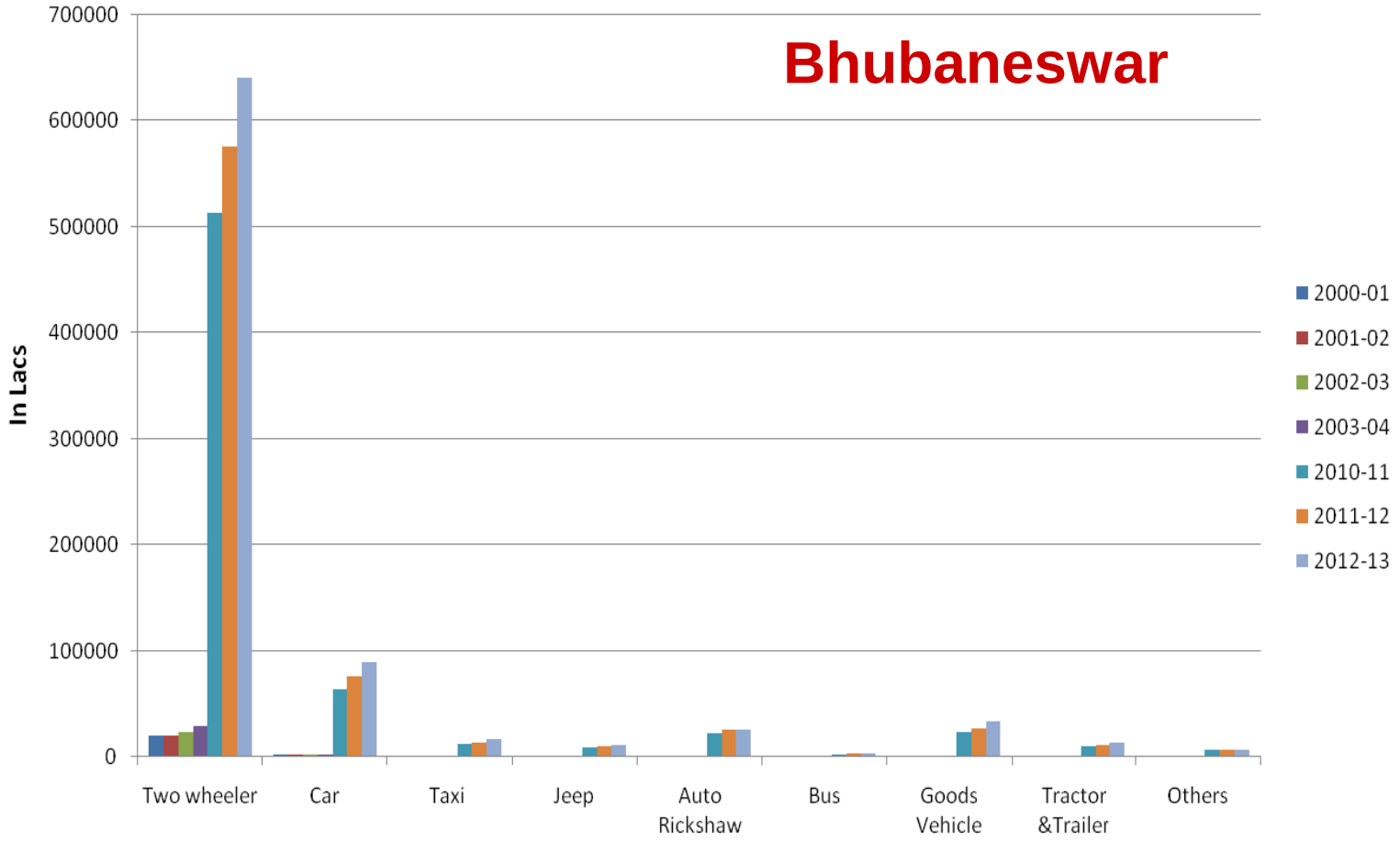
Explosive motorisation

Odisha registers fastest growth in vehicle ownership

Odisha has clocked a massive 293% decadal growth in car, jeep and van per 1,000 households during the period from 2001-11. (ASSOCHAM study)

This is in contrast to all-India average growth of 105% between 2001-11

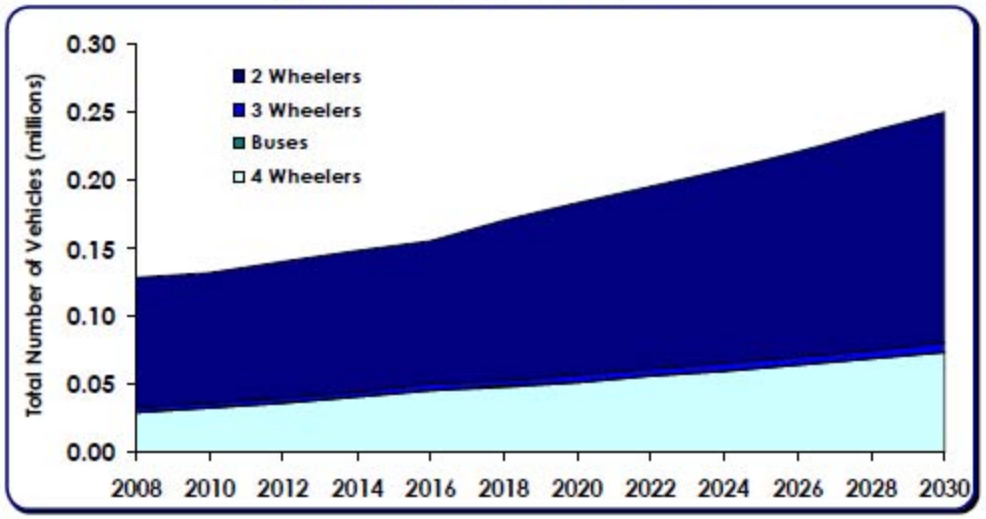
Vehicle growth trend



Source: Mass Transit System of Cuttack and Bhubaneswar, RITES 2008 and Transport Department, Cuttack

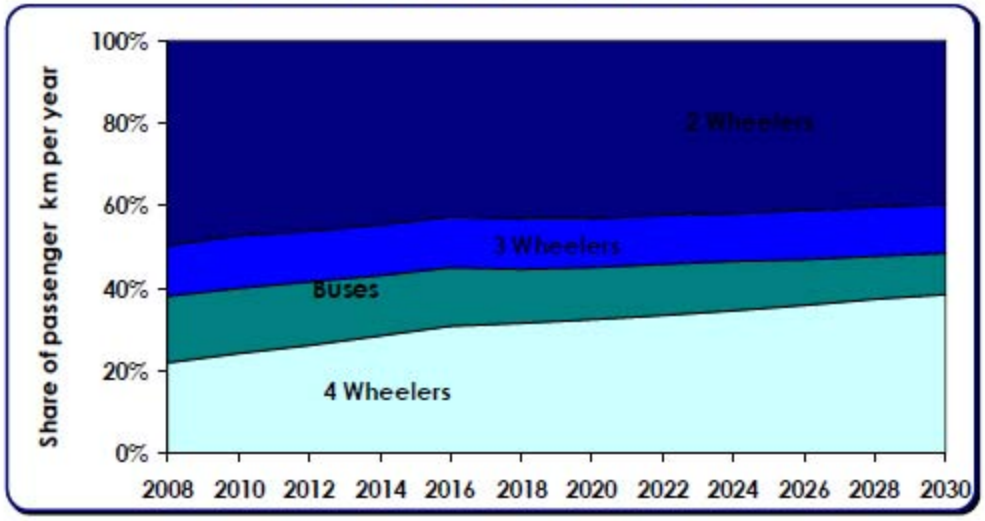
Trend in motorisation Bhubaneshwar

Number of Vehicles



While the share of two-wheelers in passenger kms will stagnate, that of cars and four wheelers will increase and dominate…..

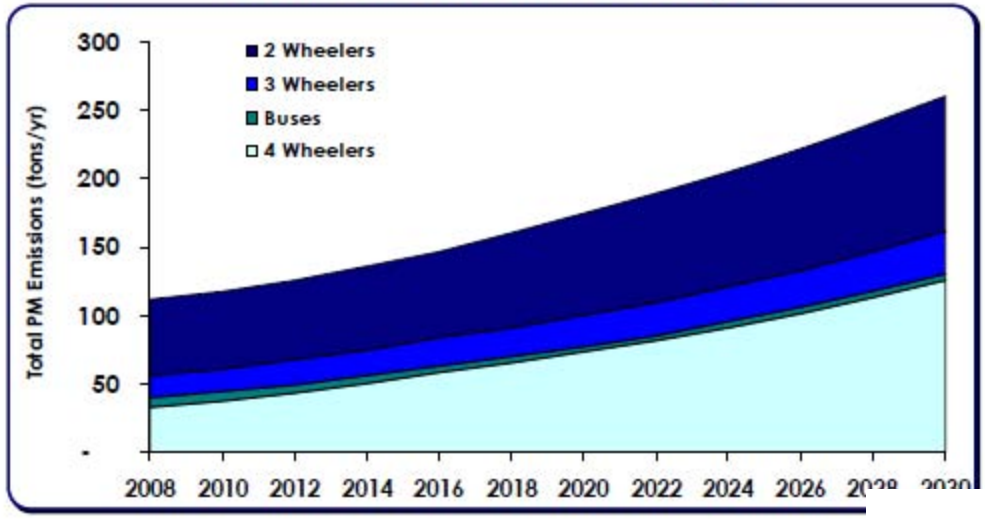
% Passenger kilometers



Source: Motorized Passenger Travel in Urban India, Emissions & Co-Benefits Analysis, Dr. Sarath Guttikunda
June, 2009

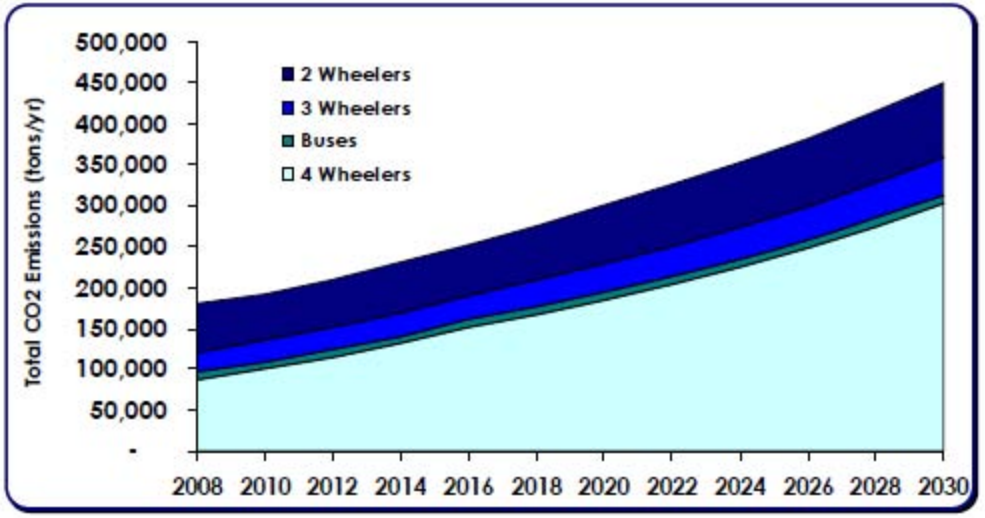
Trend in transport PM2.5 emissions and transport CO2 in Bhubaneshwar

Particulate Matter < 2.5µm



Particulate pollution and heat trapping CO2 emissions – will increase most from cars …..

Carbon Dioxide



Source: Motorized Passenger Travel in Urban India, Emissions & Co-Benefits Analysis, Dr. Sarath Guttikunda
June, 2009

