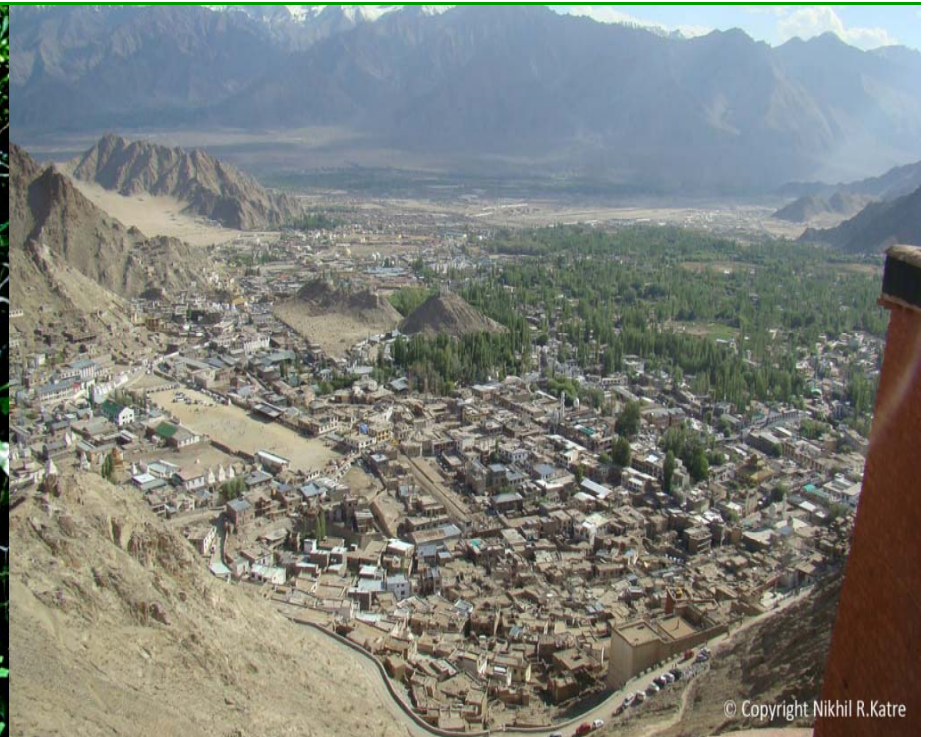


# Challenge of the Balance

## Urban explosion in the Himalayas



**Anumita Roychowdhury**  
**Centre for Science and Environment**

**Media briefing workshop**  
**Dehradun October 9, 2015**



## Unique pattern of urbanisation in the hills

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- **Colonial genesis – creation of new towns by design (Mussourie, Shimla, Shillong etc). Or around new economy of plantations (Darjeeling) – based on migration**
- **More organic growth in post independence era**
- **Massive urban growth in hill ....Valleys are magnets**
  - Hill regions have witnessed some of the highest urban growth rates in the country
  - In Arunachal Pradesh the decadal urban growth rate 101% -- Ita Nagar – 111%
  - Shimla has grown by 22%; Kangra – 29%; Kullu 29%

## Special challenge in hills: Floating population Tourism led growth



**During seasons tourist population can be more than local population**

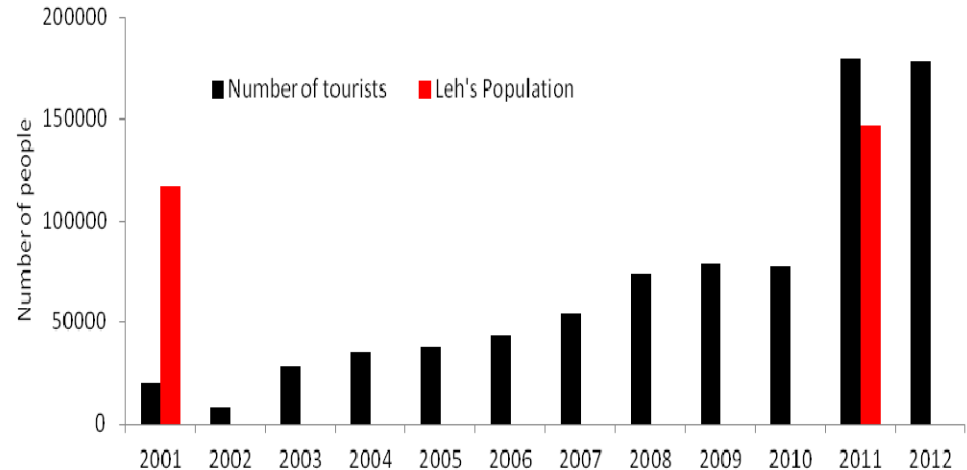
Explosive growth from 527 tourists in 1974 to 79,087 in 2009 . Tourism contributes about 50% of the local GDP.

**Tourists outnumber locals in Leh** Number of tourist arrived in 2011 are 22% higher than Leh's population.

**It transforms local economy and urban landscape**

**This creates enormous pressure on ecologically fragile areas**

No. of tourist arrivals in Leh District



*More recent reportage in 2012 show that 2 lakh tourists visit Leh in a year. And Tourist to Local ratio is 5:1*

*([http://www.youtube.com/watch?v=M3Vch\\_WKgWo](http://www.youtube.com/watch?v=M3Vch_WKgWo))*

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1.

## **Hills have special challenges**

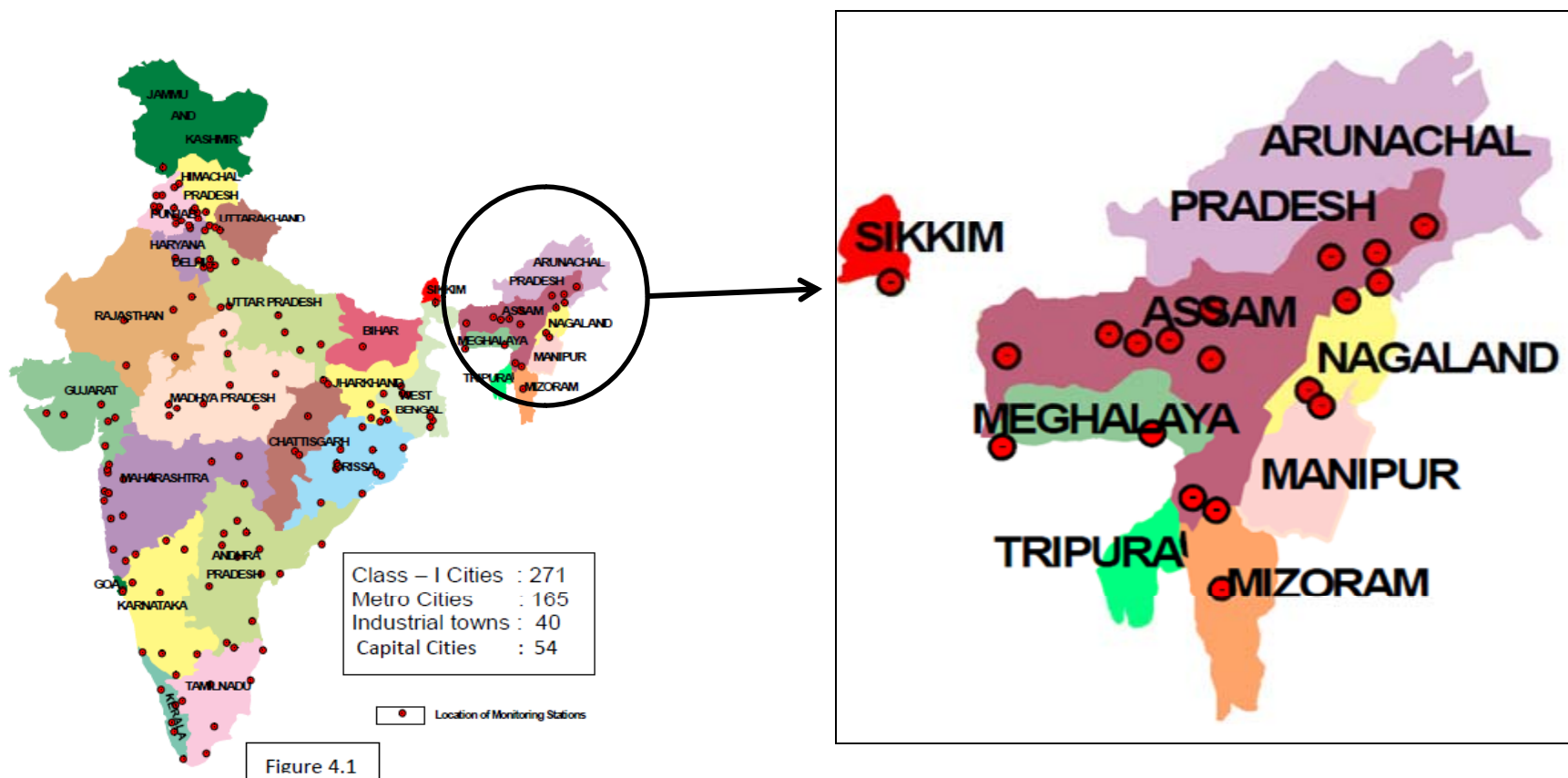
- Land constraints
- High gradient of narrow roads aggravate problem
- Low turning radius
- Restricted circulation
- Poor storage



## **The aftermath – dirty air and public health**

## Poor knowledge about air quality and risks Inadequate monitoring.....

- Assam has maximum number of monitoring stations in the region
- Arunachal Pradesh and Tripura do not have monitoring stations
- 19 cities monitored in the region: 12 in Assam, 4 in Meghalaya, 1 in Mizoram, 2 in Nagaland.

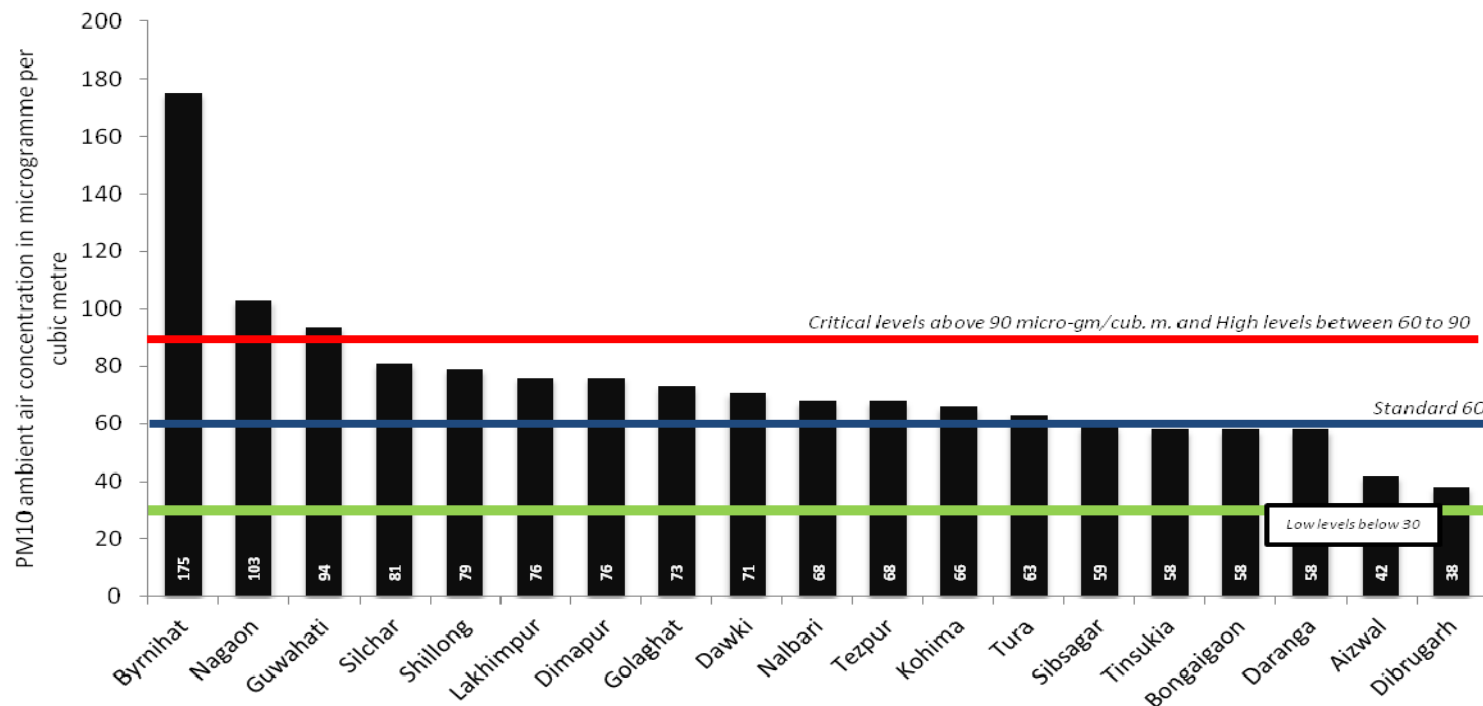


# PM10 - Killer particles

## A growing health risk in the north eastern region



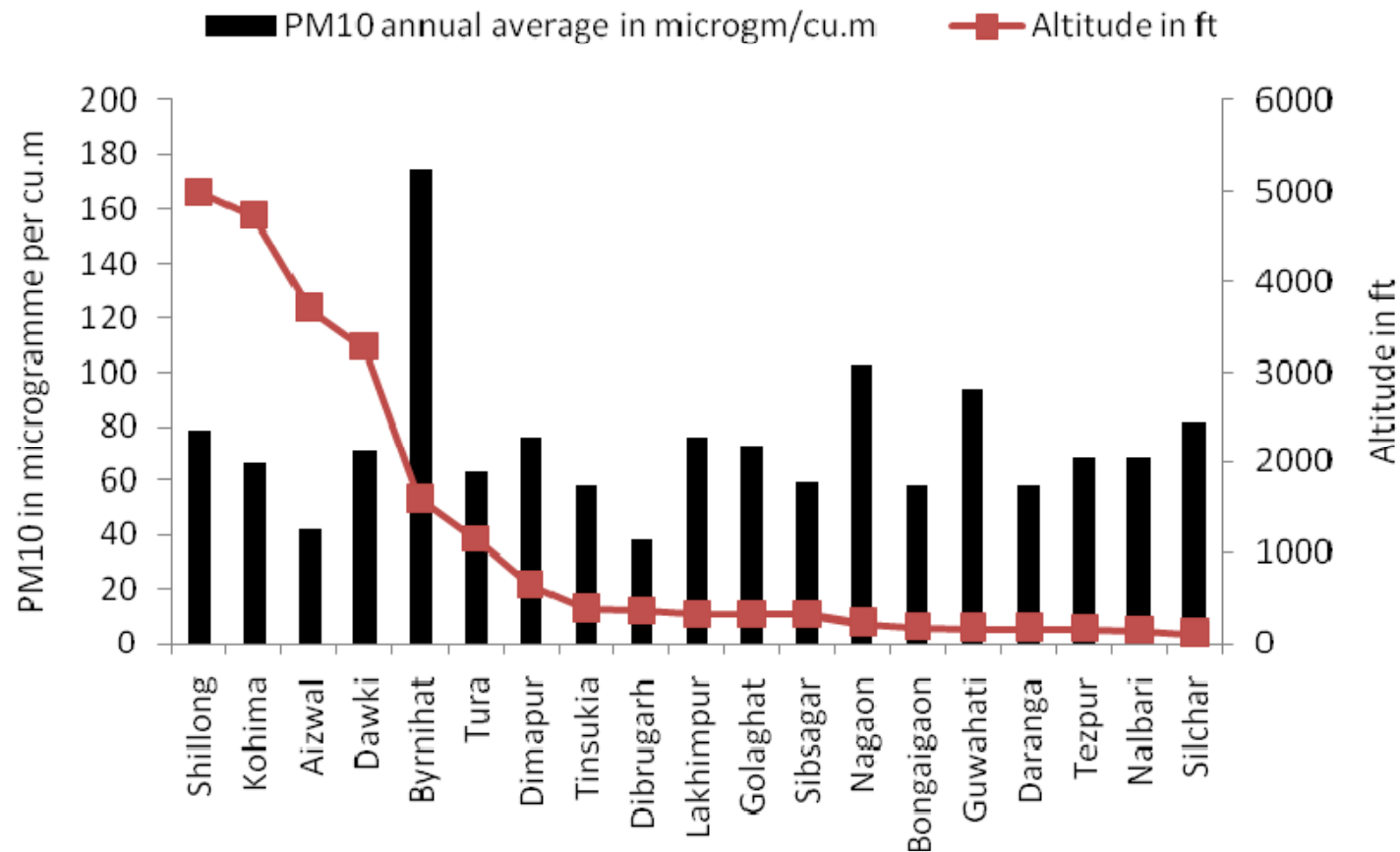
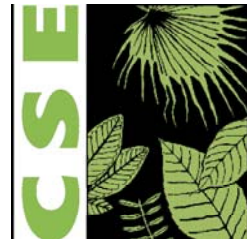
- **PM10 levels exceed standards in about 68% of all cities monitored in NE**
- Byrnihat, Nagaon and Guwahati are **critically polluted**.
- Silchar, Shillong, Lakhimpur, Dimapur, Golaghat, Dawki, Nalbari, Tezpur, Kohima, Tura have **high levels**
- Sibsagar, Tinsukia, Bongaigaon, Daranga, Aizwal, Dibrugarh, have **moderate levels**.



Source: CPCB

# Are hills still cleaner than the valleys

## PM10 and Altitude

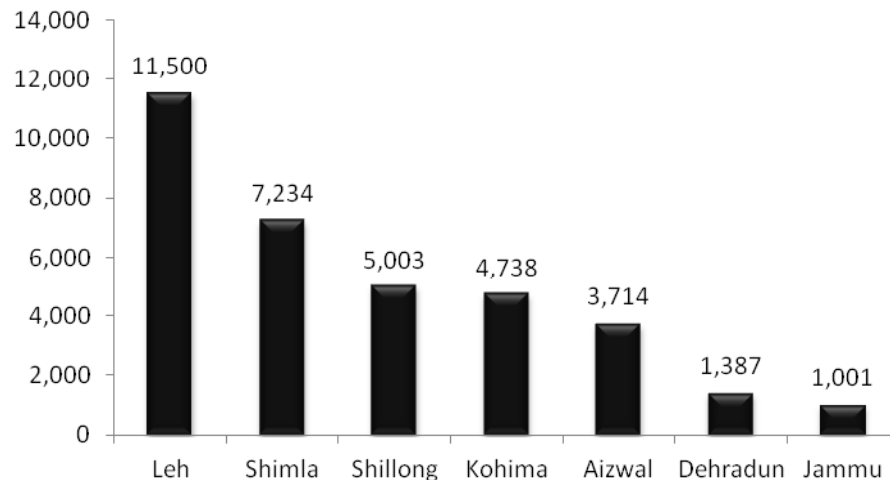




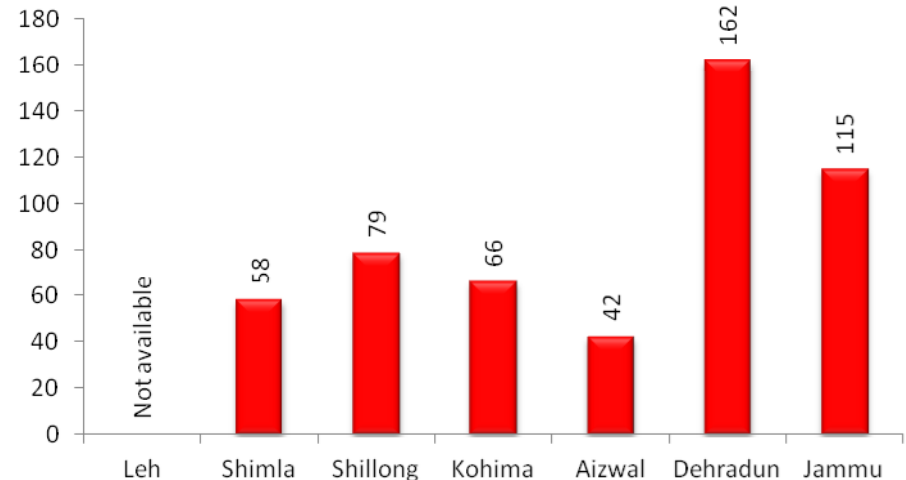
## Do we monitor air in our hill cities? Limited and not in high altitude.....



**Elevation (Height above mean sea level in ft)**



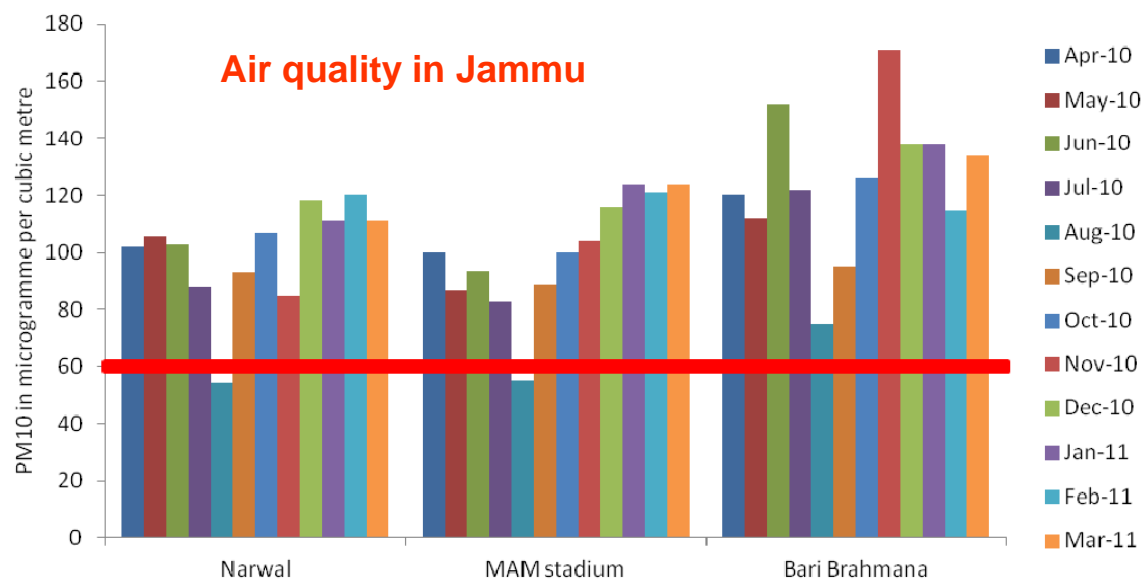
**PM10 levels in microgramme per cu.m**



*Source: CSE compilation, data sources CPCB, others*

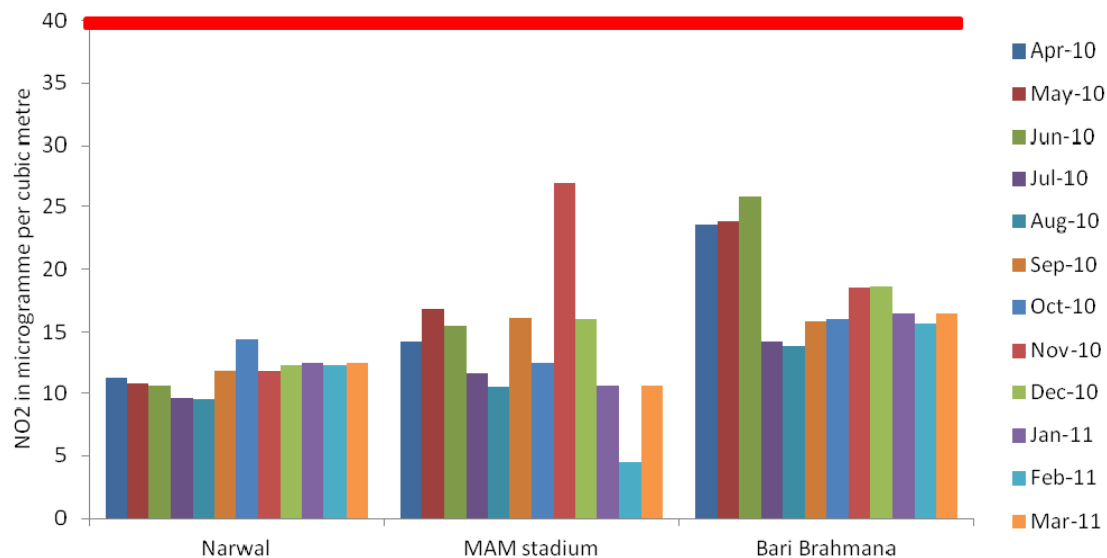
- Lower the elevation higher the pollution
- In moderately high elevation like Shimla and Shillong local pollution is high
- No data for high altitude cities

## Valley effects can be high



**Case of Jammu:** PM10 levels are significantly high than the standard

NO<sub>2</sub> also signs of rising



# Winter smog in Manipur



- In December 2012 Manipur experienced thick fog causing many road accidents and cancellation of flights
- As Manipur valley is surrounded by hills, polluted air gets confined for longer period. PM levels reached 581 microgrammes per cum.



# CAG report on air quality of Shillong



- 2012 CAG report on Ambient air quality of Shillong --- '*far from satisfactory*' due to vehicular emission
- “*Continued environmental pollution and health hazards leading to increase in the number of patients suffering from air and water borne diseases....*”





## More studies planned in the region

### **CPCB's Annual Action Plan for 2011-12 & 2010-11 has north-east focus: Planned following studies:**

Vehicular Emission Load of Shillong (ongoing)

- Impact of Jhum Cultivation on Ambient Air Quality in Mizoram-Manipur-Assam-Meghalaya (ongoing)
- Assessment of Ambient Air and Water Quality in and around Coal Mining areas of Jayanatia Hills, Meghalaya (ongoing)
- Effect of Cement Industries on Air Environment in Lumshnong, Meghalaya, the Cement Capital of North East (ongoing)
- Environmental Status of Coal Mining areas of Assam and Arunachal Pradesh (ongoing)
- Strengthening & Implementation of various Rules/Regulations; Surveillance of NAMP and NWQMP stations (ongoing) etc
- **This is expected to generate more local information.....**



## Strengthen air quality monitoring programme

---

### Some initiatives in the region

#### Assam

- Assam has 12 monitoring stations that monitor SO<sub>2</sub>, NO<sub>2</sub>, RSPM and also meteorological parameters including wind speed and direction, relative humidity and temperature
- 5 are located in Guwahati City, 2 in Bongaigaon town, 1 in Tezpur town, 1 in Sibsagar town, 1 in Dibrugarh town, 1 in Golaghat town and 1 in Panchgram town
- There is one Air quality monitoring station under NAMP along Indo-Bhutan border at Darranga (Baksa district) in Assam. Monitoring since November 2008. Plans to add more monitoring stations

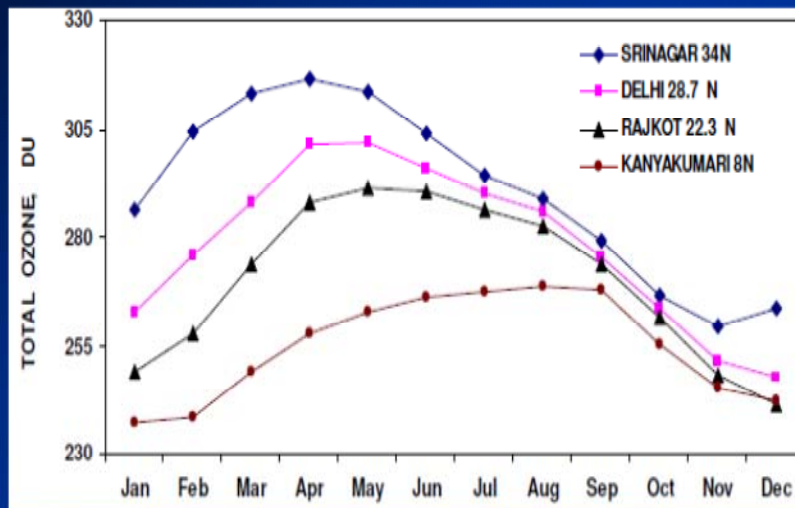
#### Mizoram

- Mizoram to set up air quality monitoring stations under the National Ambient Air Quality Monitoring Programme (NAMP). One station each at Aizawl and Lengpui and two stations each at Lunglei, Kolasib and Champhai.
- To be set up before the jhum burning season

## Special challenge of high altitude ozone



### Latitudinal variation of columnar ozone



- A comparison of monthly mean total ozone values in the year 2005, for different Indian stations indicates an increase in ozone concentration with latitude.

Ozone is formed photochemically under the influence of sunlight

Elevated tropospheric ozone concentration harmful for human health.