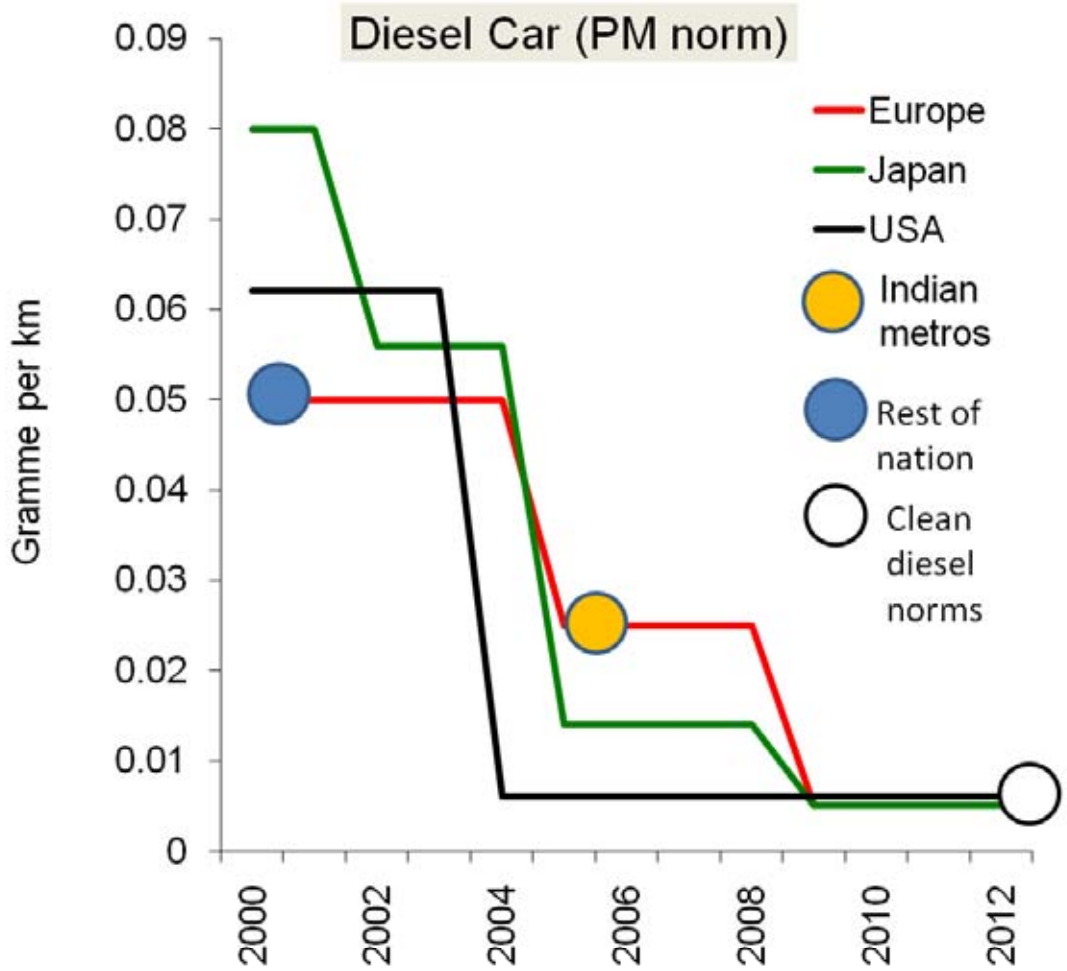
Cuttack: same challenge

Unacceptable time lag

-- Bharat Stage III 12 years behind Europe

-- Bharat stage IV seven years behind

Diesel car emission norm trajectory and India's position



Source: Compiled from European Commission, MORTH, India, Diesel Net

Link with public health goals

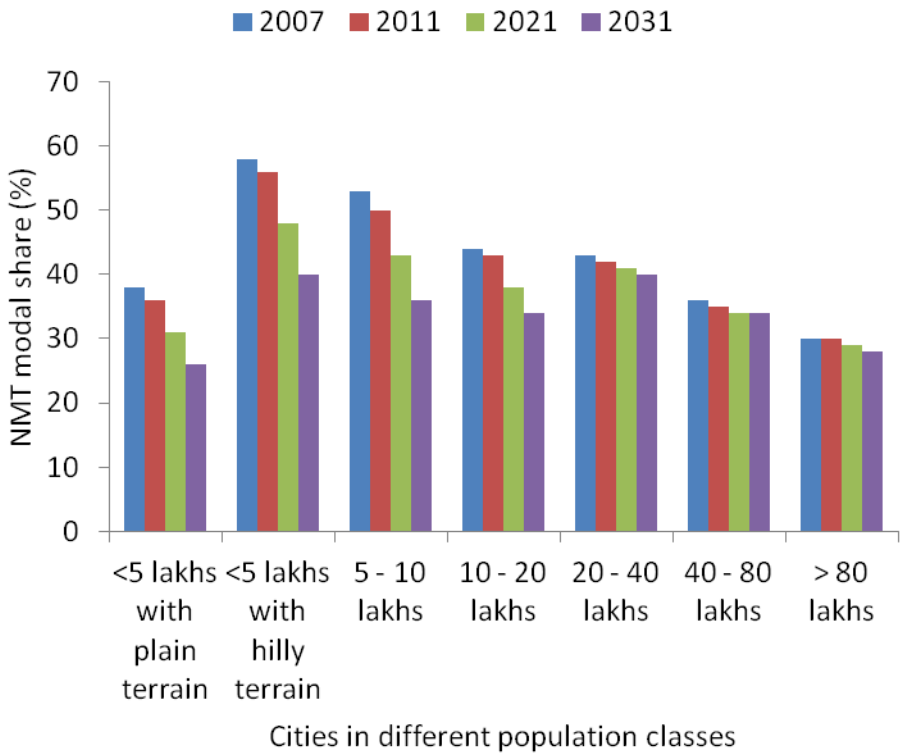
Policy must not increase the time lag

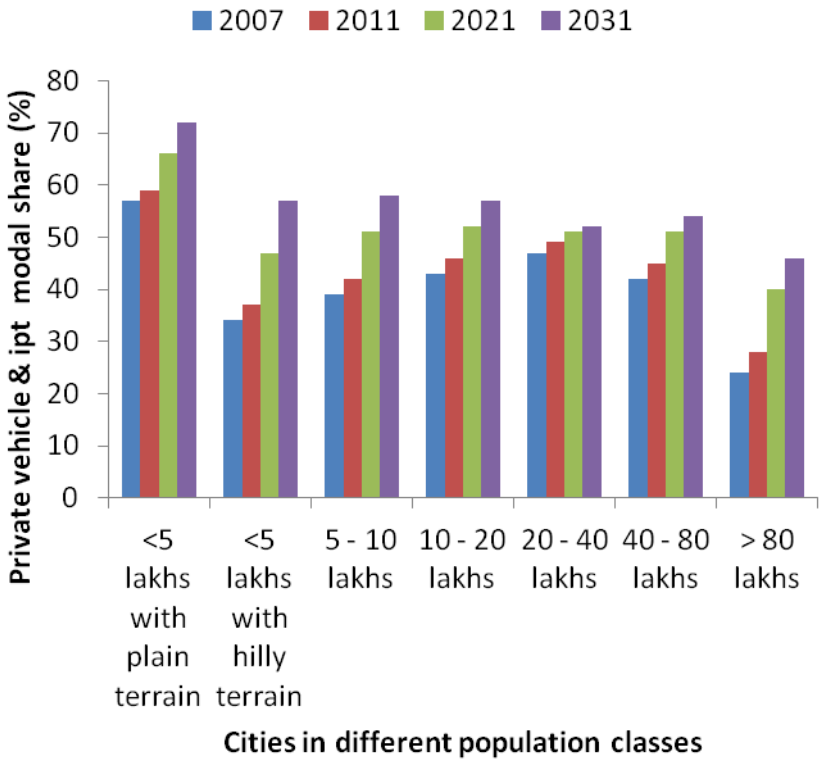
Reduce time lag to maximise health and emissions benefit

- **Address mobility crisis……..**

Share of walk and cycle declining. Motorised transport gaining…….

Personal motorised travel to gain about 20% additional modal share in most city categories until 2031

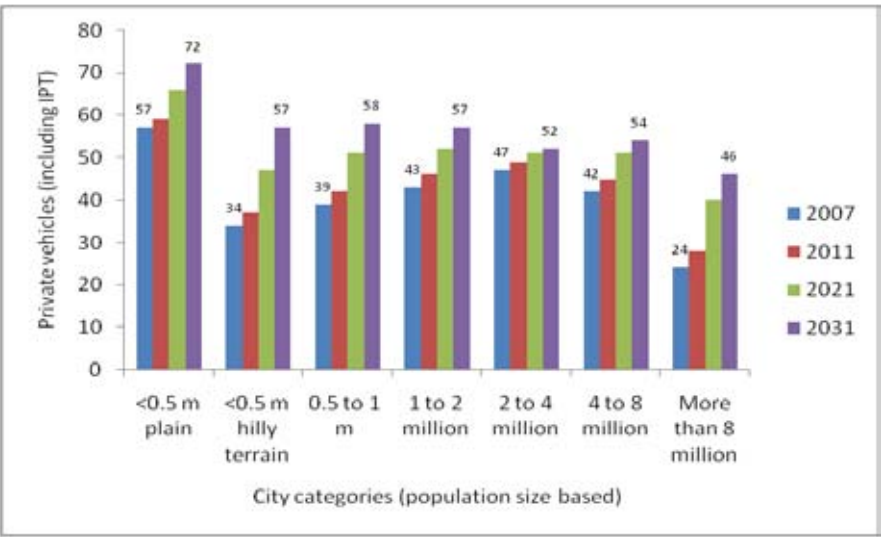


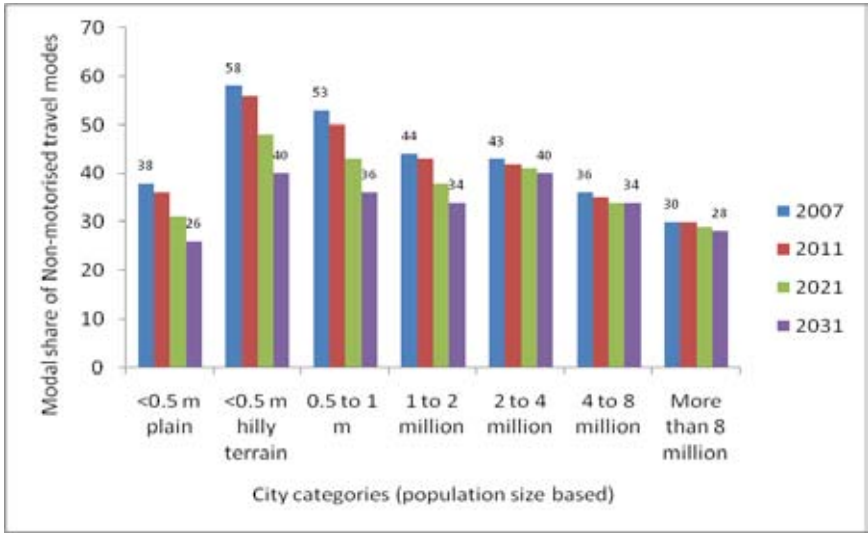


Source: CSE based on MOUD/WSA data 2008

Emerging cities: Special challenge

•**WSA/MOUD forecast -- Cities with 0.5 million to 2 million population will have massive share of private vehicles in 2031 -- about 57% -- Mega cities will be at 46%.**

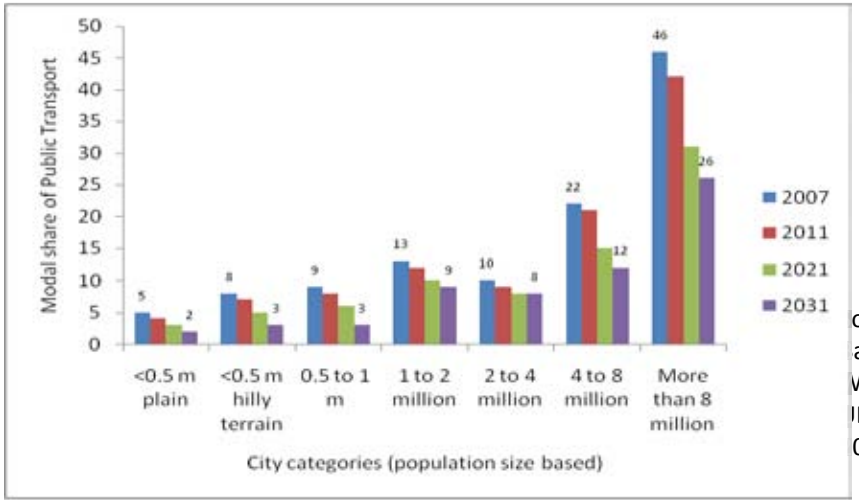




•Share of non motorised vehicles high but to decline more rapidly.

•Share of public transport will decline in all cities. But the share of formal public transport which is already low in smaller cities will slide further

•Private vehicles will grow very rapidly



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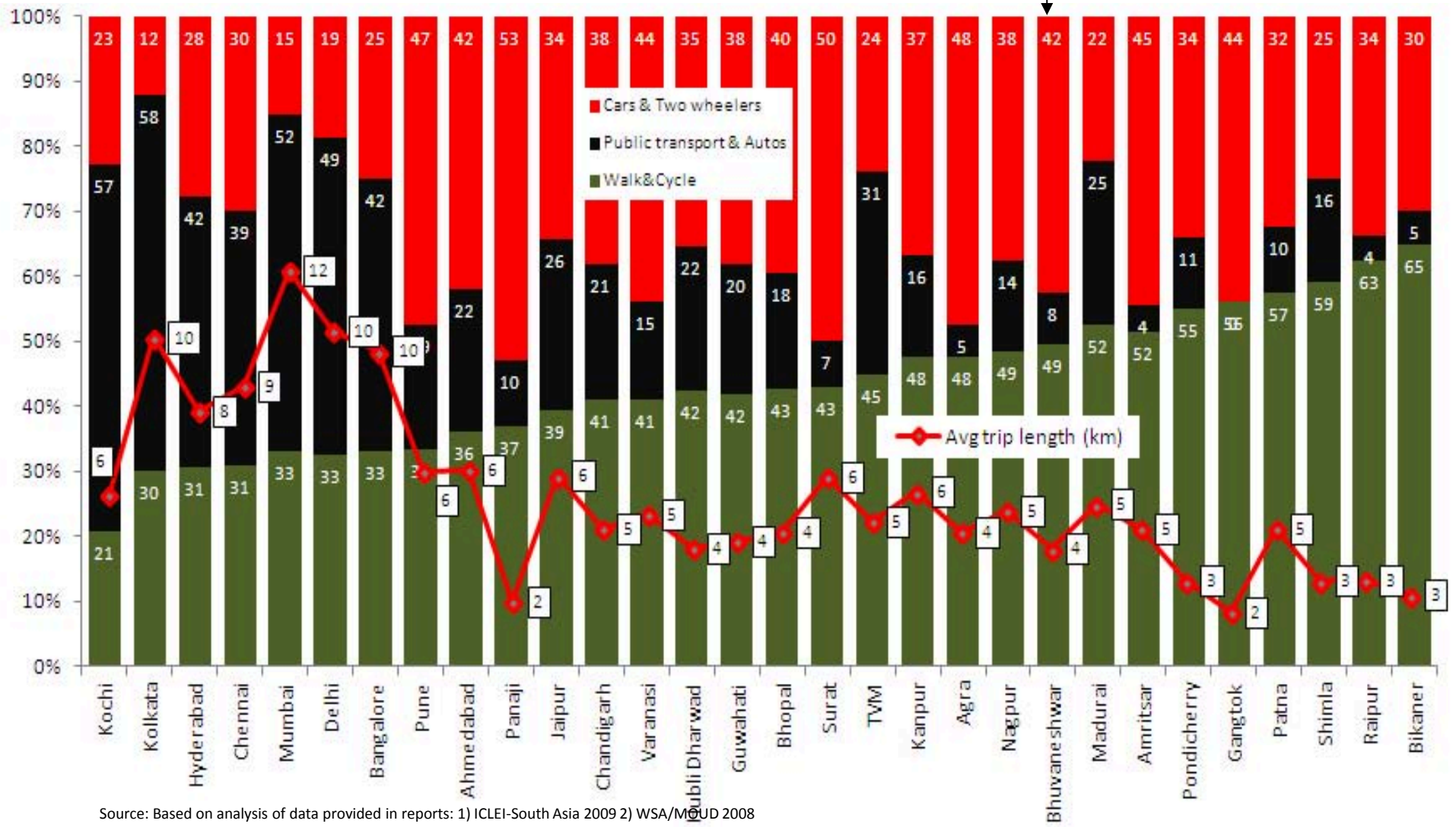
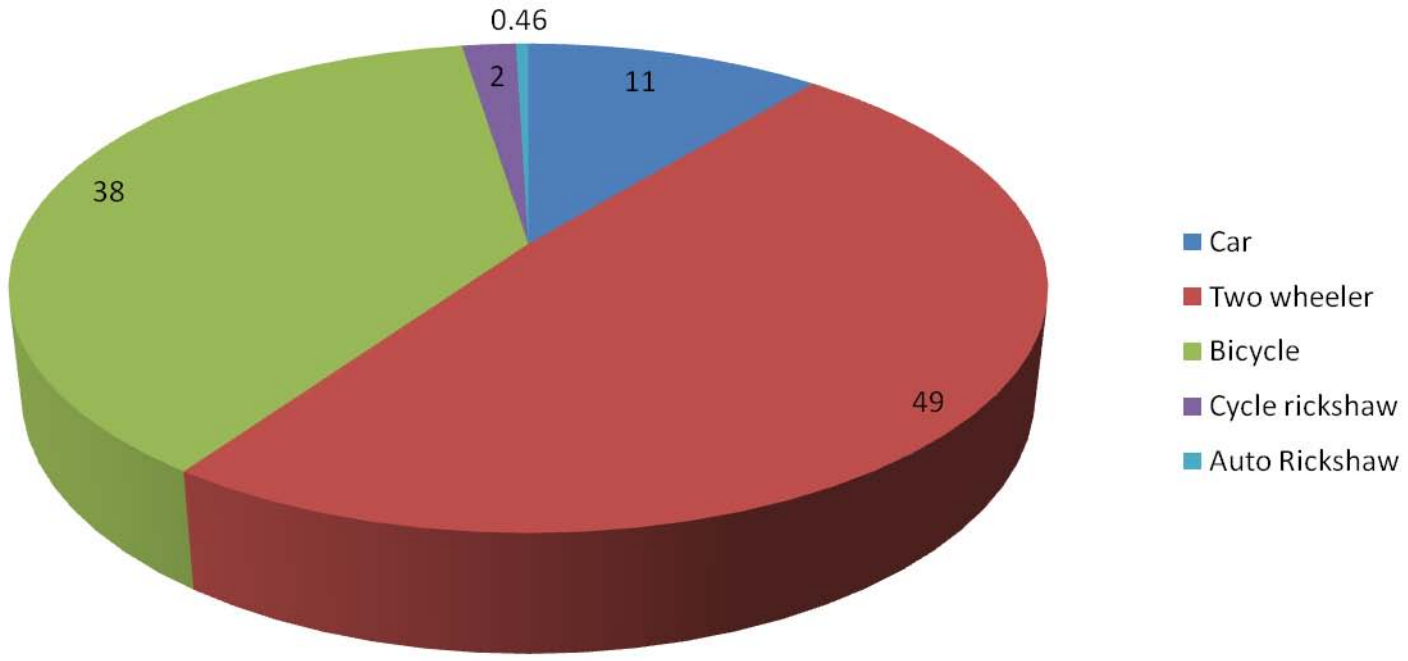
Compact cities have shorter trip length, more walking and cycle share and less CO2 emissions



Source: Based on analysis of data provided in reports: 1) ICLEI-South Asia 2009 2) WSA/MoUD 2008

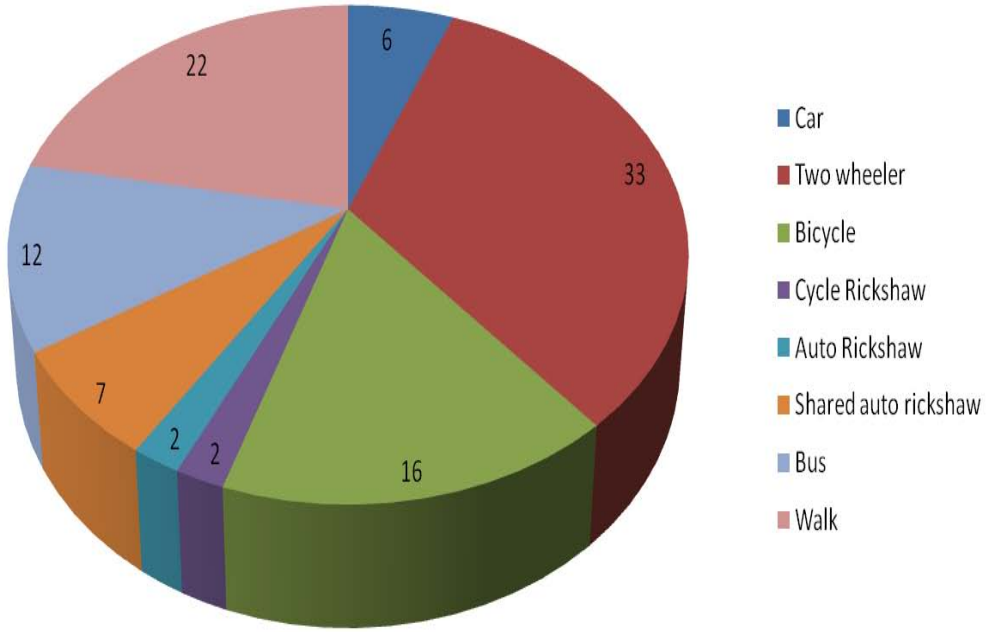
Vehicle ownership

Vehicle ownership by households (%)



Source: Mass Transit System of Cuttack and Bhubaneswar, RITES 2008

How do people travel in Bhubaneswar ?