This also damages the tissues of plants and animals. Cause temperature increase

Evidence shows higher ozone levels in higher altitude

# Challenge of black carbon



- **Emerging science .....Warming depends not only on the accumulated concentration of CO<sub>2</sub> but also on the intensity of emissions of short-lived pollutants with much higher warming potential.**

**Short lived climate forcers spike temperature peak in the short term.....**

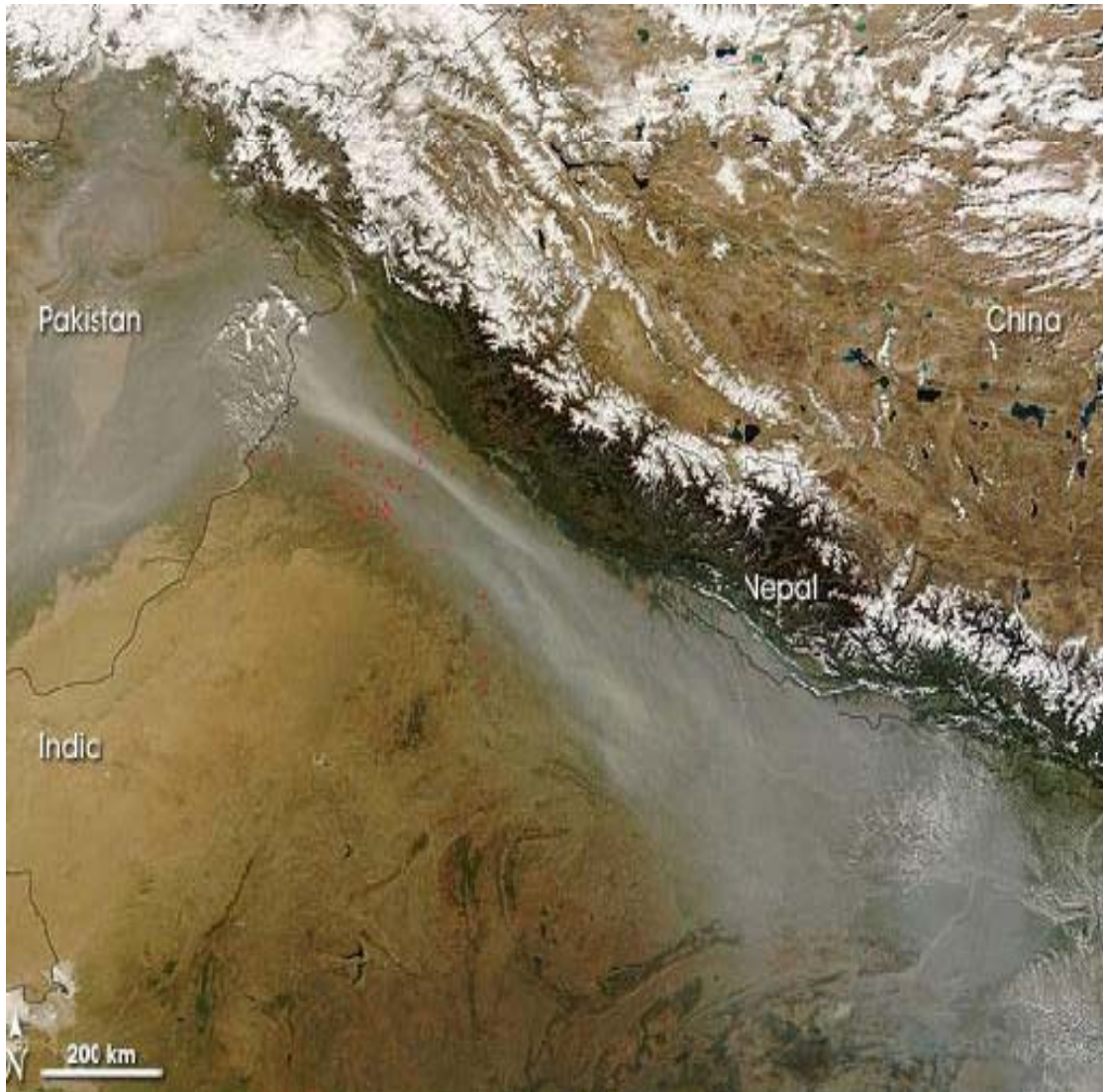
- **Black carbon are solid particle from incomplete combustion. Cause the most health damage; Absorb light and converts that energy to heat...is a climate forcer**

**Black carbon absorbs radiative heat from the sun and warms everything around it (direct effect).**

- **Black carbon interacts with clouds and affects rainfall patterns (indirect effect);**
- **Black carbon falls onto snow and ice and changes the overall reflectivity of those surfaces, making them melt faster, which exposes the darker ground or water below them, causing even faster warming (albedo effect)**
- **Controlling particles gives co-benefits for air quality and climate mitigation....**



## Haze along the Himalayas Trapped between survival pollution and luxury pollution: Chullah vs vehicles.....



**NASA image:** Haze obscures the satellite's view of the ground surface along the southwestern face of the mountain range.

- Thick band of haze appears near the national border.
- A thick cluster of fires -- indicated by red dots -- occurs in the same area. The haze is a combination of agricultural fires and urban pollution.

The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured this image of the region on October 30, 2008. The pale beige color of the haze near the India-Pakistan border suggests that some of the haze might also result from dust blown into the region from the west. Image credit: NASA's MODIS Rapid Response Team  
Text credit: Michon Scott, NASA's Goddard Space Flight Center

## Particles in Himalayas?

### **Several studies have tracked particulate pollution in high altitude**

Eg. French and Italian researchers have analysed the air for dust particles at an altitude of 5079 meters in Nepal's *Khumbu valley*. Found --

- Particles transported to the valley (with size around 80 nanometres) from outside
- Particles formed directly in the valley through photochemical processes (with an average size of less than 10 nanometre).
- These particles directly absorb sunlight causing warming of the lower atmosphere (troposphere).

# Black carbon: hurts lungs, warms up climate ... and melts ice



**In the Himalayas and the Tibetan Plateau BC is likely to have serious impacts.**

**In the high valleys of the Himalayas BC levels can be as high as in a mid-sized city.**

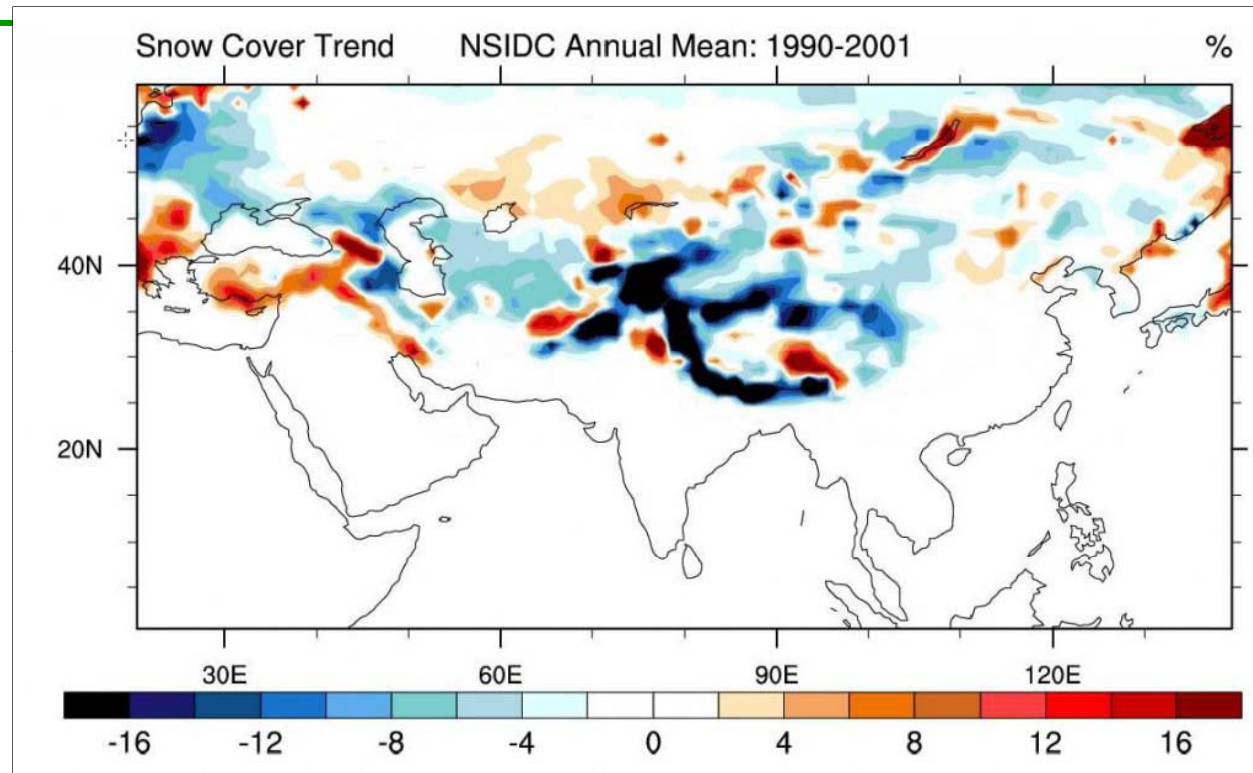
Reducing emissions from local sources and those from outside should lower glacial melt in these regions, -- reduce risk of glacial lake outbursts etc.



Credit: Veerabhadran Ramanathan

*Widespread haze over the Himalayas where BC concentrations can be as high as in mid-sized cities.*

# Himalayan Snow Cover Trend



The thick blue band across the Himalayas shows snow cover declining by at least 16 percent.

Source: Surabi Menon, LBL



## Warming will affect water regime in the Himalayas



The IPCC: The Himalayan glaciers, the source of water for billions, are retreating faster than in any other part of the world and are in danger of disappearing by 2035.

(Cruz et al., 2007). Credit: NASA EROS Data Center, September 9, 2001

What is happening around Ladakh region?...

## Black carbon challenge in Leh, Ladakh – ‘survival emissions



- **Population of Leh is about 68,000. The reported per capita BC emission of 600 g (2000) Leh contributing minimum of 0.04 Gg of BC annually.**
- **Kargil with a population of 119,307 is contributing about 0.07Gg of BC around the glaciers.**
- **Similar emission figures** in other high altitude towns along the higher Himalayas
- **BC emission from the foot hill Himalayas also reach higher altitude.** During winter snow brings down all the BC floating in the atmosphere. This is the reason why many Himalayan glaciers appear black.
- **BC emission from rural areas (Eg Leh).** Combustion rate of all fuels are low at this elevation. Dung cake, biomass and coal are extensively used to heat the homes and of course for cooking. Guest houses, army and affluent society use cooking gas or a device that uses kerosene (or some times saw dust) to heat rooms and homes. *Source: Prof D Chandrasekharam,*  
<http://dchandra.geosyndicate.com/news/?p=105>

## Vulnerability of hills.....?

- Diesel vehicles (need clean diesel and advanced technology).
- Need clean-burning cook stoves

Source UNEP and WMO



**-- What about our health?**



# City enveloped in smog, Delhi this winter back to pre-CNG



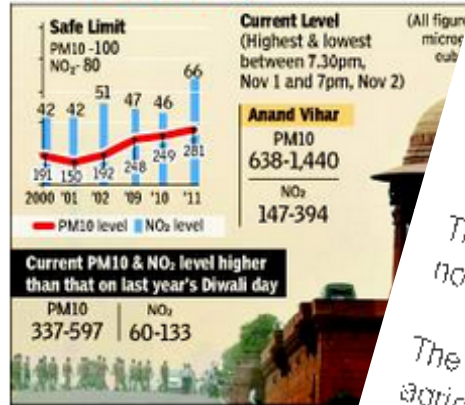
Gains Of Switch To Cleaner Fuel Frittered Away

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

## CITY AIR WORSE THAN EVER



**Delhi winter smog is not an act of God**

Nov 22, 2012

During the first week of November, Delhi went under a thick blanket of smog. The breeze nearly stopped, and the skies turned grey and dank. Cool and calm weather led to fumes settling close to the ground. People held masks, scarves or handkerchiefs to their faces.

The resultant outcry in the smog-hit city had officials stubbornly insisting that this was nothing new and that it happened every winter.

The new twist came...

## Smog leaves Delhi gasping for breath

TNN | Nov 3, 2012, 01:33 AM IST

Smog delays Sheila Dikshit's flight to Punjab

## Disadvantage Delhi: Smog here to stay

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

+1 0

Email to Author

email print

0 Comments

Like 3

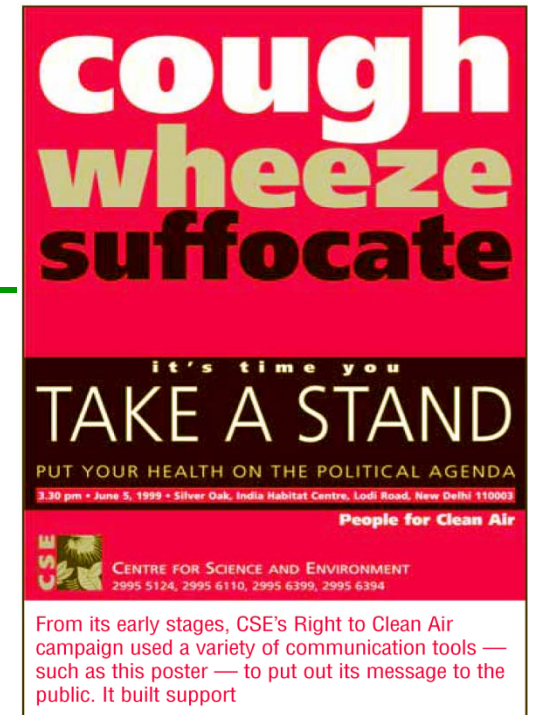
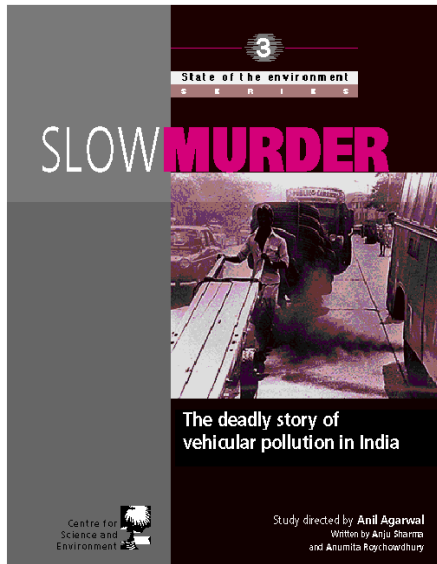
Tweet 0

The Centre for Science and Environment (CSE), in its latest report, has delivered a stark warning: The smog is here to stay. It has also warned that Delhi is in the grip of a multi-pollutant crisis. The matter is not the only thing choking us. Nitrogen

12:44 AM IST

Punjab | NASA | flight | Flashpoint | Apex

Ludhiana trip by Delhi chief minister Sheila Dikshit in a chartered aircraft. The telecom industrialist family became the flashpoint of the ongoing row between Delhi and Punjab when the plane was delayed by nearly three hours.



Public  
campaign  
in Delhi





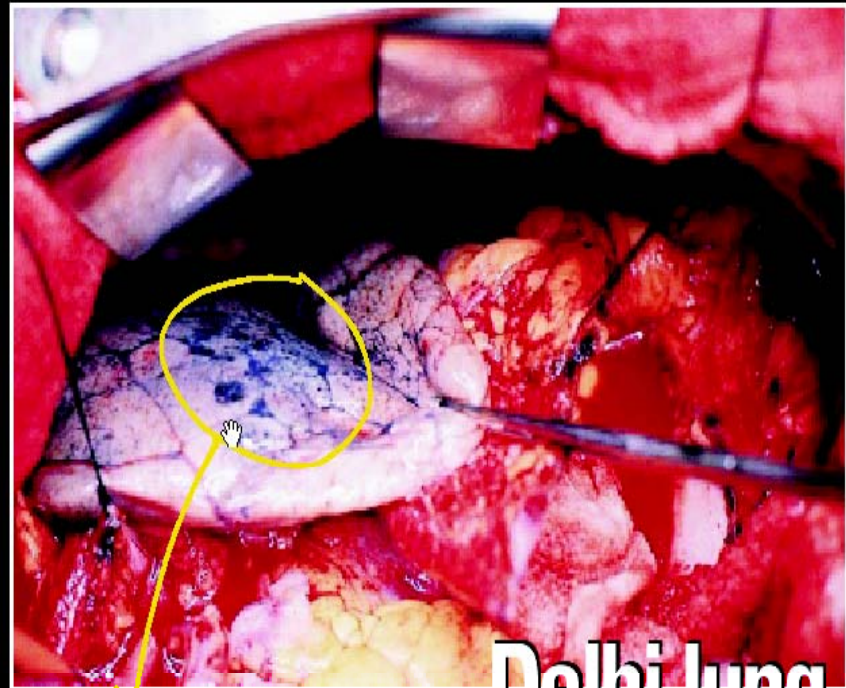
# Evidence of health damage in Delhi



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

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

## Himachal lung



## Delhi lung

Capital punishment

Look at these black spots on the lung. The unfortunate owner lives in Delhi and has been breathing polluted air. Air full of carbon particles which accumulate in the lungs (black spots). What you can't see is a cocktail of gases and tiny particles, even smaller than carbon that get into our bodies.

Actually, you are getting polluted.

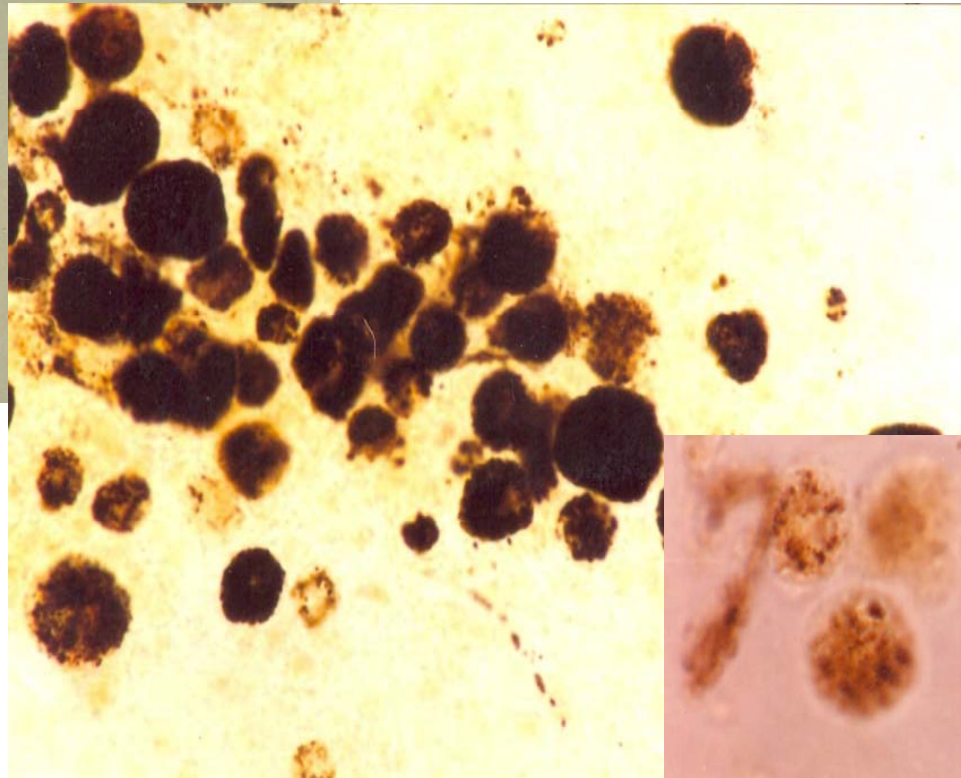
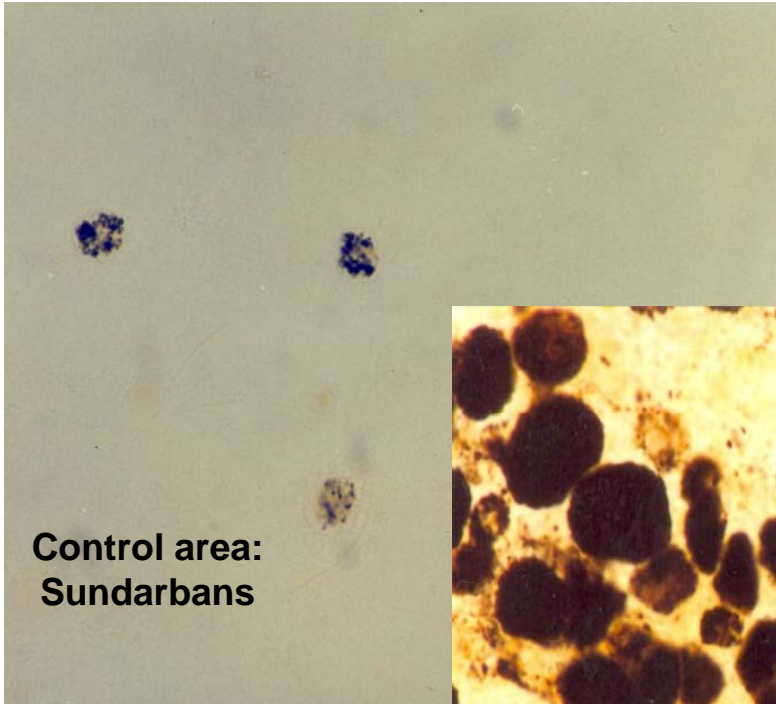
Scary? But those cars are so sexy!

# Evidences of health impacts in India.....



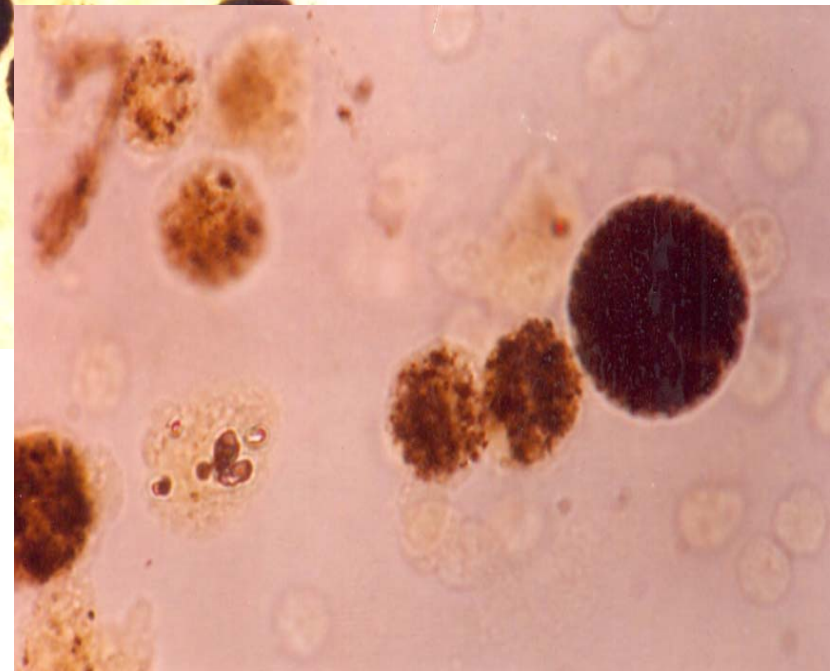
Alveolar macrophage - biomarker of air  
pollution

Control area:  
Sundarbans



Exposed group; Kolkata  
taxi driver

Increase in AM number



# Children most vulnerable to air pollution in hills....



- Not much studies in hills
- Evidence from Shillong

A study by Centre for North East Studies and Policy Research (C-NES) in Guwahati and Shillong on vulnerable groups - schoolchildren, labourers, rickshaw pullers, traffic police personnel, petrol station workers and roadside vendors found:

- 40% of schoolchildren complained of respiratory, skin and eye problems, mostly attributed to vehicular pollution.
- Khanapara (Guwahati) and Police Bazaar (Shillong) topped the list of the most air-polluted areas in the respective cities.

**Every third child in Delhi has impaired lungs**

## Respiratory health and indoor air pollution at high elevation



### Emerging evidences

- Respiratory impact at high-elevation (4550 m), rural community in Ladakh. Exposed to smoke from biomass for heating and cooking.
- Average PM concentration range from 2000 microgramme per cum to 70000 microgramme per cum – 85 per cent of PM are respirable.
- Average endotoxin concentration ranged from 2.4 ng/m<sup>3</sup> to 19 ng/m<sup>3</sup>, and average carbon monoxide levels ranged from 50 ppm to 120 ppm.
- Sputum analysis show significantly greater total inflammatory cell count in the Ladakhi natives than in the visiting scientists.

### Ladakhi' lungs are adapted but under stress

- Lung function values for the highlander population and the test-home subjects were equal to or greater than predicted, despite the highlanders' significant exposure to indoor pollutants.
- Marked airway inflammation dominated by macrophages and neutrophils. Augmented lung mechanics of this high-altitude population are adaptive to reduce the work of breathing; thus, decrements in lung function go undetected because the true predicted values are greater than expected. (Source: Rosati JA et al 2005, University of North Carolina at Chapel Hill, USA)



# Lesson from Delhi: Air pollution is a difficult battle



## 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

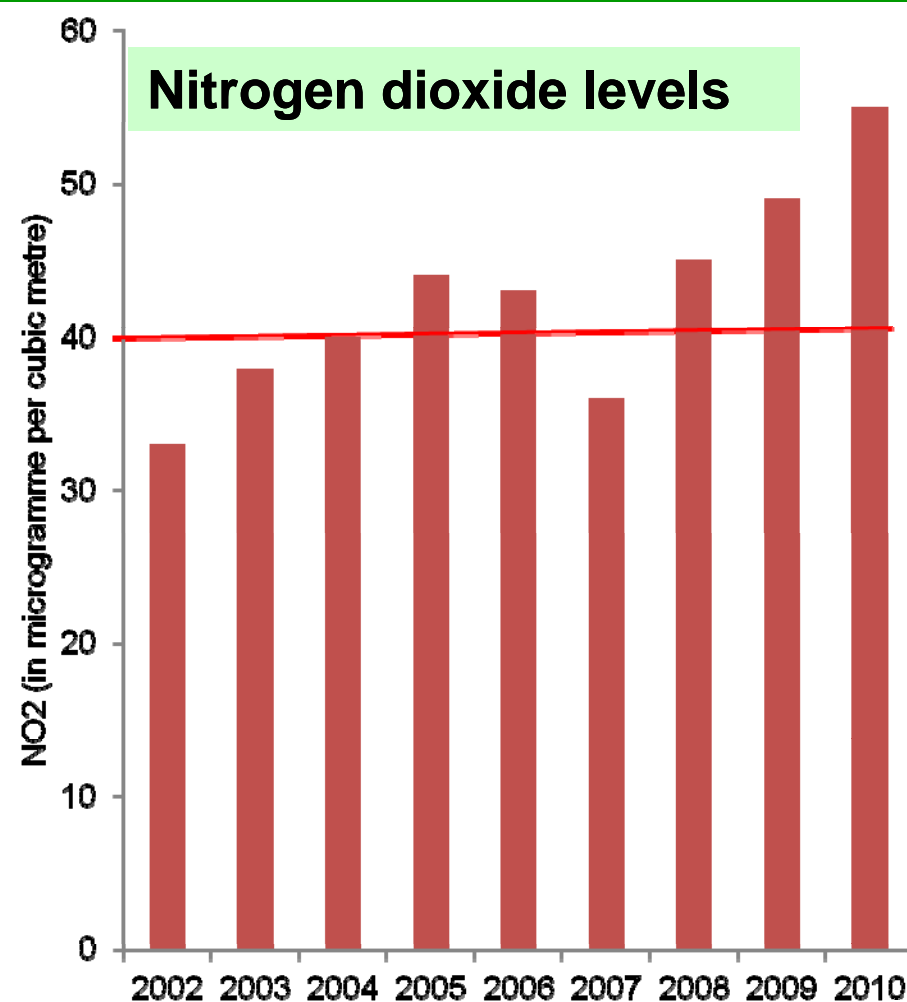
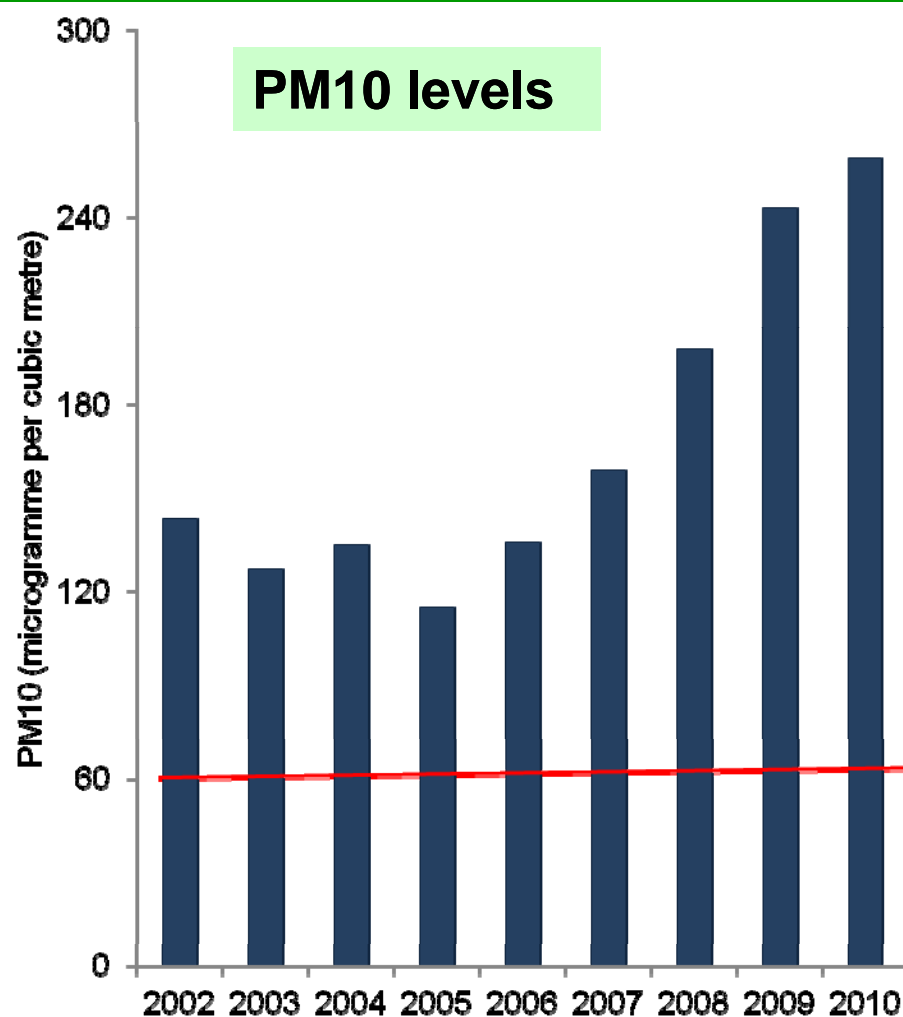
- Adopted new ambient air quality standards
- Expanded air quality monitoring and reporting