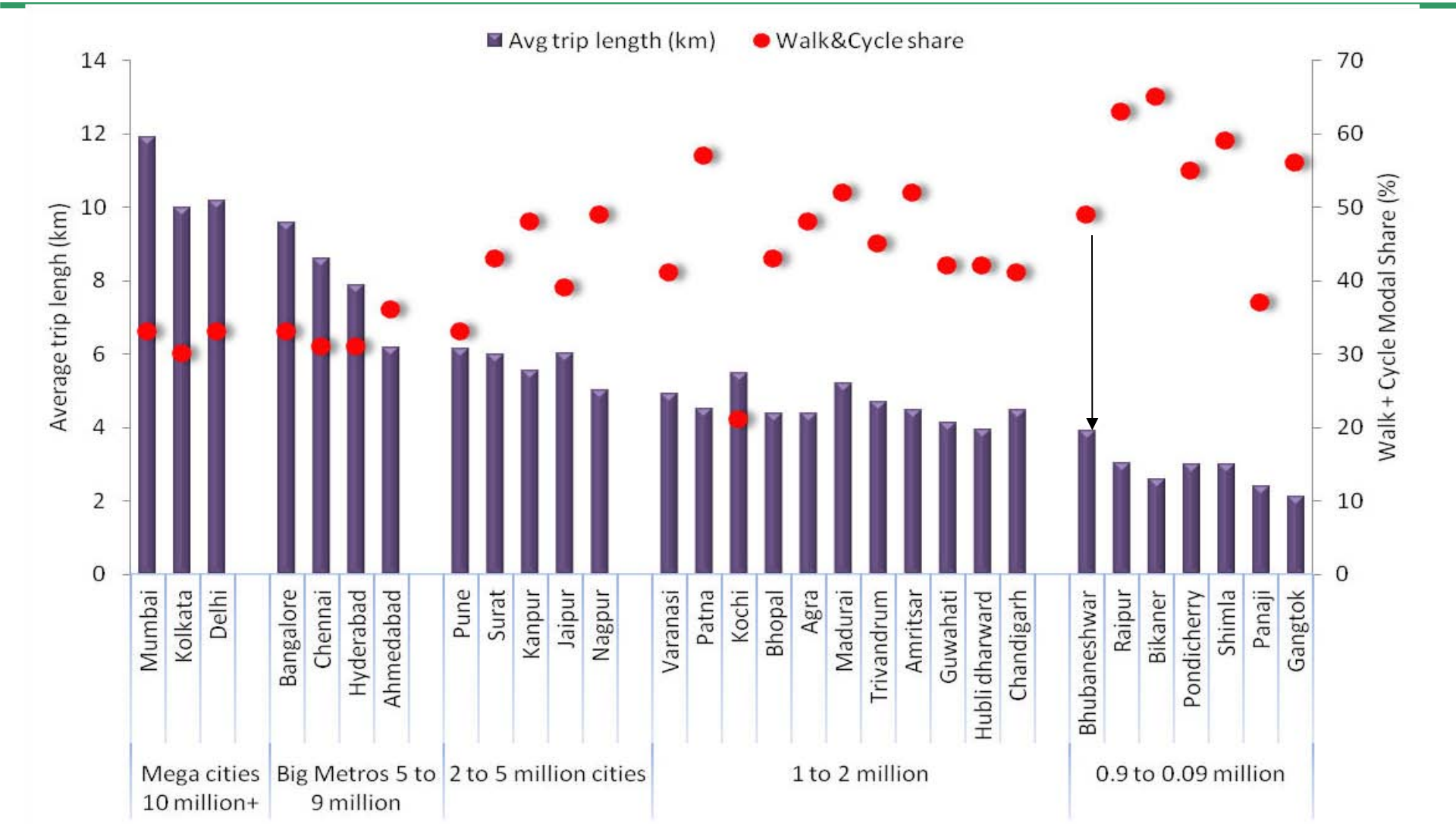
Source: Mass Transit System of Cuttack and Bhubaneswar, RITES 2008

About 40% of daily trips by two-wheelers and cars

Cars – only 6% of trips

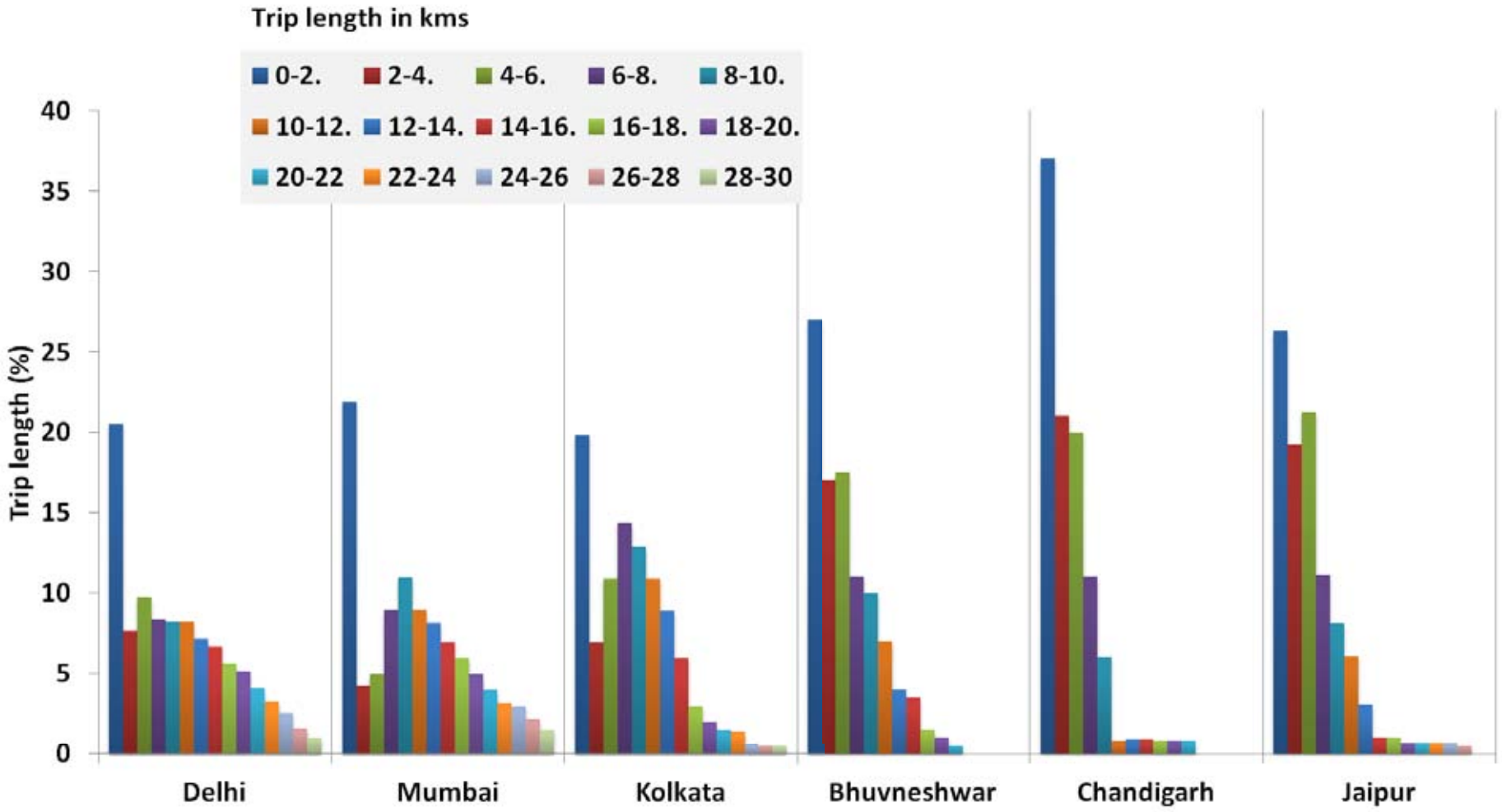
60% are on foot, pedal, bus and autos

Strong co-relation between trip length and share of walking and cycling



Source: Based on MOUD/WSA 2008

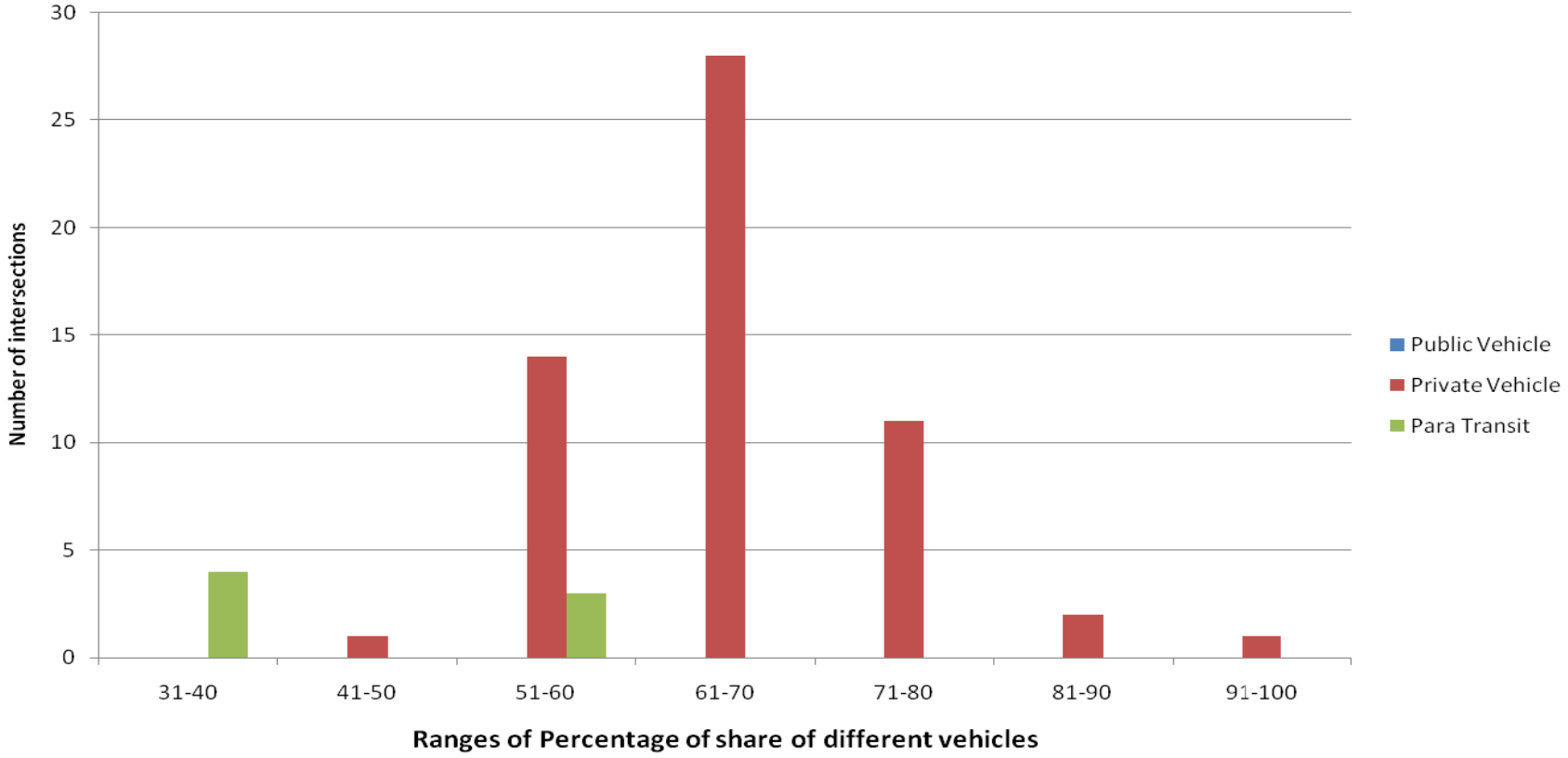
Sprawl effect
Bigger cities show more trips in higher distance range



Source: Based on MOUD/WSA 2008 database

Personal vehicles can reduce people carrying capacity of roads

Share of total motorised vehicles at intersections



Source: CDP, Bhubaneswar

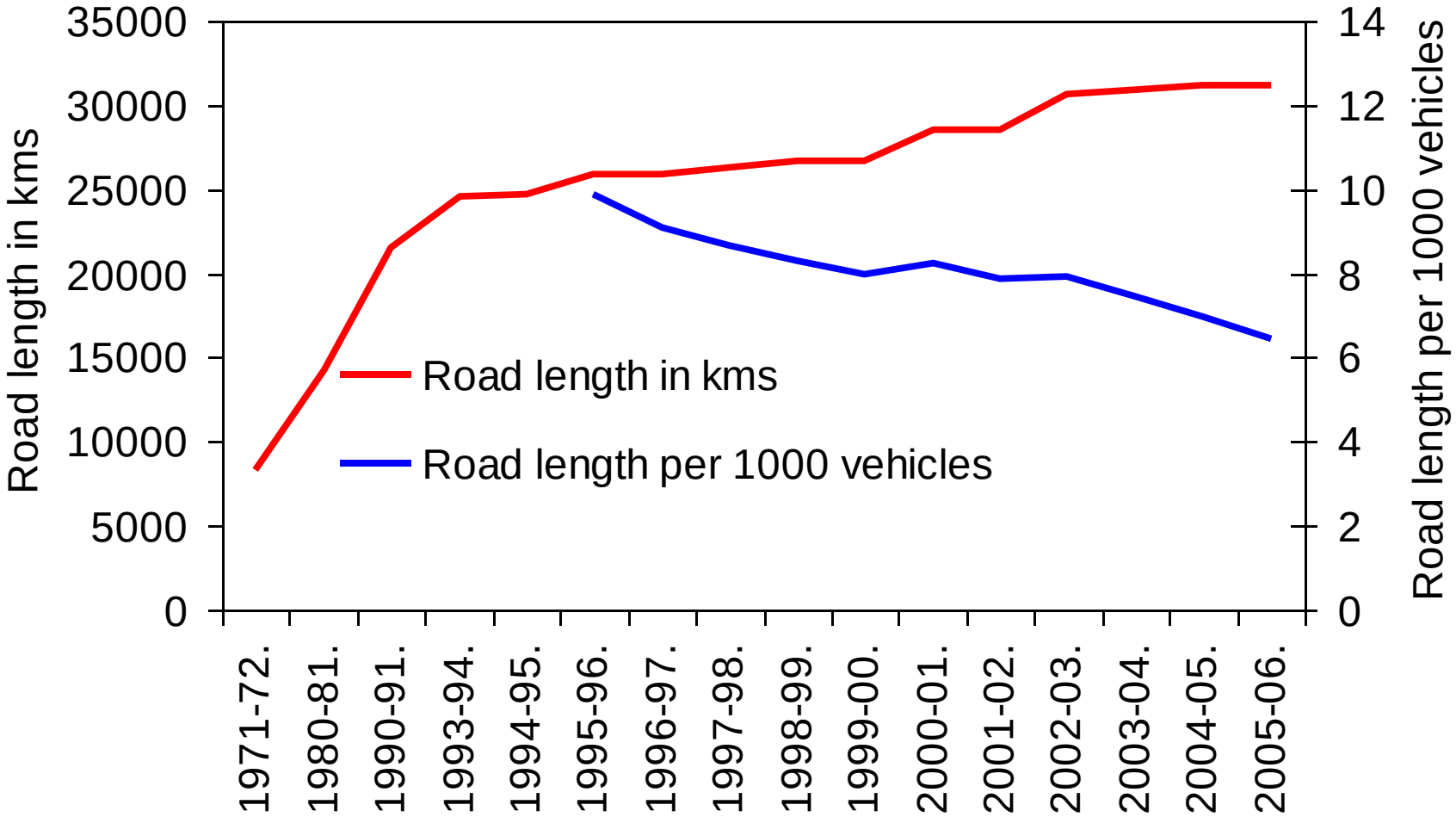
Share of vehicles vs people usage

- The following table shows the share of vehicles during peak hours at major intersections.