### Other sources

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

**Delhi has lost its gains.**

**After a short respite pollution curve turns upward**



Source: Based on CPCB data



**Vehicles are a special problem...**



## Vehicles: special concern

- 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.
- **Public transport users, walkers and cyclists are the most exposed groups.**
- **Poor have a higher prevalence of some underlying diseases** related to air pollution and proximity to roadways increases the potential health effects.
- **Guwahati** -- DRI-NASA report shows - more than 400,000 vehicles ply on Guwahati's roads. About 70% of these vehicles don't have emission clearance certificates, and emit excessive amounts of black carbon/PM and other very toxic pollutants.. ...

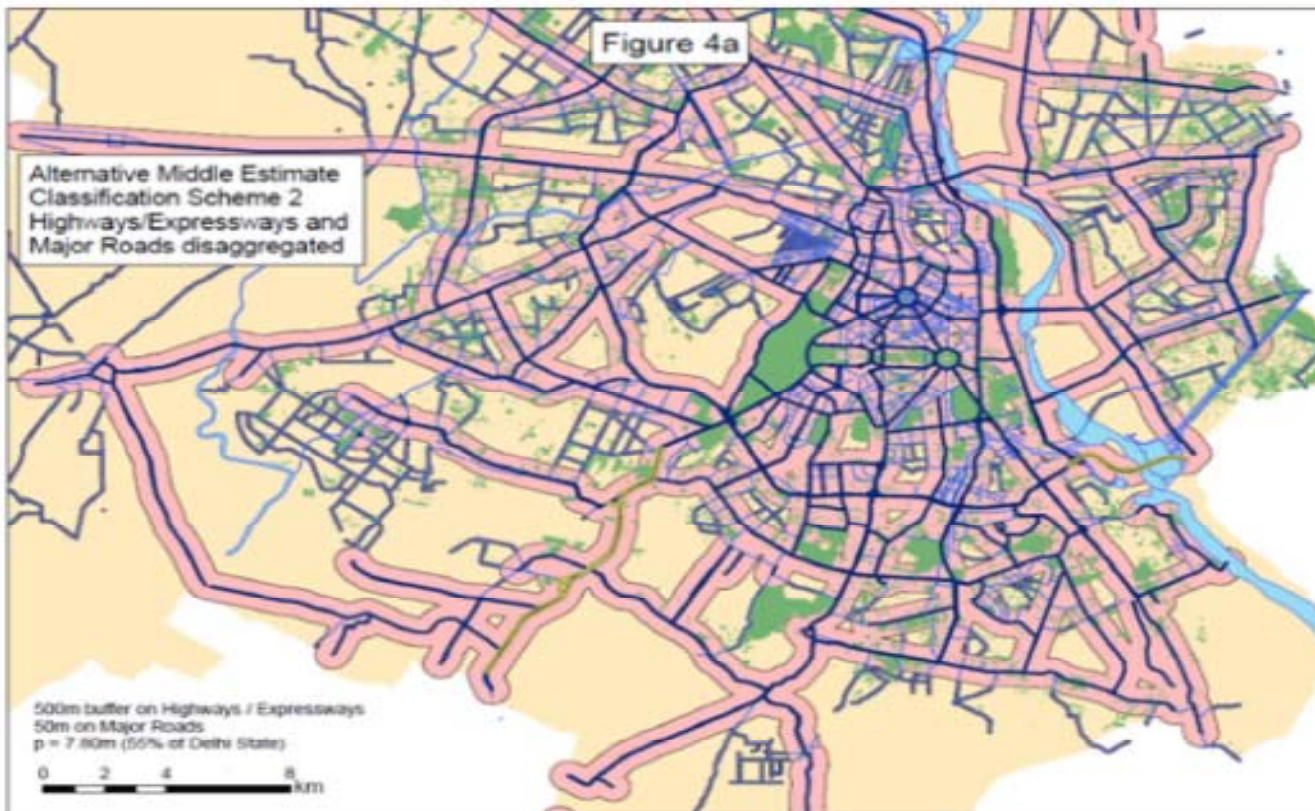


People living close to roads are most exposed to vehicular fume

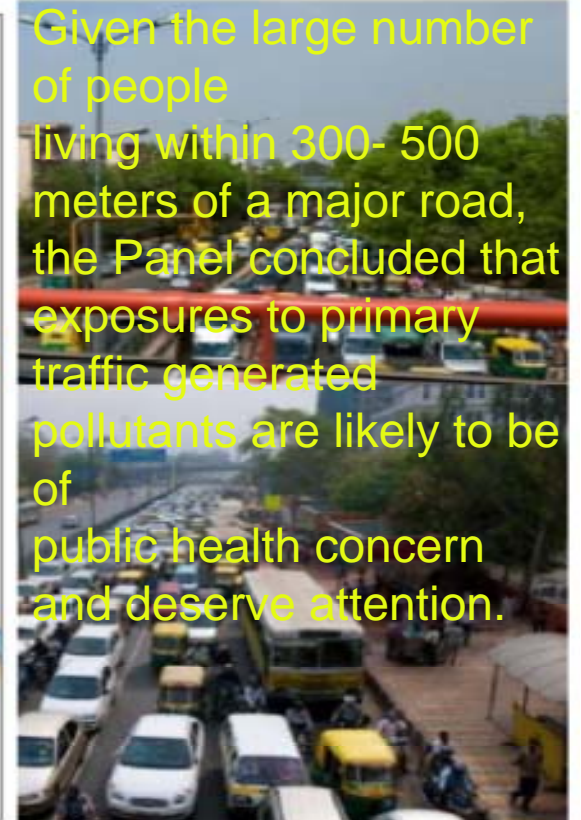
Evidence from Delhi....



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



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





## Diesel risk

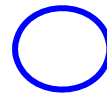
Need clean vehicle technology and fuels

Need clean diesel for ecologically sensitive areas – Melt snow; diesel emissions are also very toxic

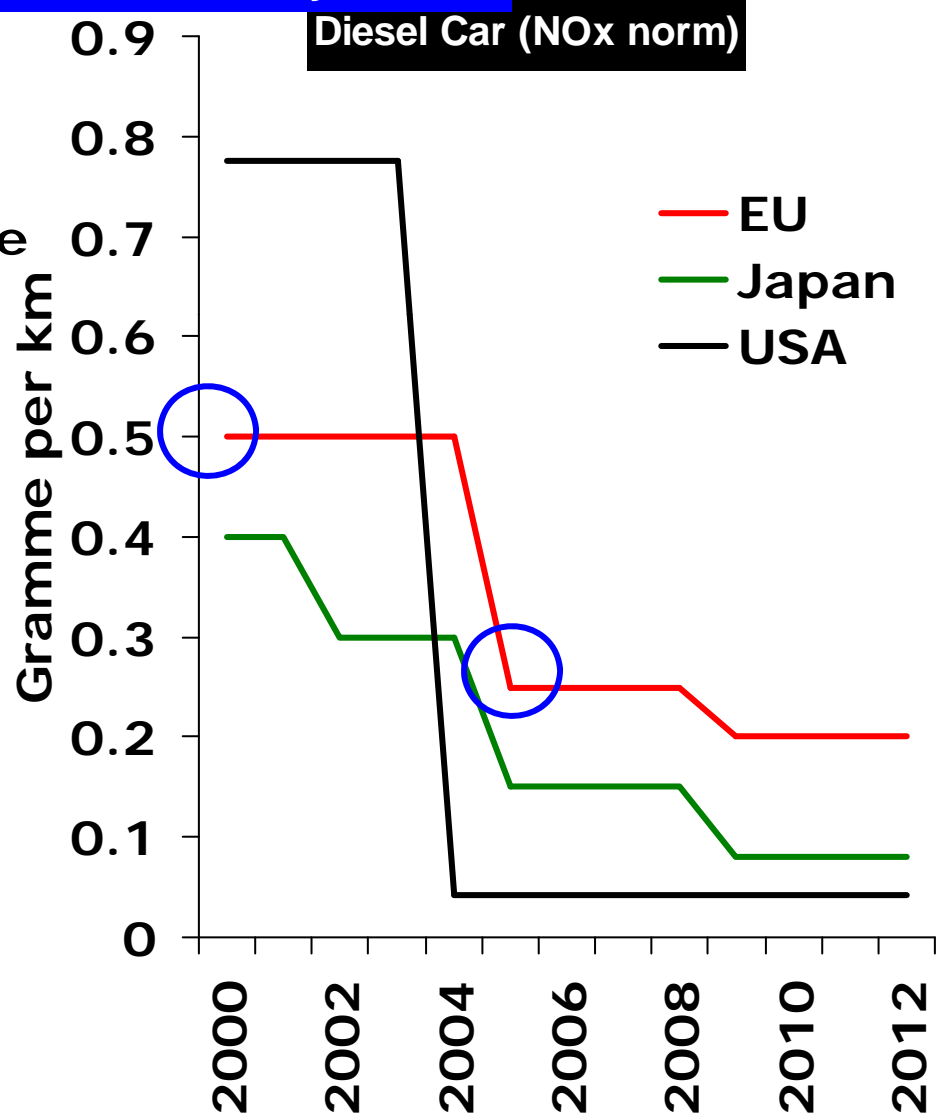
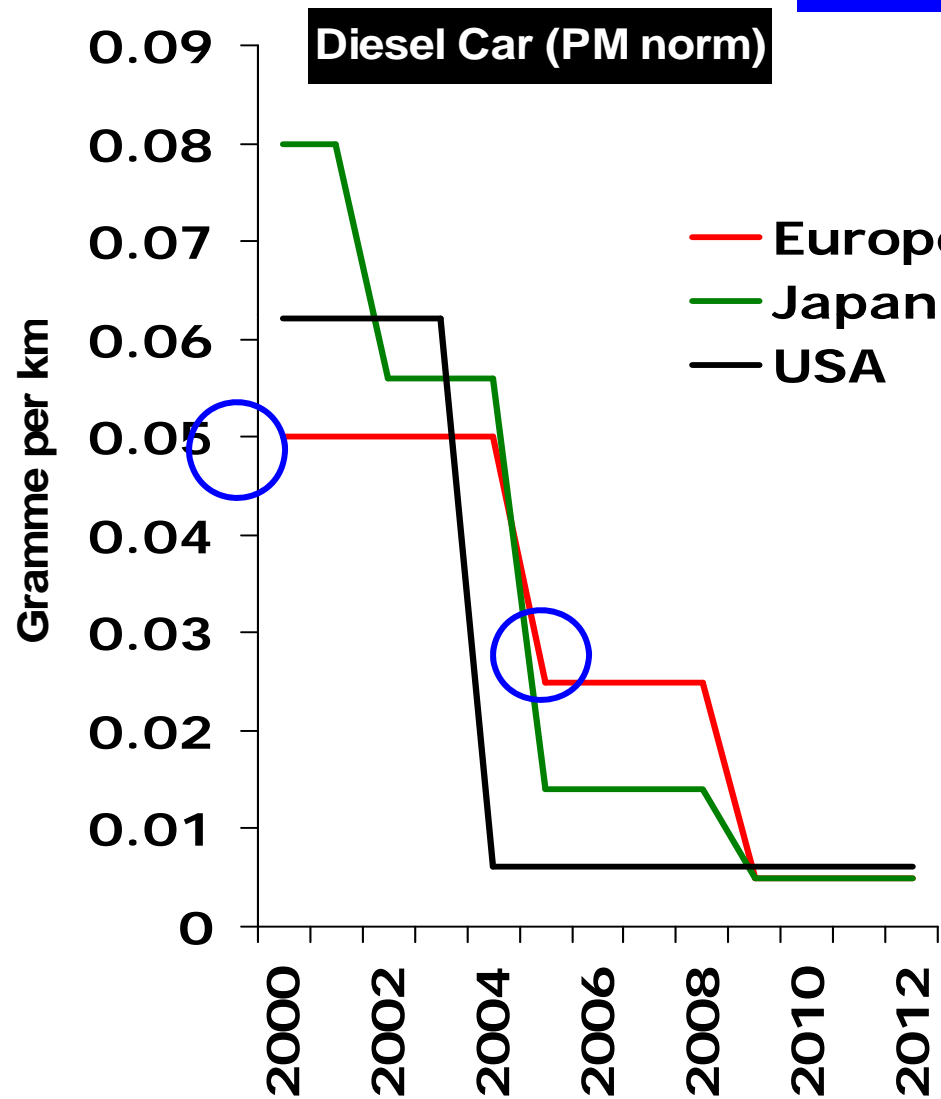


# Technology lag

India



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





**Mobility crisis.....**

# Cities are losing battle of car-bulge



The rapid increase in vehicles is destroying all gains of air pollution and health