Major intersections	Public vehicle		Private vehicle	
	Vehicle share (in %)	Total people using the vehicle (in numbers)	Vehicle share (in %)	Total people using the vehicle (in numbers)
Hansapal Square	12	960 (89%)	75	113 (10%)
Poonama Gate square	3	240 (65%)	85	128 (35%)
Dumdama Chowk	7	560 (85%)	64	96 (15%)
Shaheed Nagar crossing	2	160 (54%)	90	135 (46%)

Source: CDP, Bhubaneswar

Learn from Delhi: More roads are not the answer

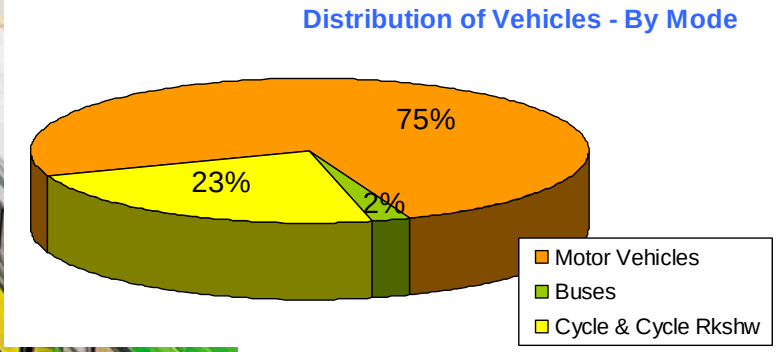


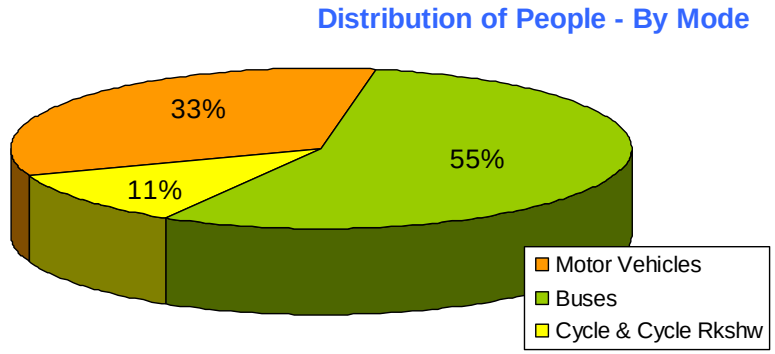
Source: On the basis of Economic Survey, Delhi Govt

Reallocate road space. More space to high capacity and non-motorised modes and majority commuters

Moving vehicles vs. moving people

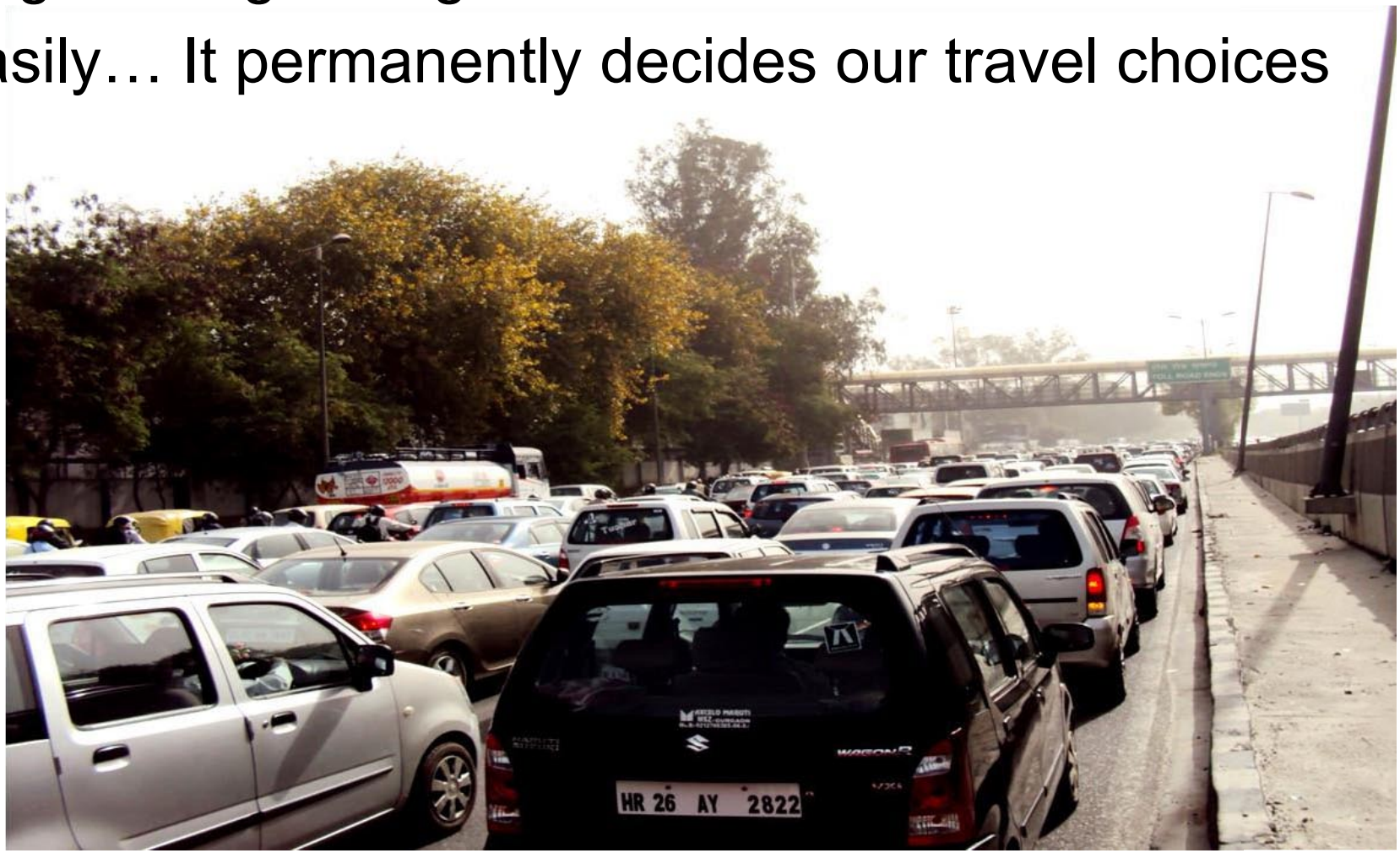
For 55% of people Speed increased to 18-19 km/hr (peak hour) from 7-11 km/hr (peak hour); Bicycle traffic increased to 2,800/hr/direction (Evening peak)





Paradigm of density control, signal free roads, FOBs…….

Engineering changes once made cannot be reversed easily… It permanently decides our travel choices



- **Scale up public transport…….**

Buses ..... The key link

-- **Spine of public transport:** Buses provide the bulk of public transport services – as much as 40-60 per cent – in cities that have city bus services.

-- **High targets for public transport share needs efficient and reliable bus service**: MPD 21 targets 80% public transport share by 2020; Pune 80%; Kolkata 90%..In Delhi buses along with bus rapid transit system can help to meet at least 73% of the target.

-- **Buses allow greater flexibility, geographical coverage, cost effectiveness, and space efficiency.** Can flexibly and easily meet the needs of changes in demography and land use. Cover areas with lower travel demand.

-- **A bus occupies twice the road space taken by a car but carries 40 times the number of passengers.** Bus allow enormous oil and pollution savings (IEA).

-- **Poor people are most dependent on affordable and cheap public transport to access jobs and services**. Urban poor can use upto 25-30 per cent of their income on transportation.

-- **Per person emissions several time less than cars**

City bus service in Bhubaneswar: The genesis

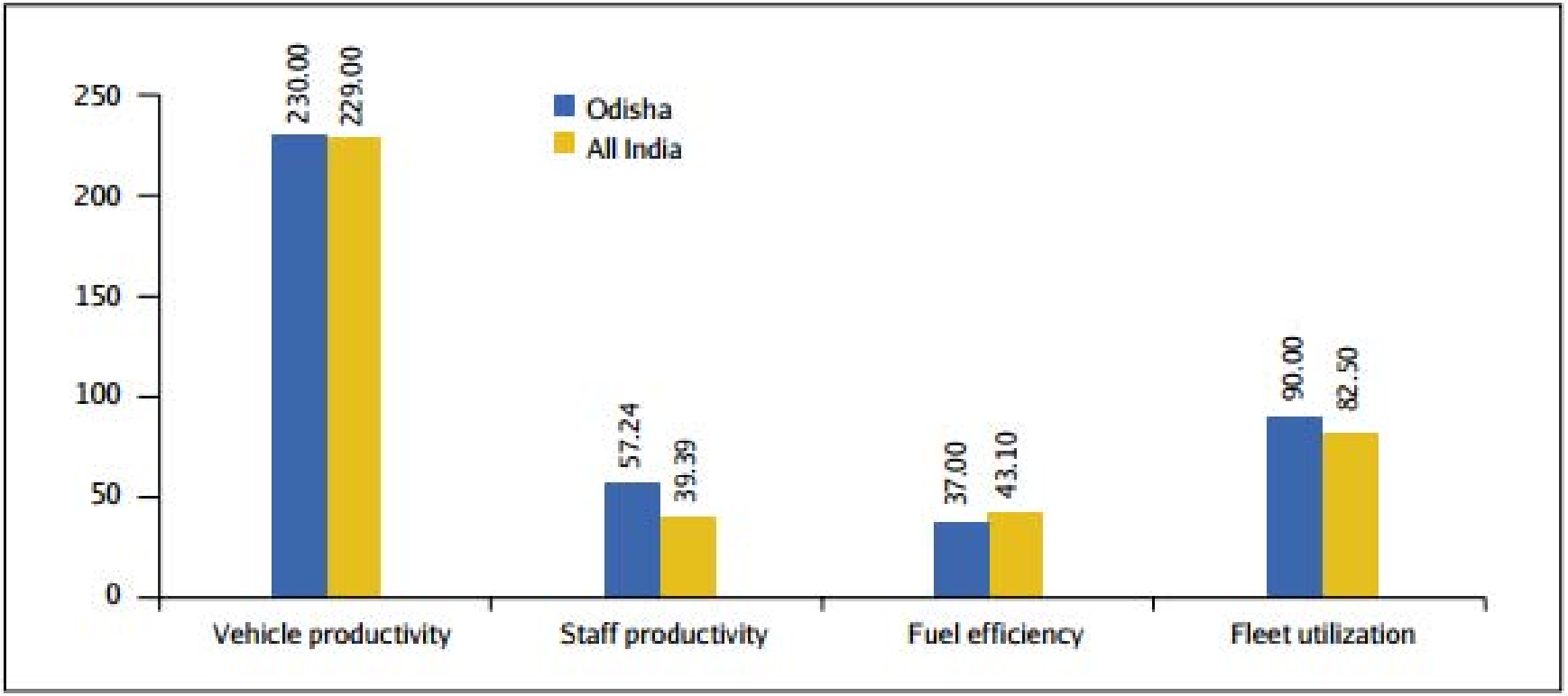
Bhubaneswar's city bus service launched on October 10, 2010

A total of 100 buses in Bhubaneswar under the JNNURM

The city bus service is initiated under the PPP mode between BPTSL and DTS.

Need cost and operational reforms

Relative efficiency of Odisha State Road Transport Corporation



2010-11: Odisha State Road Transport Corporation had 283 buses on road with a fleet strength 334 and a regular staff strength of 940 with a bus staff ratio 1:2.82

Passengers serviced by public sector buses declining over the years. Share of private sector increasing

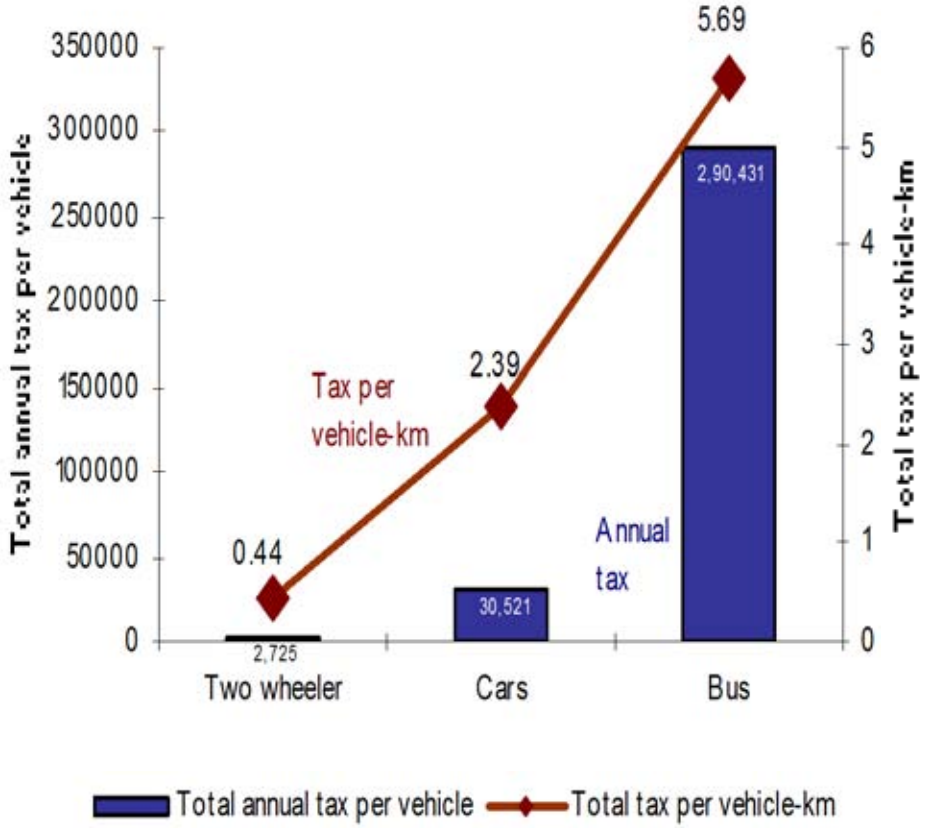
Source: Economic Survey, Odisha: 2011-12

Rationalise taxes on transport
Buses bear significantly higher tax burden in India

-- Buses pay more taxes than cars

-- 12th five year plan documents states – all taxes can be a quarter of the total costs of bus operations

-- Two-wheelers are cheaper to operate (Rs 1-2 per km) than the minimum bus fare….



Buses pay mote tax than cars

- The cars pay only a one time (life time) tax equivalent to 5% of the vehicle cost…..,

- Buses pay an annual tax based on the capacity, distance covered per day and nature of service.

- On amortising the taxes on cars and buses, one finds
-- Cars (popular mid size segment) pay approximate **Rs. 2000 per annum**

-- Buses pay taxes to the tune of **Rs. 40,000 per annum**.

Bus pay more taxes than metro...

Comparison of Tax liabilities of DTC and DMRC

S.No.	Tax liability	DTC	DMRC
1	Land Acquisition tax	Liable	Exempted
2	Property tax	Liable	Exempted
3	VAT on bus acquisition	Liable	Exempted
4	VAT on consumables	Liable	Exempted
5	VAT on spare parts	Liable	Exempted
6	Excise on bus acquisition	Liable	Exempted
7	Excise on consumables	Liable	Exempted
8	Excise on spare parts	Liable	Exempted
9	MV Tax	Liable	N.A.
11	Customs	Liable	Exempted
12	Wealth tax	N.A.	Liable
13	Fringe Benefit tax	N.A.	Liable
14	Capital gains tax	N.A.	Exempted
15	Works' contract tax	N.A.	Exempted

Source: CSE's own compilation

Source: CSE estimates based on data from data from Operational Statistics, December, 2011, March 2010, and April, 2005 issues, Delhi Transport Corporation

Metro enjoys infrastructure status to enjoy fiscal incentives to get priority financing, lower rate of interest, financing for working capital, longer tenure of financing, and other fiscal incentives etc.

Public transport is for public good. Exempt bus transport from taxes.

Cost pressures: Fuel economy of buses worsening

Fuel economy performance of the bus fleet in Bangalore

Figure: HSD KMPL

Leyland and Tata BS-I vehicles

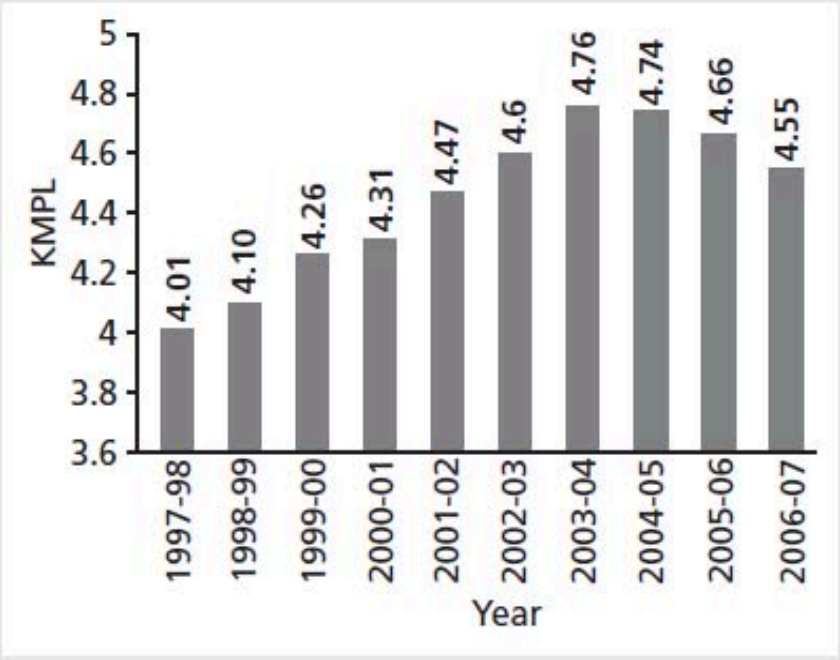
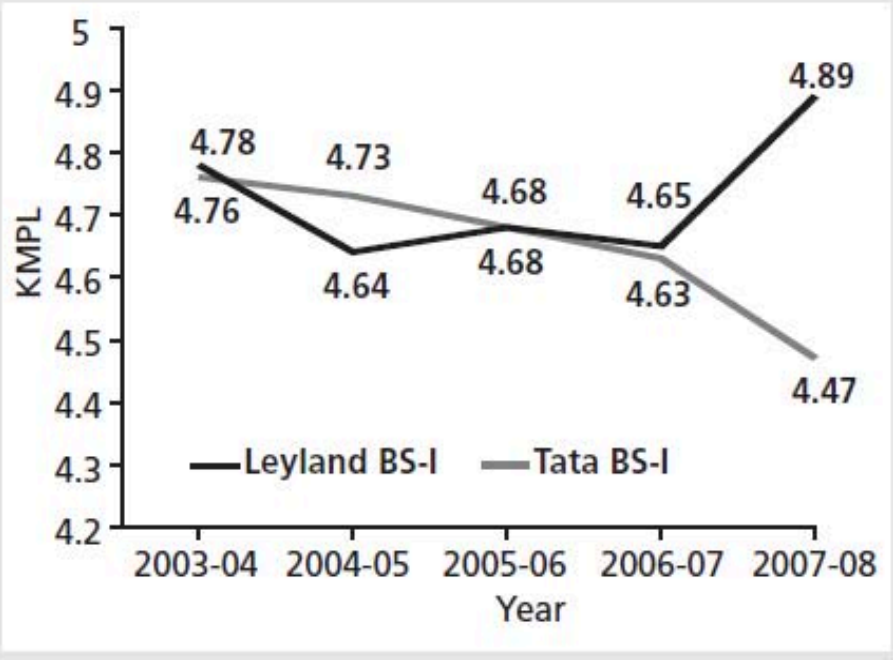


Figure: KMPL comparison of

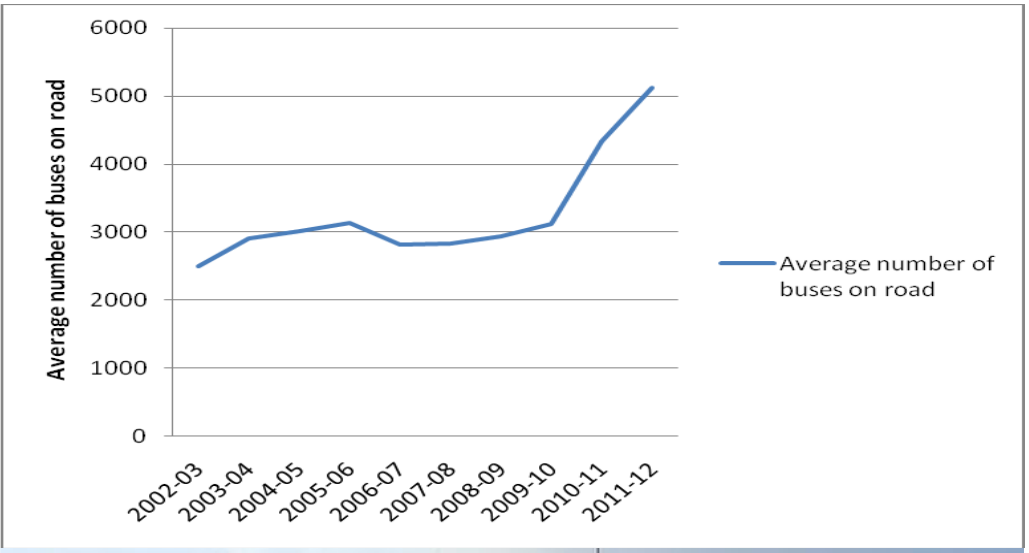


Source: BMTC

Need fuel economy standards for buses

Change in Delhi……

Average number of buses on road, 2002-03 to 2011-12, DTC



Revival of bus numbers: Average number of buses augmented to 5892 in 2011-12. ….

Revival of ridership: Within a span of one year -- 2010 - 2011, **the ridership of DTC has increased by 25%**. The turn around happened when it increased to 2.4 million in 2009-10 and hit 3.0 million in 2010-11.

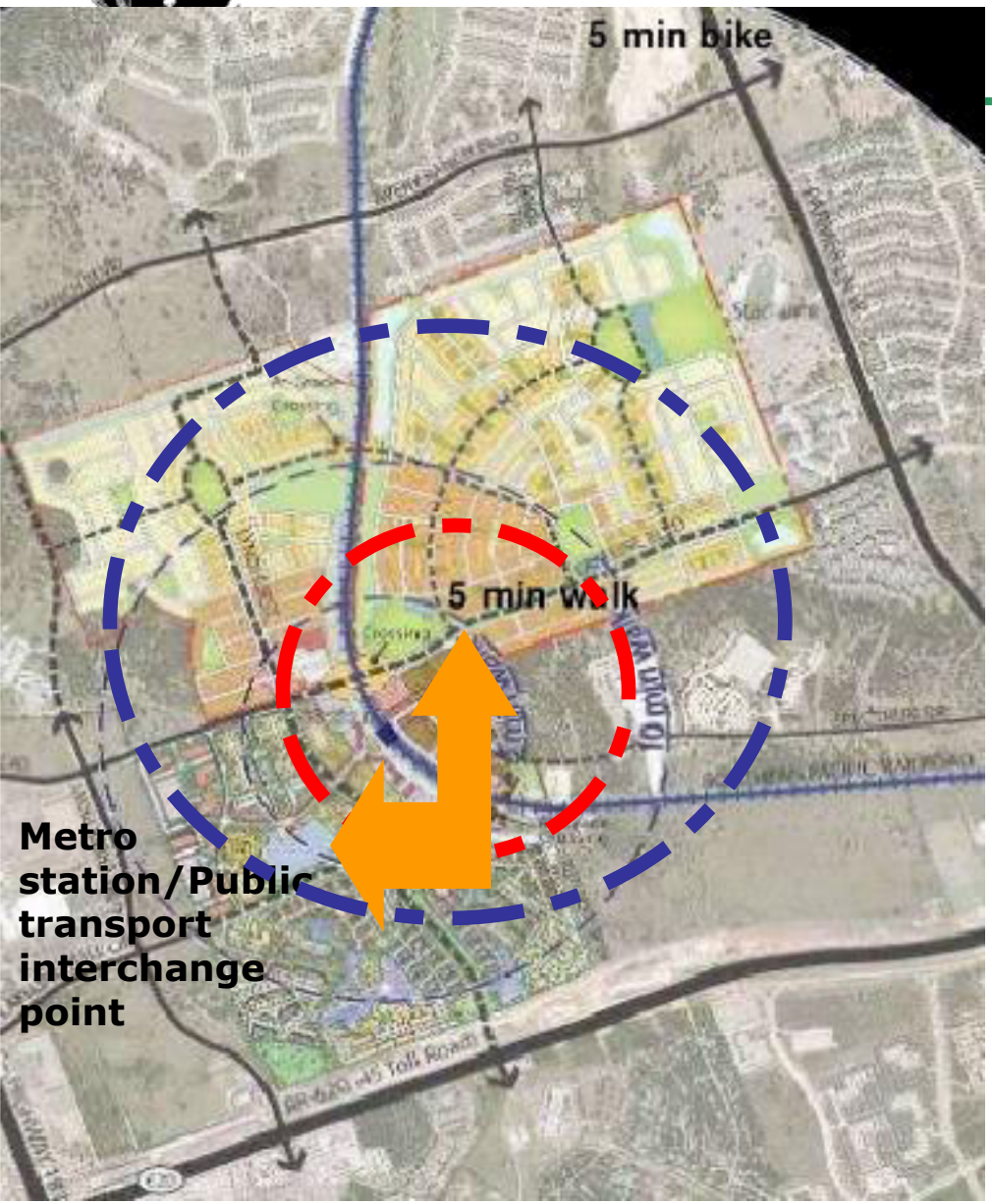
Revival of earnings: DTC earnings show major gains. During 2005-06 this was Rs 279 crores. This has **increased three times** to Rs794 Crore in 2010-11.

Yet long way to go….

Source: CSE based on DTC stats and op data

- **Need multi-modal integration**

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.

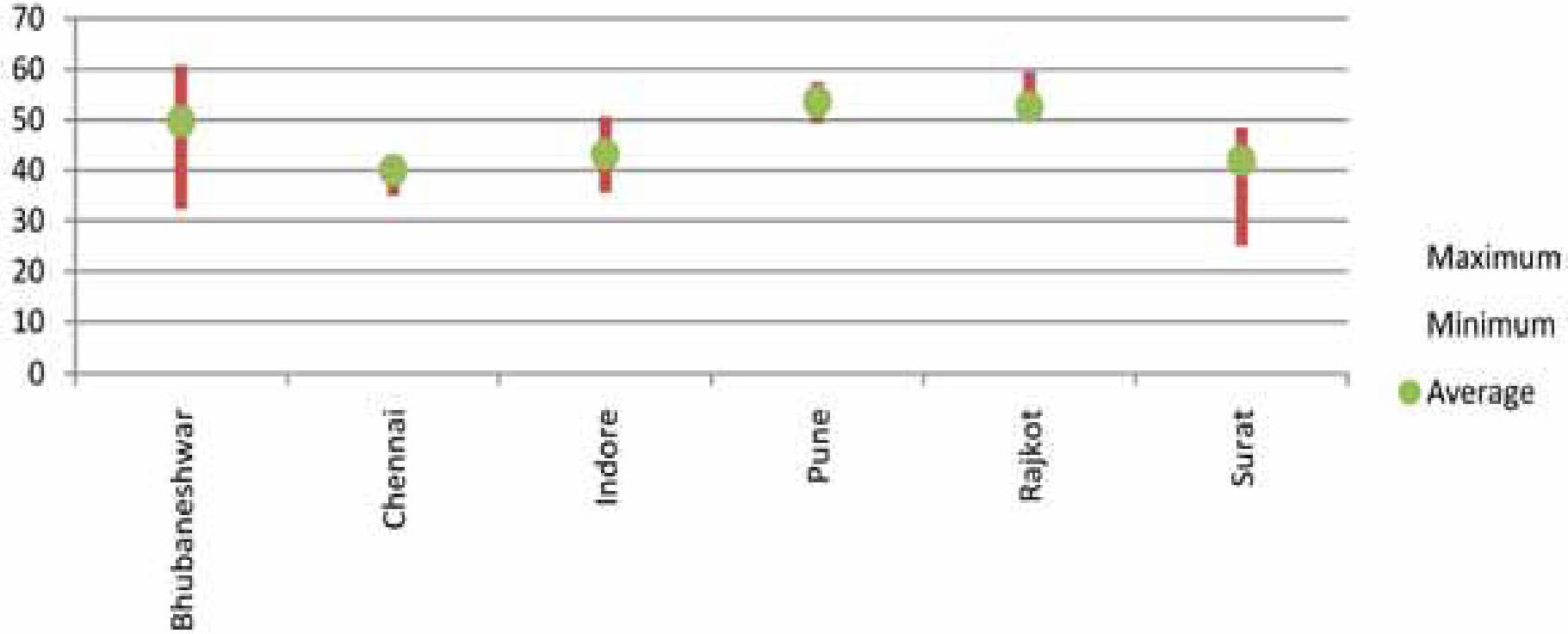
- **Improve access…**

Each and every trip begins and ends as walk trip …… Need walkable cities

Old city……

Walkability…..