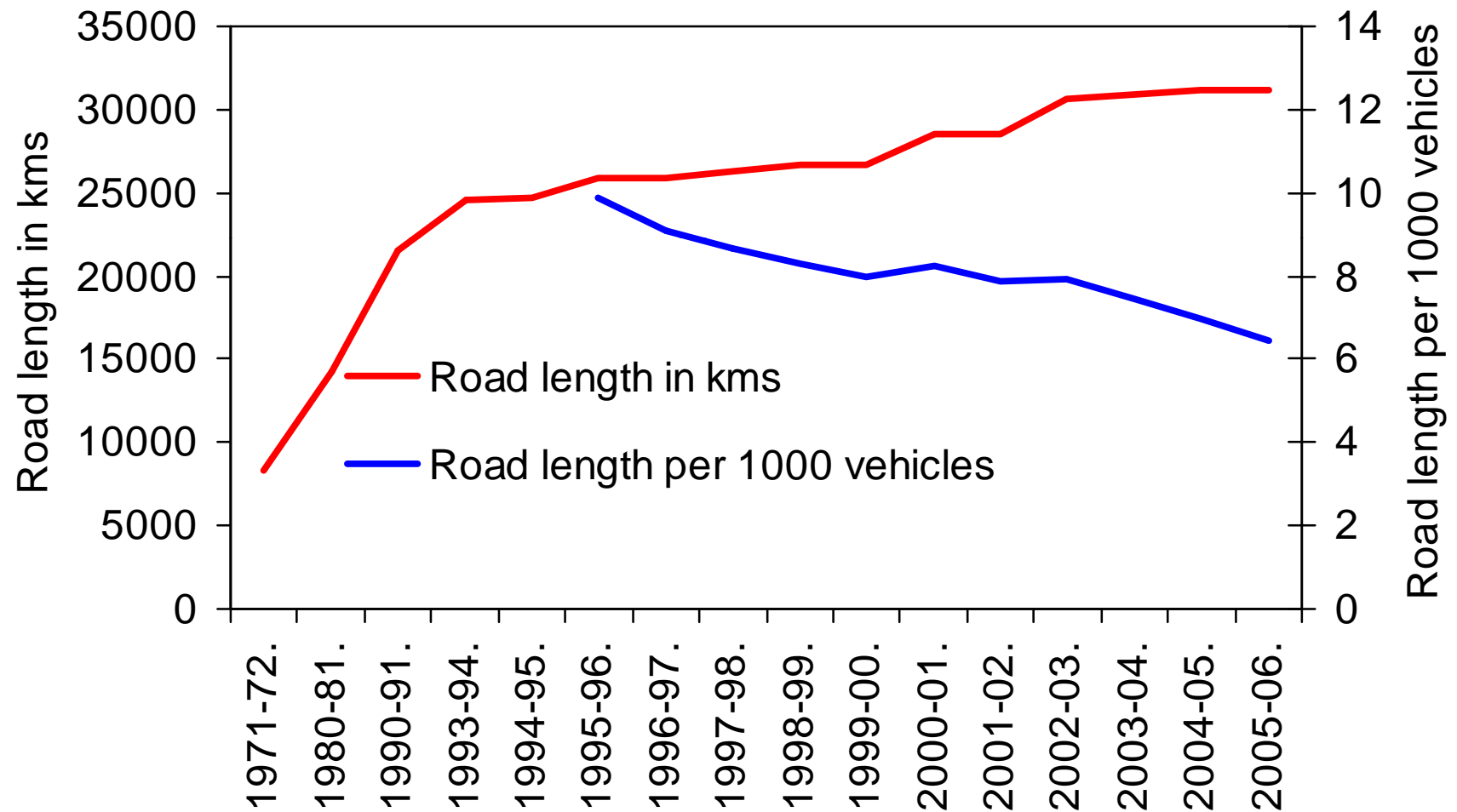


Cars occupy more road space, carry fewer people, pollute more, guzzle more fuel.

They edge out public transport users, pedestrians, bicycles, cycle rickshaws ..

# Lessons from Delhi: Roads hitting dead end in Delhi

*Roads expansion cannot keep pace with rising number of vehicles*



Source: On the basis of Economic Survey, Delhi Govt

## Traffic congestion in Shillong: Majority of roads have exceeded their capacity

Sr. No.	Name of the Road	Traffic Characteristics		
		Total Volume	Peak Hour volume	Peak hour Share (%)
1	Dhankheti Road	30958(12 hour)	3450	11.0
2	Firebrigade Road	23017(12 hour)	2416	11.0
3	G.S Road (Near Centre Point)	22967(12 hour)	2535	11.0
4	G.S Road (Near IGP)	25853 (24 hour)	3201	12.0
5	G.S Road (Near NEDFI Office)	16539 (24 hour)	1712	10.0
6	Secretariat Road	37249 (24 hour)	5668	15.0
7	Polo Road	12204(12 hour)	1432	12.0
8	Rhino point	22320(12 hour)	2427	11.0

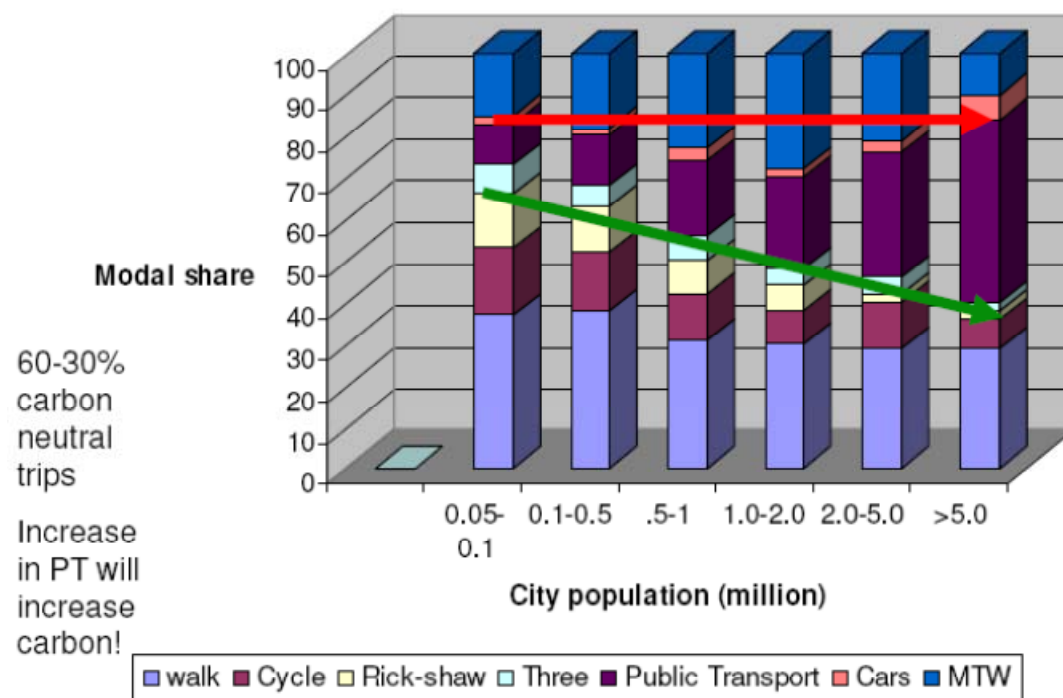
(Source: North Eastern Regi

Sr. No.	Name of the road	Width in mts.	ADT (PCUs)	Capacity (PCUs)	V/C ratio
1	Dhankheti road	7.5	31590	18200	1.7
2	Fire brigade road	8	29471	18200	1.6
3	G.S road (near center point)	8.5	32877	18200	1.8
4	G.S road (near IGP)	10	25853	25200	1.0
5	G.S road (near NEDFI office)	10	16539	42000	0.4
6	Secretariat road	10	37249	42000	0.9
7	Polo road	4.7	18876	12600	1.5

# Strength of our cities....

## Urban Mobility

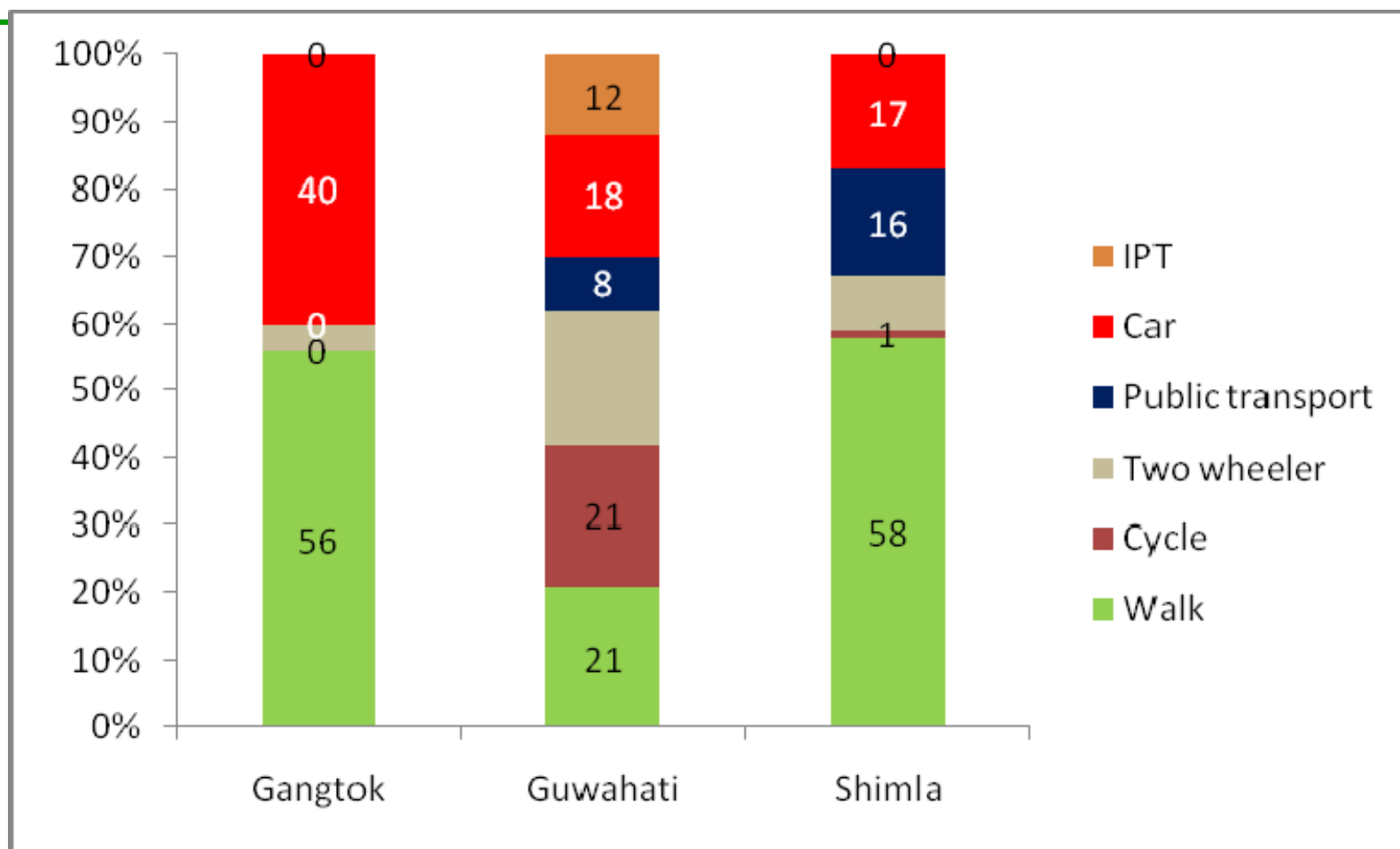
PT and NMV based, MTW majority personal vehicles





# Modal share

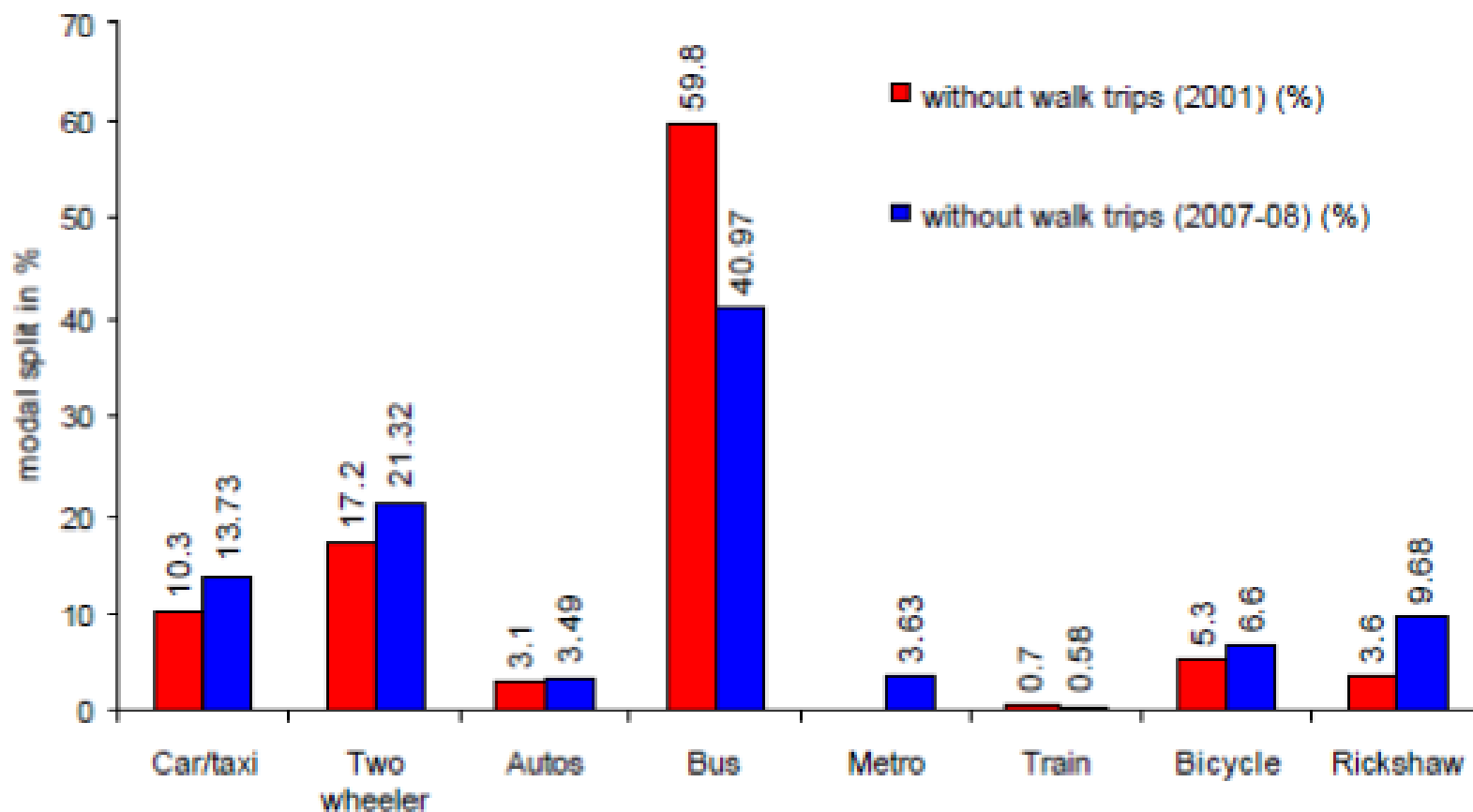
Hills and plains have different challenges



Hills are more dependent on personal vehicles: Of the north-eastern cities, Gangtok has 40% car modal share and 56% walk share. Guwahati has 18% car, 20% two-wheeler, 18

# Reality check in Delhi

## Public transport losing ground



**80% surveyed households in north-eastern states prefer public transport, do not own a vehicle**



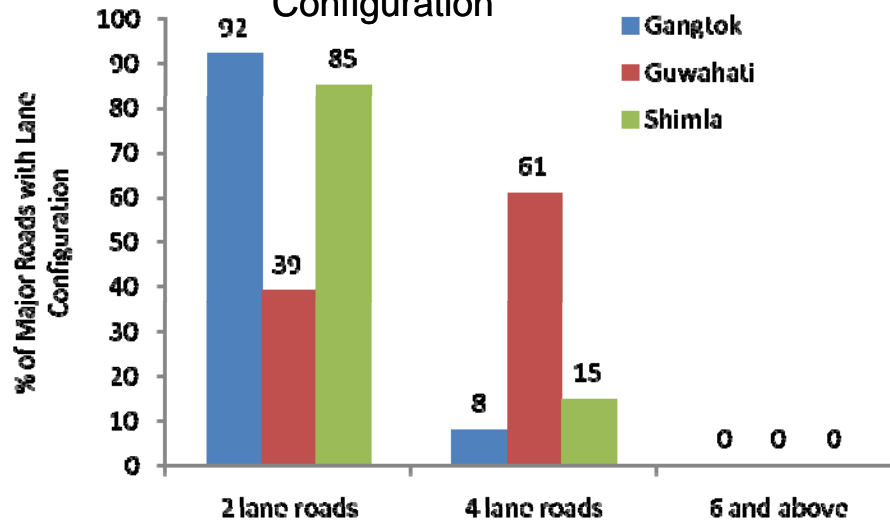
- 
- The Census Commission of India results of a 2010 survey: roughly 246 million households showed that 44.8% own bicycles
  - The northeastern states of Sikkim, Nagaland and Mizoram where over 80% surveyed households do not own a bicycle, a scooter or a car
  - Sikkim had the lowest figure, with just 0.9% households owning bicycles
  - Only 5.6% households in Meghalaya travel by motorized two-wheelers.
  - Sikkim, Nagaland and Mizoram -- over 80% surveyed households do not own a bicycle, a scooter or a car.

**Low car ownership is an advantage.....**

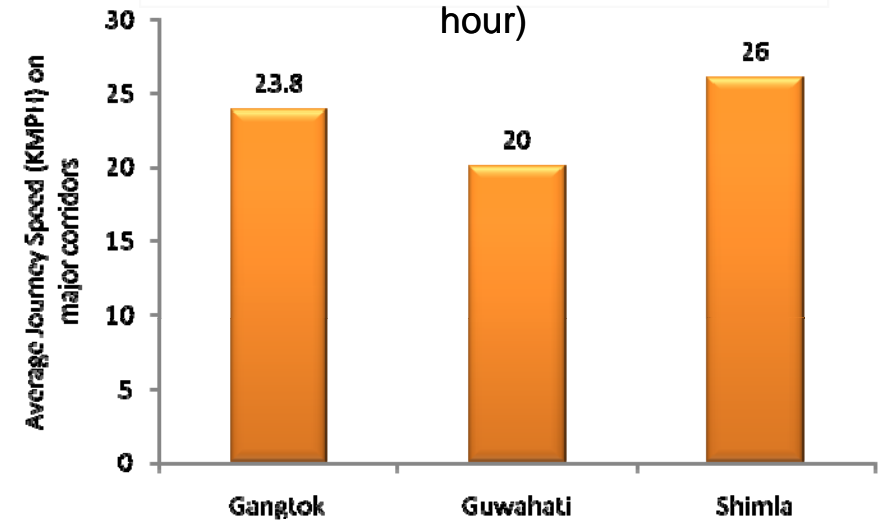


# Roadblock!

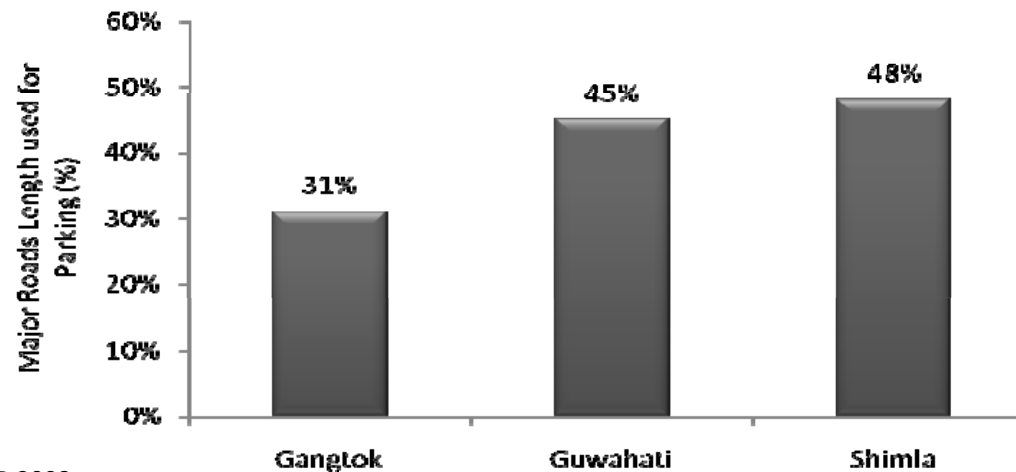
% of Major Roads with Lane Configuration



Average journey speed (in km per hour)



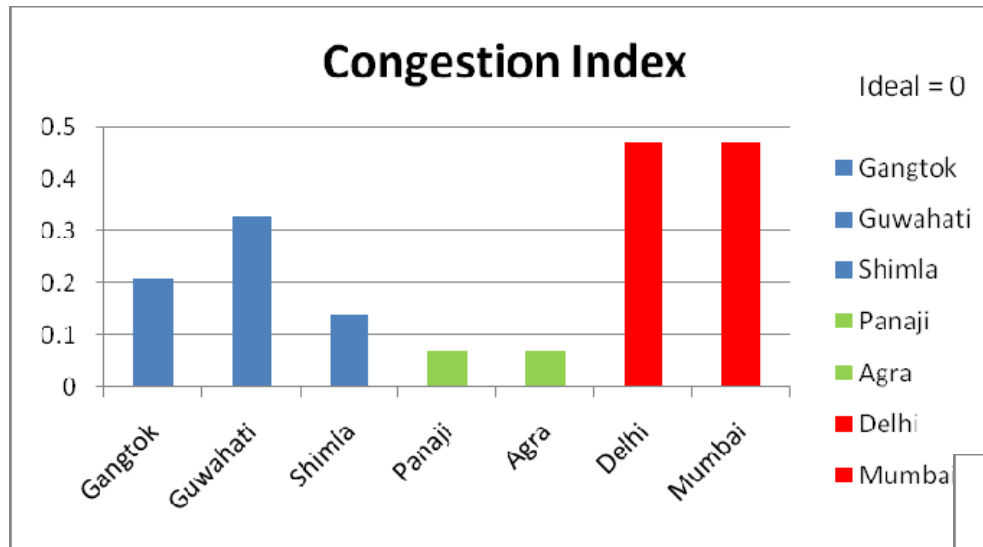
Road length used for parking (in %)



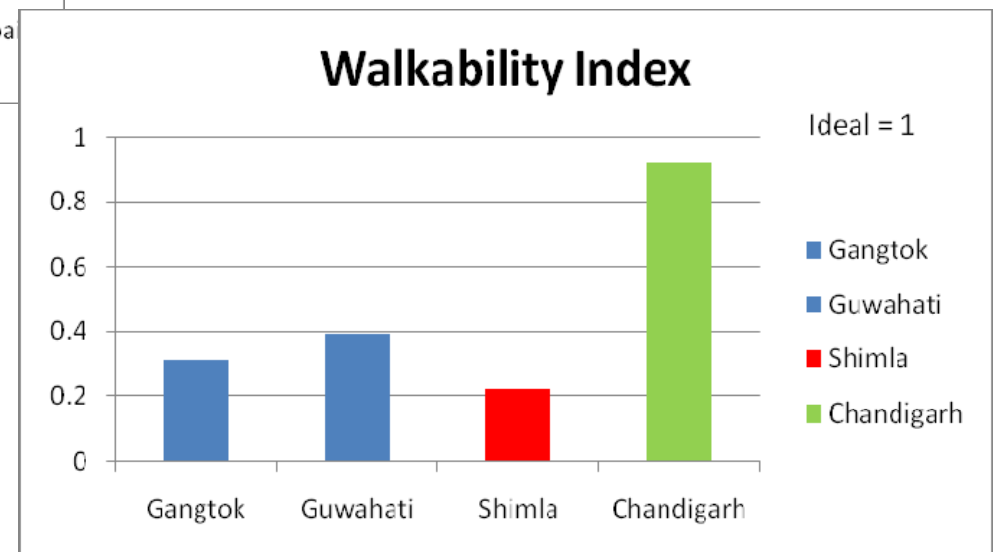
Example of Shimla as a reference hill town

# Congestion nightmare

## Growing Congestion



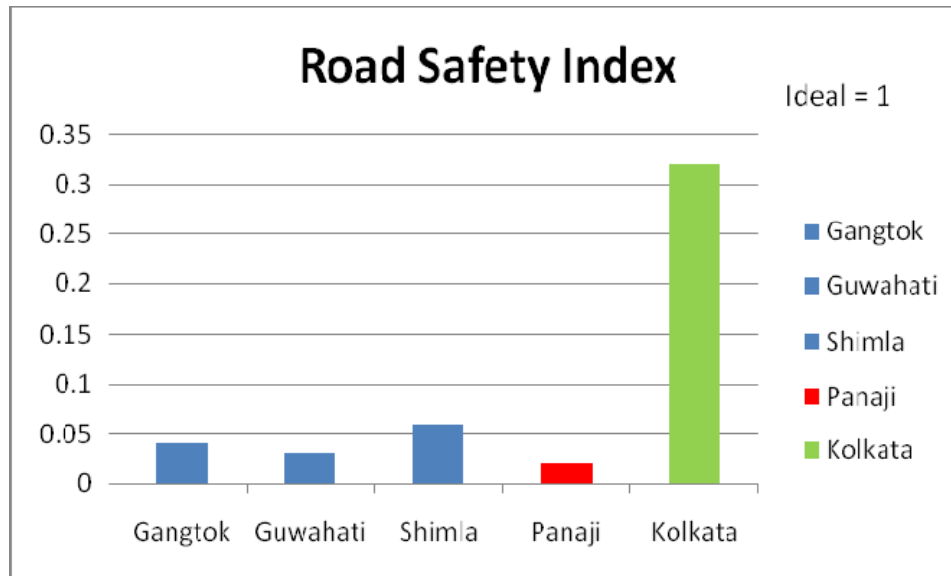
Less walkable



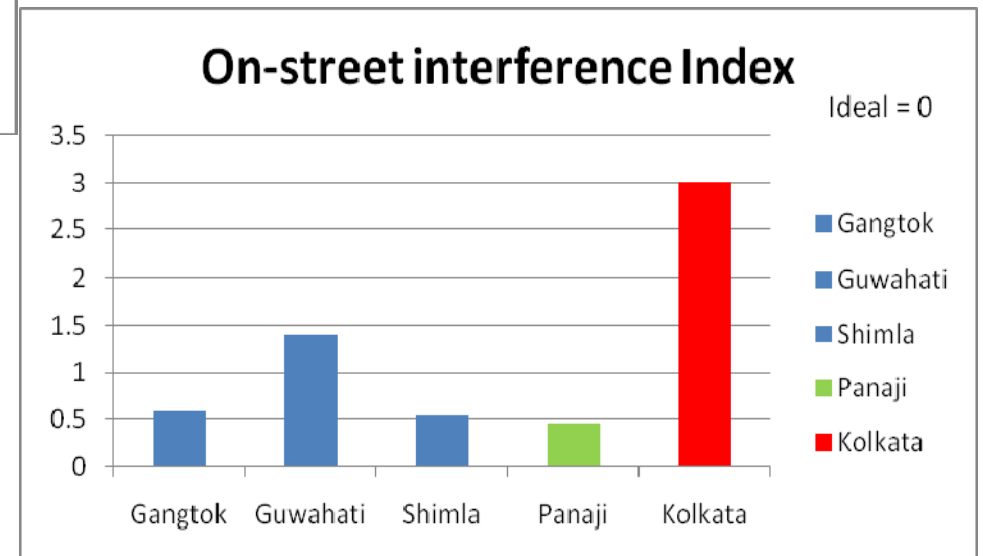


# Road safety.....

## Unsafe roads



## Reduced capacity of roads



## Cities challenged!



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### Guwahati: Challenges of valley

- The density of vehicles in Assam was 7 per sq. km. during 2001-2002 and has gone up to 9 per sq km in 2003-04. -- Growth of vehicles within the city has been rapid.
- Traffic volume of the major roads substantially high resulting in low travel speed, poor level of service and increase in congestion. Mean speed of the traffic stream on different roads varies from 10 km ph to 41 km ph during peak hours. In most of the sections, the running speed can be 20 km ph.
- 72% of the road length in the city have footpaths.

### Gangtok: Challenges of hill towns

- Public transport buses have modal share of less than 1%. --
- Dependence on personal vehicles growing rapidly: Share of personalised vehicles and taxis combined -- 98% of the total vehicles in the city. 40% of modal share.....
- The vehicular accessibility to various areas is limited and no organized public transport.
- High incoming traffic: About 89% of passenger trips are intra-city. Only 11% is through traffic. -- On an average day, about 30,000 vehicles enter and exit Gangtok. Maximum volume of traffic is between Indira bypass and Metro Point (55174 PCU) while the volume between Zero Point and Metro Point is quite high (approx. 36,500 PCU). -- Of the total trips, about 74% of the trips generated and 64% of the trips are attracted by Gangtok city itself. -- Annual growth rate of registered vehicles in Sikkim is 11% to 13.6% during 1998-99 to 2004-05.