Bhubaneswar is among the better ones…



Source: Walkability in India cities, CAI Asia

Walking and cycling facility…Inherent strength of Bhubaneswar

Nandan Kannan road

Raj path road

Raj path road

Bidyut Marg

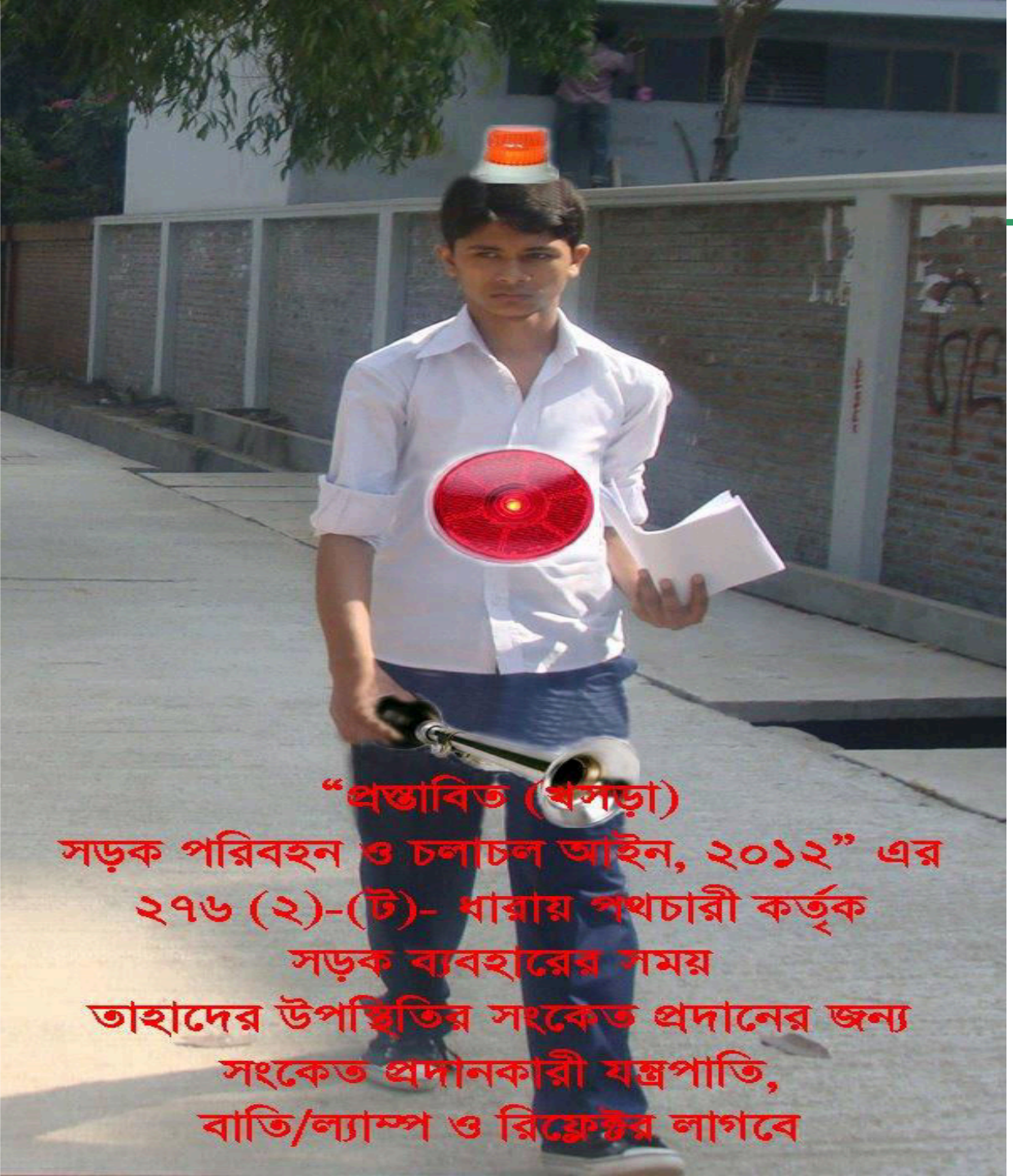
Well shaded tracks and footpaths, with dedicated lighting, Rajpath road

Segregated tracks and footpaths

Nandan Kannan road

Lighting…….

Residential colony



Onus on whom?

Experience from Dhaka

Bangladesh Road Transport Regulations and Rules 2012 requires pedestrians to carry indicators including reflector, lamp etc

People are complying to protest

But…. crossings vulnerable as primacy given to motor vehicles

Nanadan Kannan road and
Rajpath road

Need innovative approaches to signals, crossings and round abouts …..

Example London: Global innovations……

Need safe crosings at signalised intersections`

Globally more innovative design for rotaries and roundabouts at for safe and calmer movement:

Protect bicycles and cycle rickshaws – the ultimate zero emitters and feeders for multi-modal integration

Share of bicycle ridership in Bhubaneswar is higher than cars, and buses

Bit – nationwide -- between 1980 and 2000:
- Bicycle ridership droped from 20% to 5% in Delhi; 45% to 35% in Nagpur; 33% to 18% in Indore; 3% to 16% tn Ahmedabad.

Enhancement of NMT infrastructure under urban renewal missions programmes

Bus-bike integration

Priority access to NMT.

Cycle rickshaws are zero emissions intermediate transport.

Can we have zero emissions street?

Cycle rickshaws are part of the solution….
High share of short trips make para transit convenient and affordable. Even buses are not convenient for short distances.

Delhi is reorganising this sector: Cycle rickshaw policy in Delhi under preparation.

Visionary interventions. The Delhi High Court ruling:
-- The Municipal Corporation of Delhi (MCD)‟s policy of restricting cycle rickshaw licenses was unconstitutional as it violated the right to earn livelihood.
Since cars were not regulated, cycle rickshaws could not be blamed for causing congestion.

Punjab, Haryana and Chandigarh: 2012, Punjab and Haryana High Court: suo motu action to introduce Ecocabs in 22 district headquarters in Punjab, Haryana and Chandigarh

Vehicle of the future……..

Patiala Green Cabs

Fazilka Ecocab

Amritsar Ecocab

-- Also other para transit need integration

Three-wheeler policy in Delhi:

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.

- **Need compact cities to reduce vehicle miles traveled and pollution……..**

Car centric paradigm (flyovers, signal free roads, foot over bridge) undermine sustainable mobility

Car centric infrastructure cut off walking and cycling access

Increase distances

Convert short zero emissions trip to motorised trips

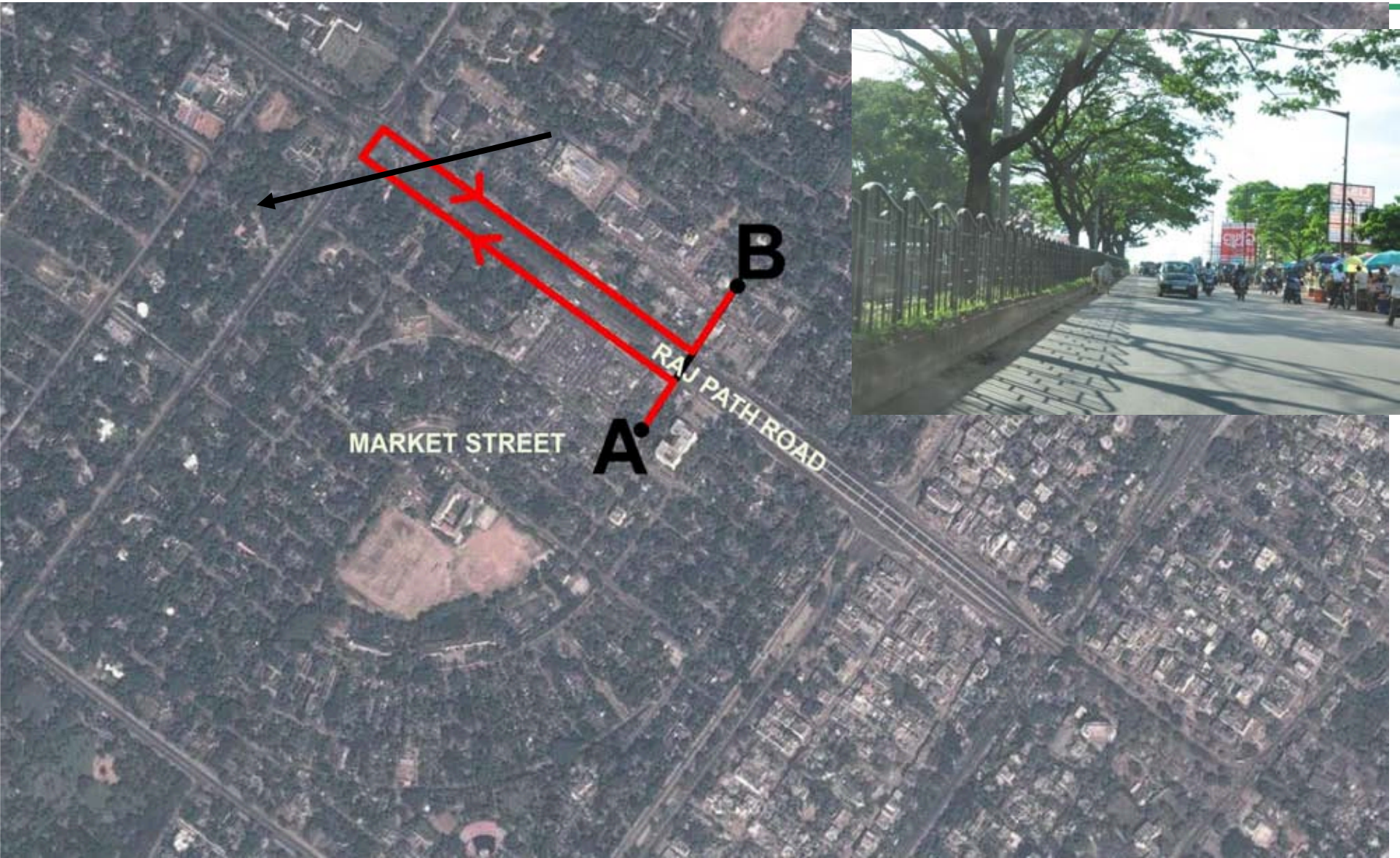
Add enormously to pollution

Case Study, Rajpath road

Travelling from A to B (Originally 100 M across the road)

Case Study, Rajpath road

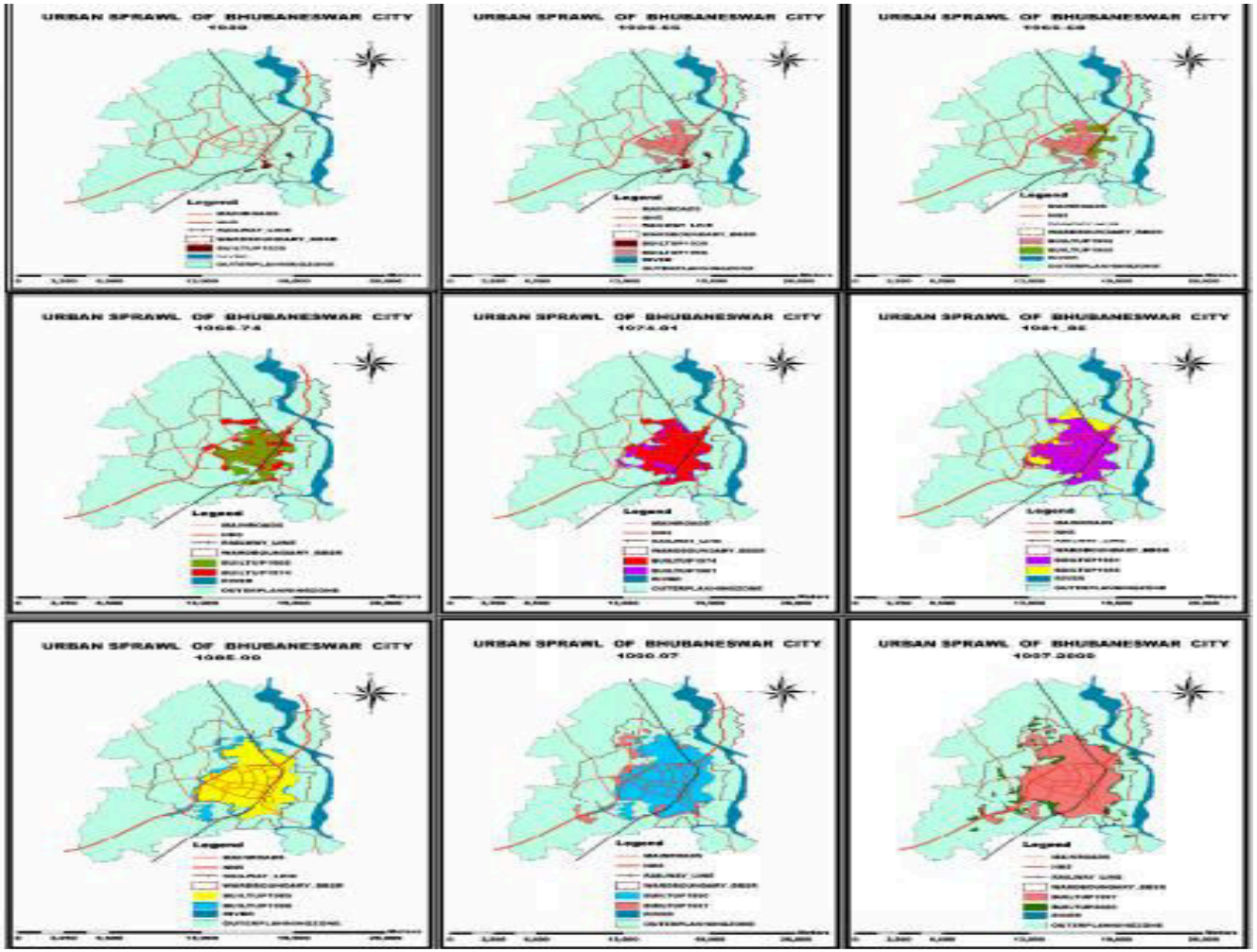
Travelling from A to B Pedestrian Crossing (1.1 km as the crossing is limited and has high railings)



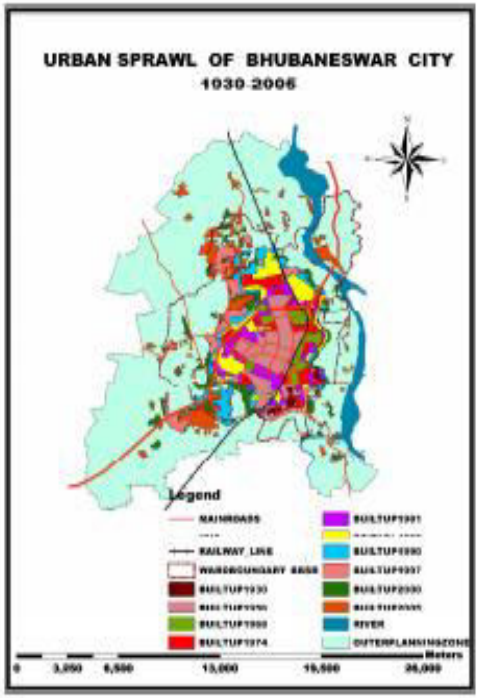
Engineering interventions lead to more energy guzzling and CO2 emissions

- Walk direct access 100m
- Travel in motorised mode 1.1 km
  - In a Car, 154 g of co2
  - In a Two wheeler, 44 g of CO2

Urban sprawl in Bhubaneswar (1930-2005)



Changes in Bhubaneswar by 2031



Source: Urban sprawl mapping and landuse change analysis using remote sensing and GIS (Case study of Bhubaneshwar)

Planning for a compact city
Delhi setting norms for high density requirements

Delhi framing Transit Oriented Development Policy (DDA/UTTIPEC)

Density minimums as per the table below:

Gross FAR (site)	Minimum permissible density (with ±10% variation)	
	Residential dominated project (Residential FAR ≥ 50%)	Predominantly non-residential (Residential FAR ≤ 30%)
Below 1.0	Under-utilization of FAR (not permitted)	Under-utilization of FAR (not permitted)
1.1 - 2.0	200- 400 du/ha	100 - 200 du/ha
upto 3.0	400 - 600 du/ha	250 - 400 du/ha
3.1 - 4.0	600 - 800 du/ha	400 - 600 du/ha

*** Site level FAR shall be based on Approved TOD Influence Zone Plan.**

Source: UTTIPEC

Build compact and accessible city

National Habitat Standard Mission of the Ministry of Urban Development

Guidelines for compact mixed land use

-- 95% of residences should have daily needs retail, parks, primary schools and recreational areas accessible **within 400m walking distance.**

-- 95% residences should have access to employment and public and institutional services by public transport or bicycle or walk or combination of two or more.

-- At least 85% of all streets to have mixed use development.

-- Need small block size with high density permeable streets etc

UTTIPEC TOD guidelines

Hierarchy of Facilities	Accessibility Standard from each home/ work place.*
MRTS Station	Approx. 800 m or 10 min walk
Metro feeder/ HOV feeder Stop	Approx. 400 m or 5 min walk
Bus Stop	Approx. 400 m or 5 min walk
IPT/ auto-rickshaw Stand	Approx. 250 m or 3 min walk
Cycle Rickshaw Stand	Approx. 250 m or 3 min walk
Cycle Rental Stand	Approx. 250 m or 3 min walk
Shared private parking garage	Approx. 500 m or 6 min walk

To ensure Safety of Pedestrians:

Excerpts:

Initiate planning and road design schemes where unwatched streets can be transformed... to make safe urban areas:

- **Get rid of walls and setbacks. Add street edge uses -- for road safety at night, Transparent fencing** shall be used above 300 mm high toe wall from ground level.
- Add planned hawker zones.

- Adhere to IRC 103:2012 for Street Design.
- Introduce planned mixed-use housing …along road edges of major vulnerable roads.

Slow down vehicles on Roads :

- No more signal free corridors- signalize existing ones.
- Remove gates on public streets from gated colonies from vulnerable areas.

Towards restraint measures …….

Parking policy: Getting the principles right

Parking crisis….

- **Parking: most wasteful uses of cars**: Out of 8760 hours/ year total steering time of an average car is 400 hours. For about 90 to 95 per cent of the time a car is parked.
- **Insatiable demand for land**:
- In Delhi new car registration created demand equal to 310 football fields.
- **Bhubaneshwar: Nearly 30 football fields**
- **36% of the circulation area in Bhubaneswar is under parking encroachment.** (WSA study 2008)

.

Inequitous use of land: **Delhi --** A car is allotted 23 sq m for parking. A poor family 18 sqm under low cost housing scheme.

Land is limited. Where will cities find more land to park cars?

Parking policy as a restraint measure

JNNURM reform agenda linked to the National Urban Transport Policy:

- Its states –" Urban land is valuable. Levy high parking fee that represents value of land occupied. This should be used as a means to make use of public transport and make it more attractive. Graded parking fee should recover the cost of the land."

Supreme Court (EPCA submission)

"Land is limited and there is a limit to the additional parking space that can be created in the city. This will also require …. well thought out pricing policy to control the demand for parking. The provision of parking for personal motorised vehicles cannot be considered as a matter of public good."

Supreme Court has taken this on board. Issued directives for a parking policy as a demand management tool…….

Parking and air pollution control

High Court case in Delhi – Parking charges in Khan Market

….. Shoppers wanted free parking for their affluent clientele. Contested priced parking in court….Shoppers pay license fee to NDMC but do not charge users; Defeats user pay principle; have fixed a lower bound fee

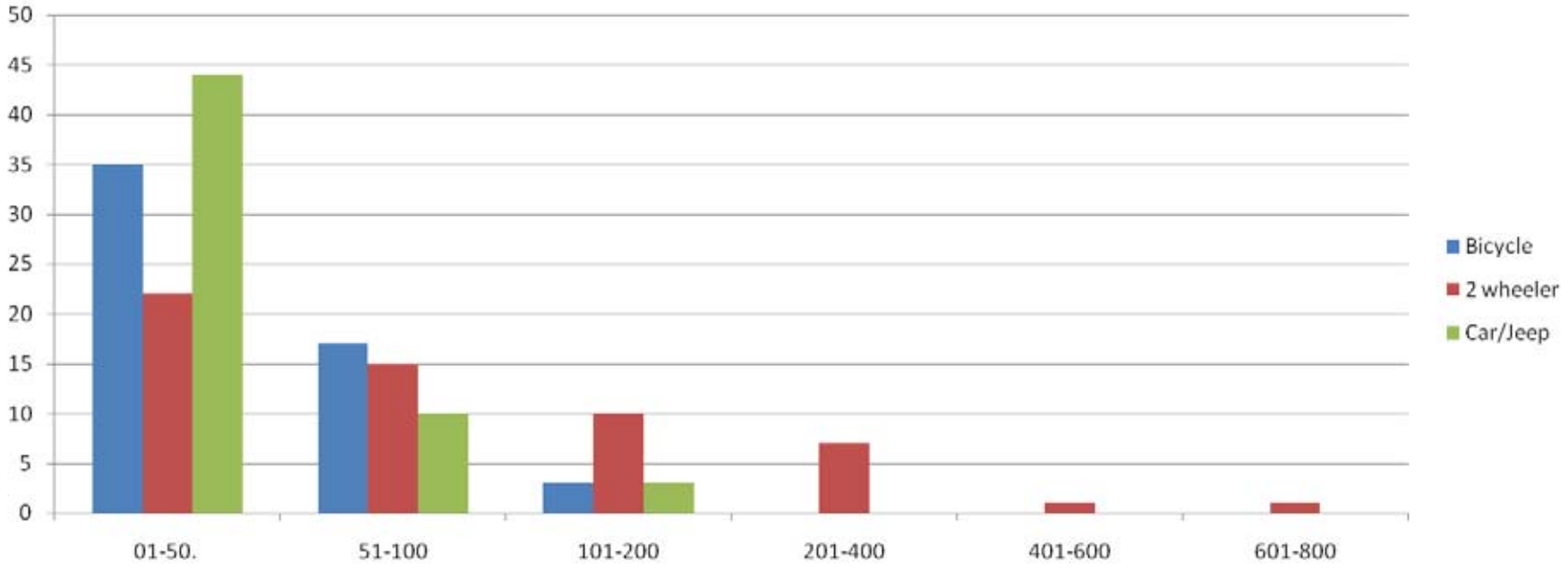
Shopkeepers of Khan market asked how parking policy is linked with clean air

- **Global examples presented…….**
- **Boston** froze their parking requirements at a level that is only 10 per cent higher than the 1973 level to meet the Federal clean air standards.
- **Amsterdam -**parking fees expanded to meet EU directives on NO2 and PM10 emissions. Car plate numbers are registered with emissions information. …
- **Zurich** considers total NO2 emissions when determining the amount of parking to be allowed.

Resistance in Delhi to parking charge hike……

Parking accumulation at different intersections in Bhubaneswar

Private vehicle dominate parking demand
Unique feature – substantially high bicycle numbers in parking lots.. Needs design protection….



Source: CDP, Bhubaneswar

Enforcement: The first steps……

Find method in the madness….Tame the chaos

EPCA directives to MCD, NDMC in Delhi

-- Demarcate legal parking spaces. Organise them well.

-- Inventorise the parking spaces. Put out the list on the website

-- Prevent encroachment of walkways

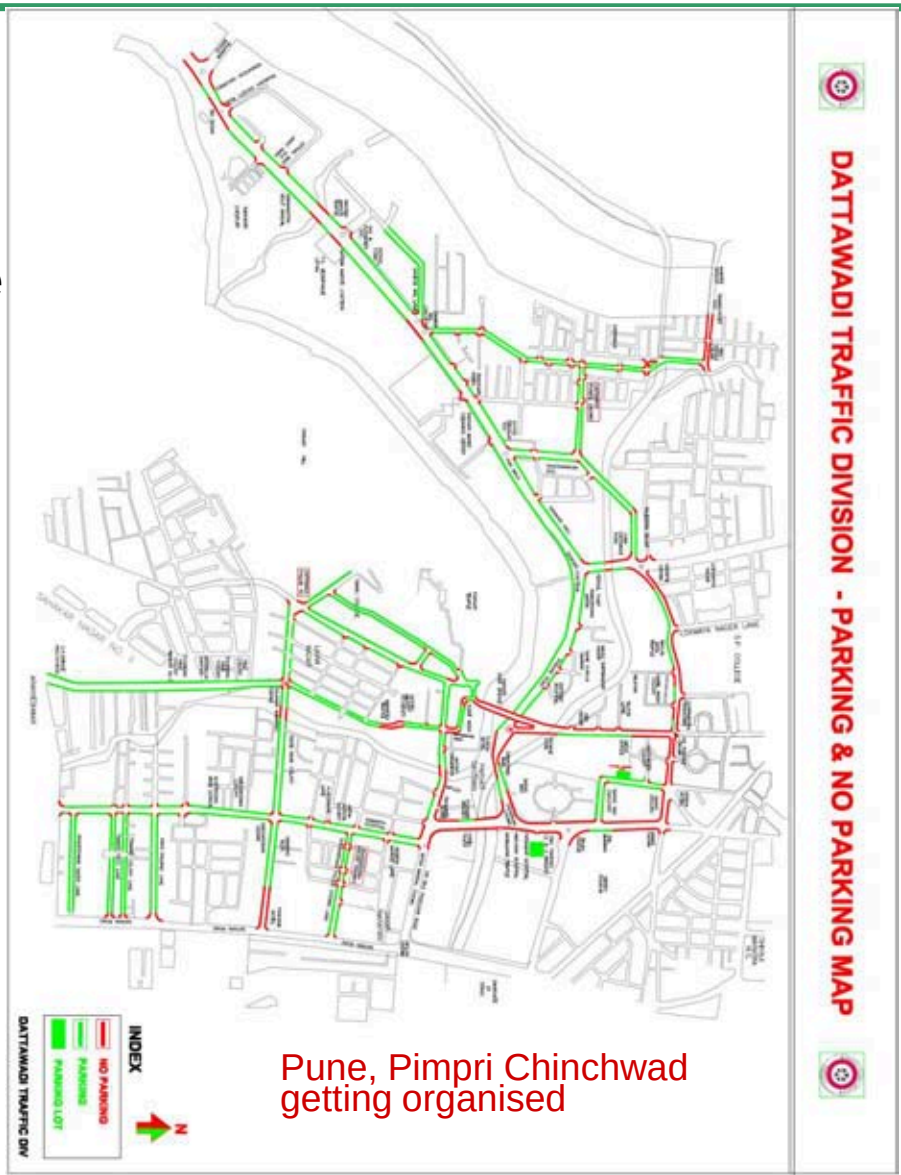
-- Put up signages and information systems

-- Introduce metering

-- Impose penalty

-- Similar moves in other cities – Chennai, Pune, Pimpri Chinchwad etc

On-street parking cannot be eliminated. Needs to be managed well.



Pune, Pimpri Chinchwad getting organised

Proposed Asaf Ali Road, New Delhi

Off street car and auto rickshaw parking area along the road

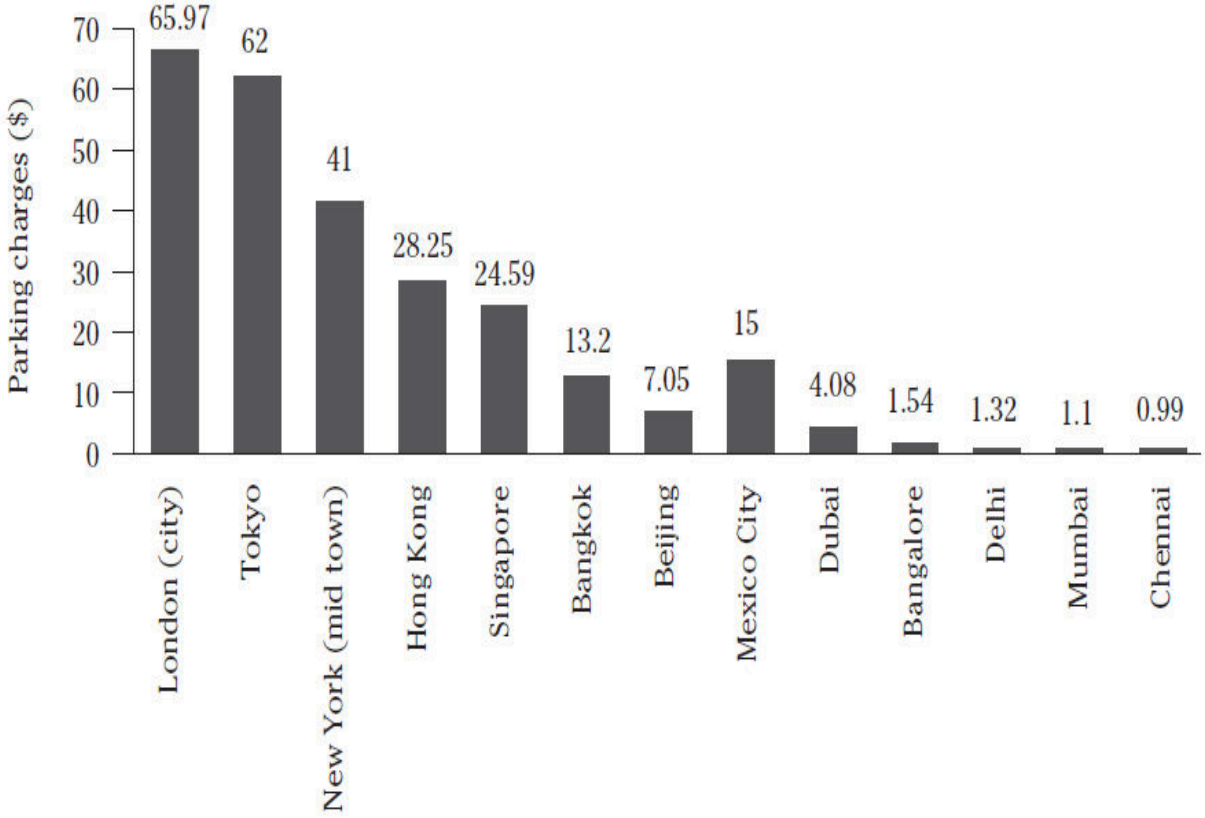
Source: I Trans, Anvita Arora

Reform parking pricing

Global studies show :
Shifting from free to cost recovery parking rates can reduce automobile commuting by 10-30 per cent especially if linked with other transportation choices

Parking charges influence commuting choices:
People will opt for alternatives; delay journey to avoid peak parking charges; or go somewhere else……

Indian cities have the lowest parking rates in the world



Source: Colliers International (2011) - CBD daily parking charges (in US $)

New proposal on parking charges in Delhi

Public notification from transport department.

- -- Rs 30 for three hours during peak hours + Rs 20 for every additional hour or part thereof during non-peak hour + Rs 50 for every additional hour or part thereof during peak hours.
- -- Rs 50 for three hours during peak hours + Rs 20 for every additional hour or part thereof during non-peak hours+ Rs 50 for every additional hour or part thereof during peak hours.
- -- Rs 1500 per month for monthly permit for residents of the area (only one vehicle to be allowed per family/shop)

How pricing can influence this street?

Source: CSE

On-street parking pricing has major impact.....

No meters

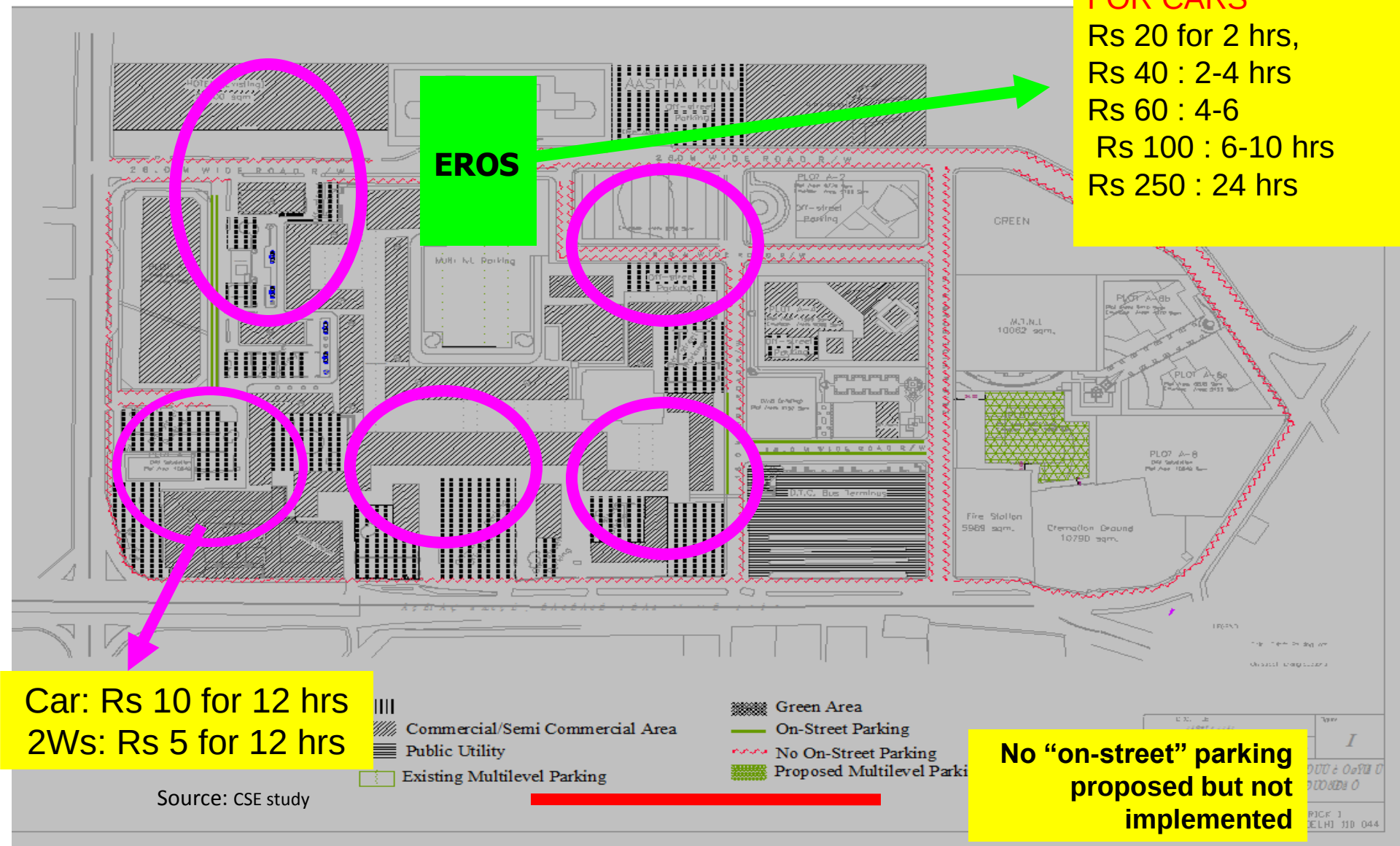
Meters

Prices quadrupled

Grosvenor square, London

Source: TRL in ITDP (2011): Europe‘s Parking U-Turn

Multi level parking need local area management plan and rationalisation of parking rates



Source: CSE study

Whiff of change in India….

Aizawl in Mizoram: Regulation and Control of Vehicles Parking

To own and buy a car…..

- the owner of any type of motor vehicle including two wheelers shall have a garage within his own residential or business compound or in some other place, or a garage hired from any other person, for parking the vehicle (*The Mizoram Gazette, Vol XL, Issue No. 52, February 2011*)

- Purchaser, before purchasing any type of motor vehicle including two wheelers or the person intending to purchase any such motor vehicle shall obtain a certificate from the ….transport department…that he has a garage, within his own residential or business compound or in some other place, or a garage to hire from other person, for parking the vehicle he intends to purchase (*The Mizoram Gazette, Vol XXXIX, Issue No. 295, August 2010*)

Sikkim enforces similar measures – strict enforcement

High Court of Jodhpur makes availability of parking space mandatory to car ownership in key cities of Rajasthan.

Parking revenue for public good

- **Parking revenue to be earmarked to create dedicated urban transport funds under JNNURM**

-- **Periodic license renewal pegged to the market driven parking rates** can be an important source of revenue.

-- **Tax parking spaces at the same rate** – if the land was used for other developments. Offset revenue losses from the other potential uses of the land

-- **Use parking pricing revenue to fund transportation** and other local area development programmes,

-- **Finance special transportation and pollution reduction projects** etc.

Other countries are limiting and pricing parking

Capping parking supply

Portland, Oregon 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

Parking pricing strategy to reduce car usage. Benefits public transport

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

Bogota Removed limit on the fees charged by private parking companies. The revenue goes to road maintenance and public transit improvement.

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

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

Barcelona– Parking revenue directed to a special fund for mobility purposes.

London: parking income channeled to transportation projects.

Strong enforcement and penalty

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

Antwerp: parking fines are invested into mobility projects

Free up public space

Paris: Street space freed for bike sharing and trams

What other options do we have? Other governments are proposing restraints on personal vehicles use..

Delhi High Court order: Task force to propose car restraint measures…

Ministry of Urban development issues advisory on congestion pricing

Other governments enforcing tax and road pricing measures and caps on car sales to reduce congestion and pollution…

Congestion charges:

-- London: This has reduced traffic delays by 30 per cent.

-- Seven European cities are adopting congestion charges.

-- Trondheim, Norway: peak hour traffic dropped by 10% after the introduction of congestion charges.

-- Singapore's road pricing measures: This reduced percentage of commuters entering central areas from 56% to 23%.

Caps on cars in Beijing, Singapore and Shanghai

-- Shanghai has adopted a system of auctioning a limited number of car licenses per month. This has helped the city to cap car registration at not more than 7,500 cars per month -- or 250 cars per day.

- **How to fund the transition?**

Address the funding challenge…….

National government assurance…….

The 12th five-year plan: Public transport requirement -- Rs. 2, 02,628 Crores.

Funding scheme for metro system proposed: About 20% projects on PPP with 20% viability gap funding from government of India and **20% viability gap funding from state government.**

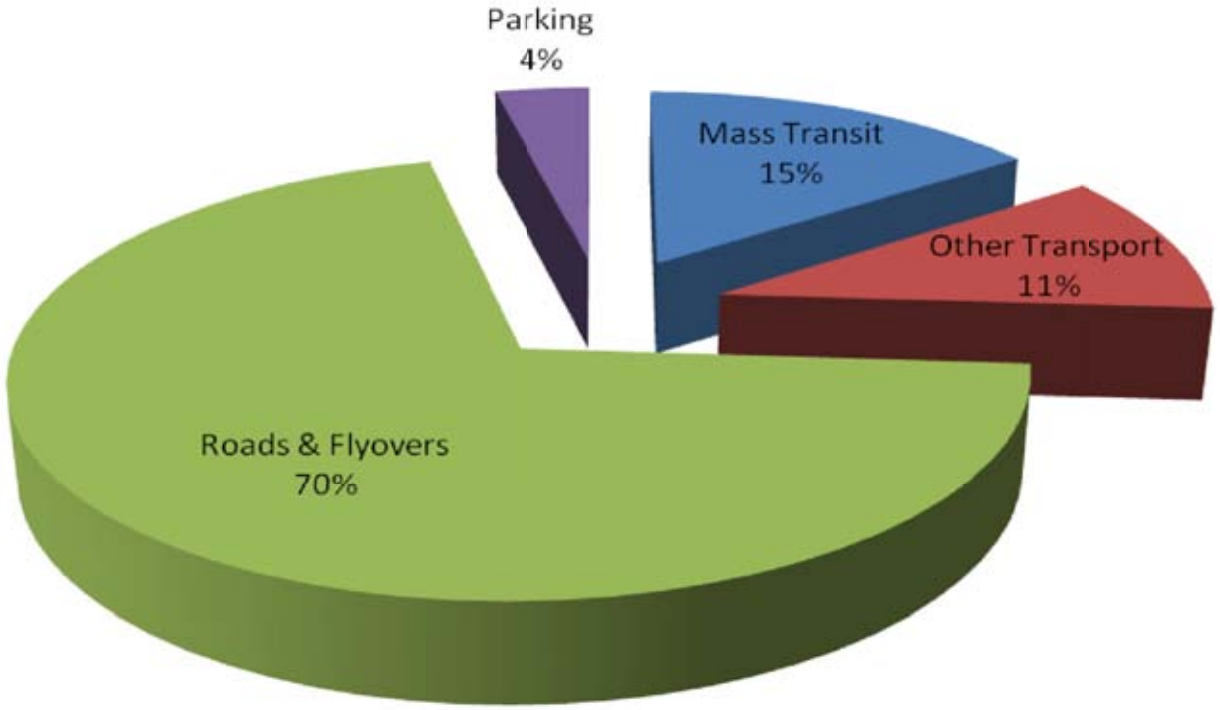
For remaining 80% of projects, the government of India will put in 20 -30% as equity/subordinate debt/grant, 20% from **State Govt./Parastatal, 5% from property development, 5% from Developmental Agencies,** and 50% as loan from international and domestic financial institutions.

Funding scheme for bus system proposed: The Union government to provide the 20% of the fund and the state government and the urban local body will share 80% of the costs.

For bus rapid transit system, Union government and the state government will share the cost equally.

Spending signals priority

70% of the projects are roads-and flyovers



Source: Based on data provided in JNNURM website, available in http://jnnurm.nic.in/nurmudweb/Project/sector.pdf

Proposed Investment plan for traffic and transportation

Sl. No.	Recommended Action	Cost (in crore Rs.)	
		Phase I (upto 2015)	Phase II (2015-2030)
1	Construction of various order of roads including up-gradation, capacity augmentation and construction of new alignments (ROW > 100ft)		
1A	Up-gradation of existing links	190	-
1B	Construction of new alignments	2000	2800
1C	Up-gradation of the pedestrian and cyclist facilities in the existing links	200	550
2	Intersection management measures		
2A	Grade separated interchanges	350	750
2B	Installation of signals and other pedestrian and cyclist facilities	50	100
3	Creation of off-street parking facilities		
3A	Off-street parking facilities for 2-wheelers and cars	100	300
3B	Para-transit parking facility	25	75
4	New bus cum truck terminal at Khurda		150
5	Augmentation of regional bus passenger terminal facility near Nandankanan	60	-
6	Construction of multi-modal logistic hub facilities at Jatni	250	-
7	Construction of whole sale trading and truck terminal facilities near Nakhara.	150	-
	Total	**3375**	**4725**

Bhubaneswar earmarks separate budget for non-motorised vehicles

Source: CDP, Bhubaneswar

Need innovative financing……

Urban Transport Fund proposed under JNNURM: To tap different revenue streams and innovative financing mechanism

Example: World Bank assessing similar approach in other global cities…(OP Agarwal/Worl Bank)

Potential revenue in billion units (Yet to be released study)

Fares – 35 billion units
Rent on property – 40
Parking -- 30
Station naming rights – 5
Betterment levy – 75
Fuel tax – 15
Vehicle registration – 2
Advertisement -- 3

Generates a lot more than the target of meeting the O&M cost of 93 billion units

Our cities need upscaled transition to cut pollution and health costs

12th Plan requires major cities to comply with clean air standards. Cities have begun to work towards policies. This will have to be enabled and scaled up.

Opportunity to provide scaled up alternatives

- Public transport
- Infrastructure for walking and cycling

Reduce demand for travel and vehicle usage

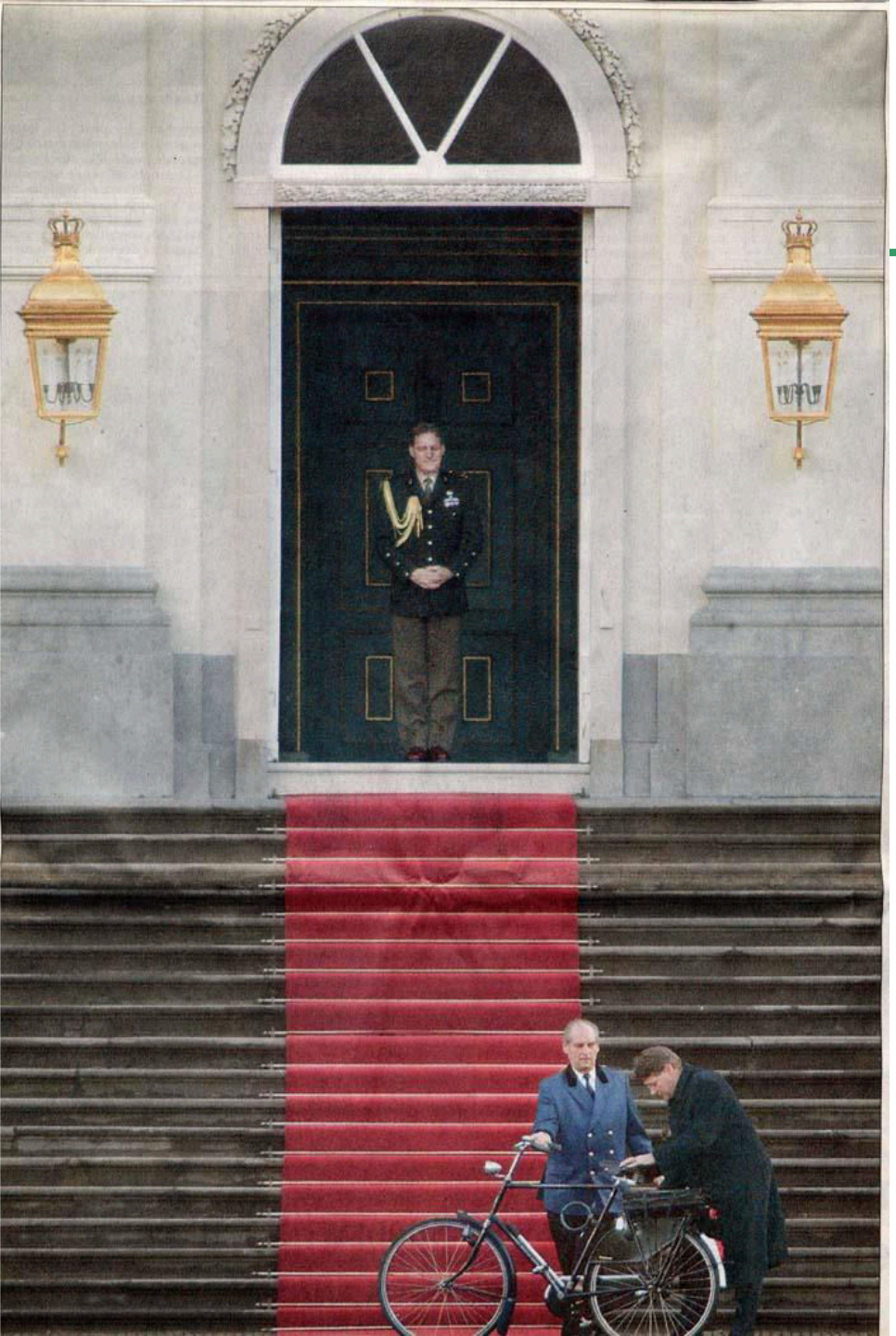
- Land-use planning
- Road pricing
- Tax rationalisation
- Parking policy as a restraint measure

Leapfrog technology

- Emissions standards
- Fuel economy standards

Fund the transition: Need tax measures and resource mobilisation to create dedicated fund for pollution control in cities (Eg. Air Ambience Fund in Delhi)

This needs support. Must not be allowed to fail…Otherwise what??



Dutch Minister visits the queen

Source: GIZ

Thank You