# Challenge of motorising ecologically sensitive hill towns....



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## Shillong: Rapidly growing hill town

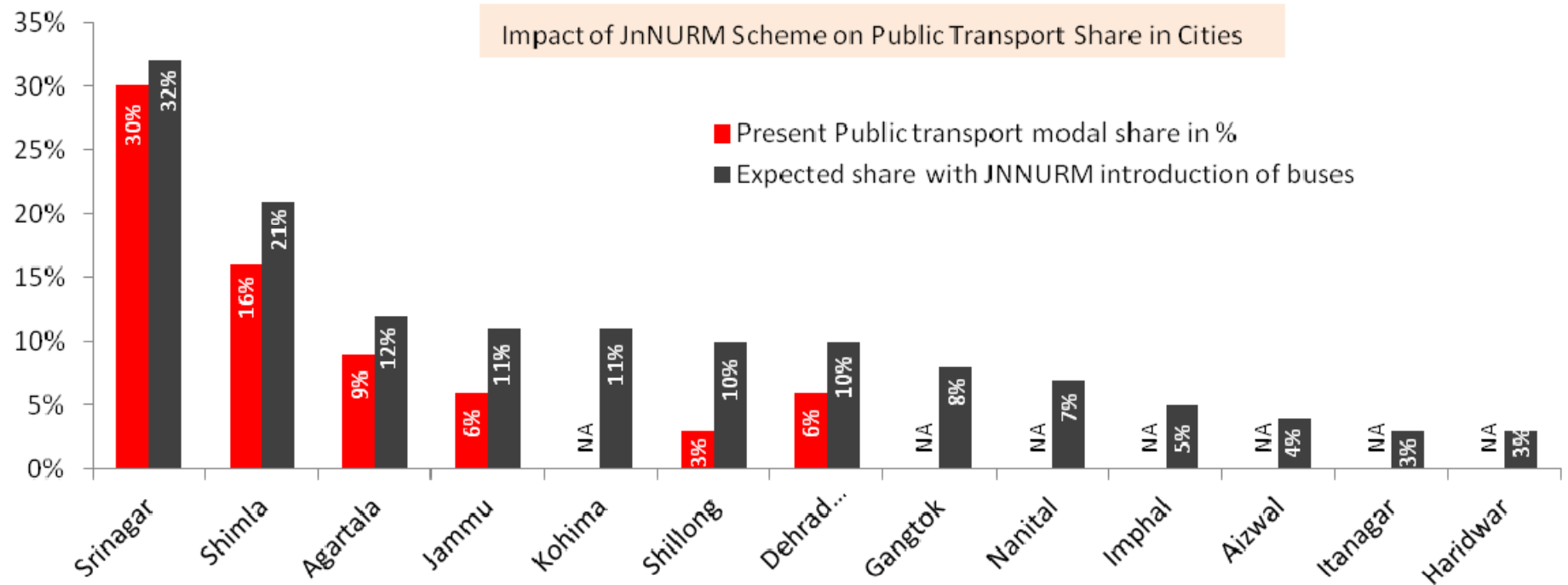
- Cars and two-wheeler account for 55% of vehicles.
  - Car share has steadily increased from 25% in 2001 to 29% in 2006.
  - Cars have shown a rapid growth rate of 14.4% while the two wheelers have registered a rate of nearly 9%.
  - Large number of local taxi (9.41%)
  - The Tourist Taxis have grown at rapid rate of over 19%.
  - Annual average increase of about 10.5% for a period between 2001- 2006.
- CPCB has identified hotspots with high traffic congestion because of cars in the eleven spots.
- Traffic jams contributes significantly to ambient noise. L10 was found over 50 dB (A).

**Public transport.....**

# Public transport intervention can make a difference



## Introduction of new buses expected to improve bus ridership

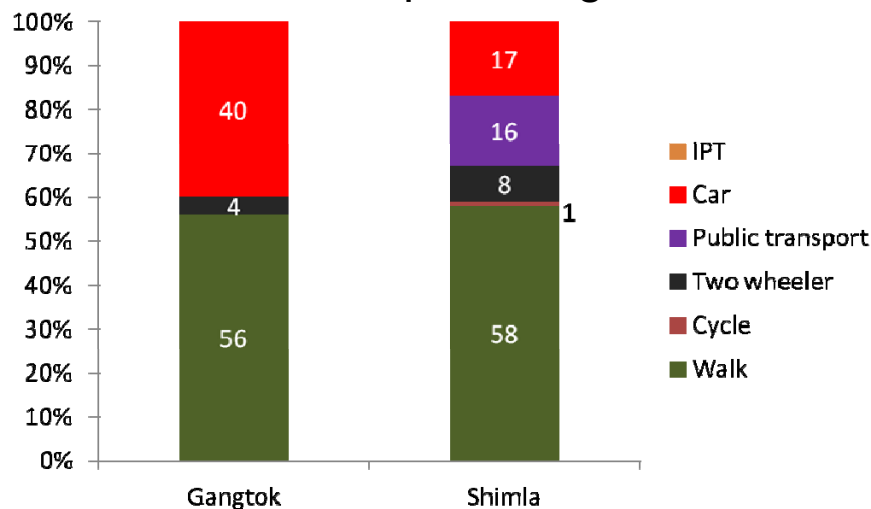






## How people travel in hills? They mostly walk: Zero emitters

- **Most people walk:** MOUD funded study in 2008 show hill cities with very high share of walk trips. Example: **Gangtok and Shimla** have **close to 60% of trips as walk trips**.
- **Small trips length:** Average trip length is 2.1 km to 3 km—makes these cities highly walkable.
- But poor walkability, indicating the poor conditions and availability of pedestrian facilities. Clearly pedestrian infrastructure, amenities and services are neglected in hilly cities.
- Hills can develop walking network integrating the current paths and staircases --



Source: Based on Wilbur Smith study on Traffic & Transportation Policies and Strategies in Urban Areas in India for MOUD, 2008

# Hill cities finding solutions

## Gangtok



Sikkim Government pedestrianized the MG road, the central artery and a commercial centre

A large number of tourists and locals walk through Nam Nang road towards Deorali for the picturesque view of the hills and valleys.

The Government is developing a walk-way with view points, restaurant and cafeteria, toilet facility, street furniture, solar lighting and other activities.

Leveraging eco tourism

Developing step network and ropeways



Image Aerial view of MG Road, Gangtok

# Shimla: passes law



The Mall and the historic Ridge, notified as the auto-free zones.

The Shimla Road Users and Pedestrians (Public Safety and Convenience) Act, 2007 (SRUPA):made provision for special permit/pass for vehicles only those whose work place or the residence is situated on the restricted road

In January 2012 the Himachal High court recognized Shimla as a pedestrian city, and even brought the army vehicles under the purview of SRUPA



View of Mall Road, Shimla

Image Source: <http://delhitoshimla.net>



# Nainital: pedestrianises the core with cycle rickshaws



About 1.5 km stretch has been restricted for vehicular movement. This has an organized pre-paid rickshaw service. Infrastructure including rickshaw stands, signs put up.



Rickshaw stand for pre paid rickshaw, Mall road, Nainital

# Rickshaw Bank



- ~~Innovative financing model called Rickshaw Bank~~ ~~Deep Bahan finds state support~~
- Advertisement space behind the rickshaw is sold to local businesses and corporate houses. This helps reduce risk of delayed payment.
- After the loan is repaid, 65 per cent of the revenue goes to the rickshaw puller and 35 per cent to the bank. More than 3,000 pullers in Guwahati own Deep Bahan rickshaws today.
- This initiative had started as a community action by the progressive individuals. The state government is now providing 25 per cent subsidy on rickshaws.



Deep Bahan Rickshaws



Space used for advertisement

Image Source: Pardeep Kumar Samrah



## Dehradun: Pedestrian core

**Paltan Bazar the commercial hub in Dehradun:** Four-wheelers and three-wheelers banned from 10 am to 9 pm.

Even shop keepers are not be allowed to bring their vehicles inside the Bazaar. After public protest two wheelers allowed



# **Matheran**

## **The only no vehicle town**



Source: CSE

**Maharashtra  
protects its non-  
motorised legacy**

**Town of 5000  
does not allow  
any vehicle to  
come inside.**

**No resident is  
allowed to own  
any vehicle.**

**Train and horses  
are the only  
access**



# **‘Pedestrian only’ regulations in Imphal market**



## **•‘Pedestrian only’ regulations in Imphal market**

- Enforcement challenge: Led to mayhem on the first day of implementation on the roads surrounding the main market.

- Proposal -- ‘Pedestrian only’ regulation in the market area should be regularized and also implemented in Thangal Bazar and Paona Bazar

Also -- Manipur cabinet decided to revoke the no entry of vehicles norm at the commercial centres. Vehicles to be allowed to park at MG Avenue, Paona Keithel and Thangal Keithel following the one way norm

**Source: Only pedestrian zones rule :: Unplanned planning**

**- The Sangai Express Editorial :: February 14, 2012 -**

## Limit to Growth: Parking crisis

### Cars lead to inequitable use of limited urban land

- **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:** Parking space needed for the car fleet in Delhi is 10% city's urbanised area. Delhi's forest cover -- is 11.5 %.
- In Delhi new car registration created demand equal to 310 football fields.
- In a land constraint area of Shillong it would be at least 10-12 football fields
- **Inequitable use of land:** 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?**

Shillong





## **Parking strategy is identified as the first gen car restraint measure in Delhi.....**

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### **2006**

“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.
- Individual user of personal vehicle should pay for the use of the space for parking and parking facilities. The ‘user pays’ principle should govern the pricing of parking.
- Government should not subsidise this cost
- Use a wide variety of tools for pricing parking -- time variable rates –etc.
- On the basis of these principles MCD, DDA, NDMC should frame the rationalised pricing policy for all types of parking facilities...

**Supreme Court takes this on board. Issues directives for a parking policy as a demand management tool.....**



## 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

# Gangtok: demands proof of parking before registration

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**Sikkim transport department notification makes it mandatory for buyers to produce an availability-of-parking-space certificate** before registering vehicles

- The superintendent of police issues certificates after physical verification of the parking space
- This is followed by an inspection by motor vehicles inspector, who submits details to the transport department along with a rough map of the site
- In the hills, car owners often park along the road and walk to their houses, which may be located higher up or lower down
- Two car dealers received notices from the transport department directing them not to sell cars without first asking for the availability-of-parking-space certificate

# Aizawl: passes law to regulate and control vehicle parking

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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*)

## 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 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.

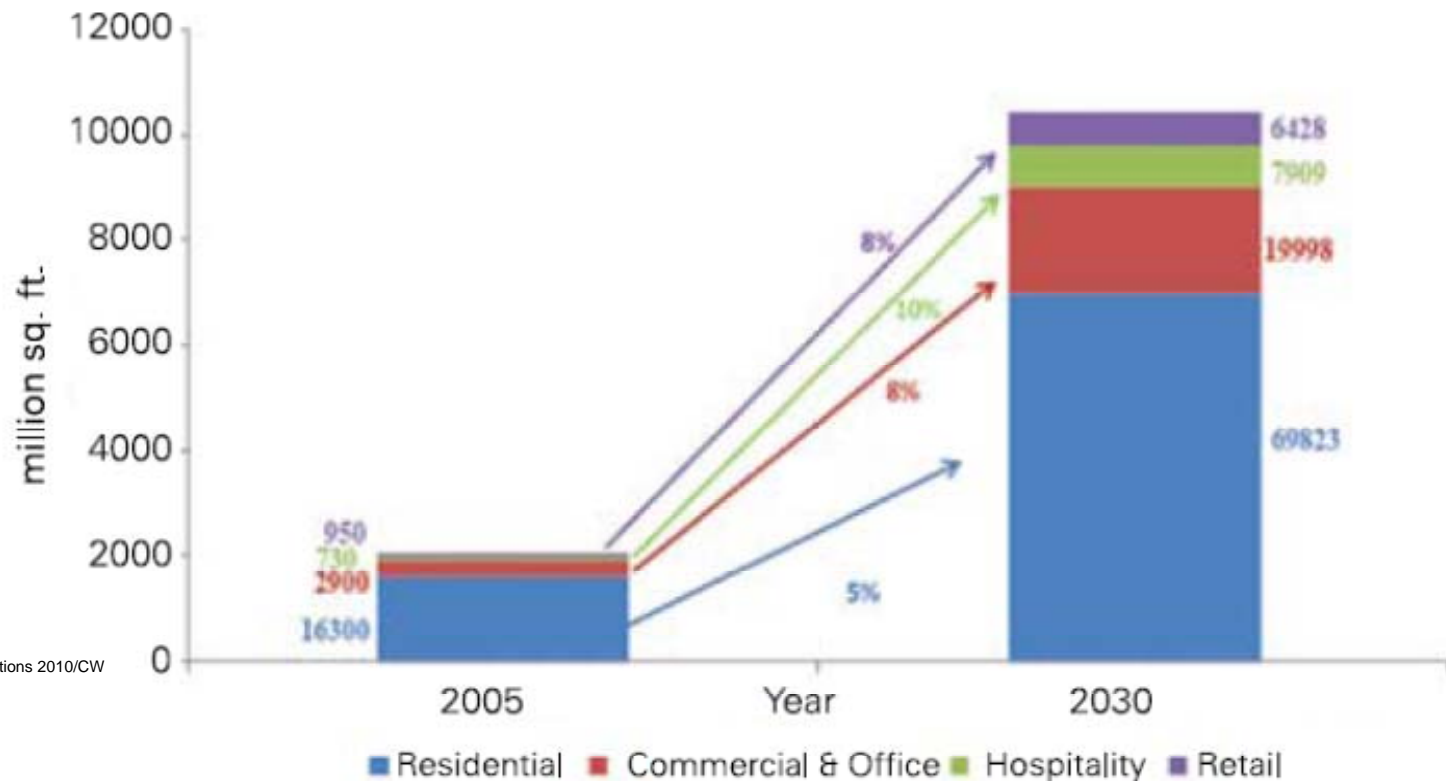
**Bremen:** **No free parking** in city centre. Parking charges higher than public transport cost.

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

- Make urban habitat safe and sustainable....



# Building sector: explosive growth



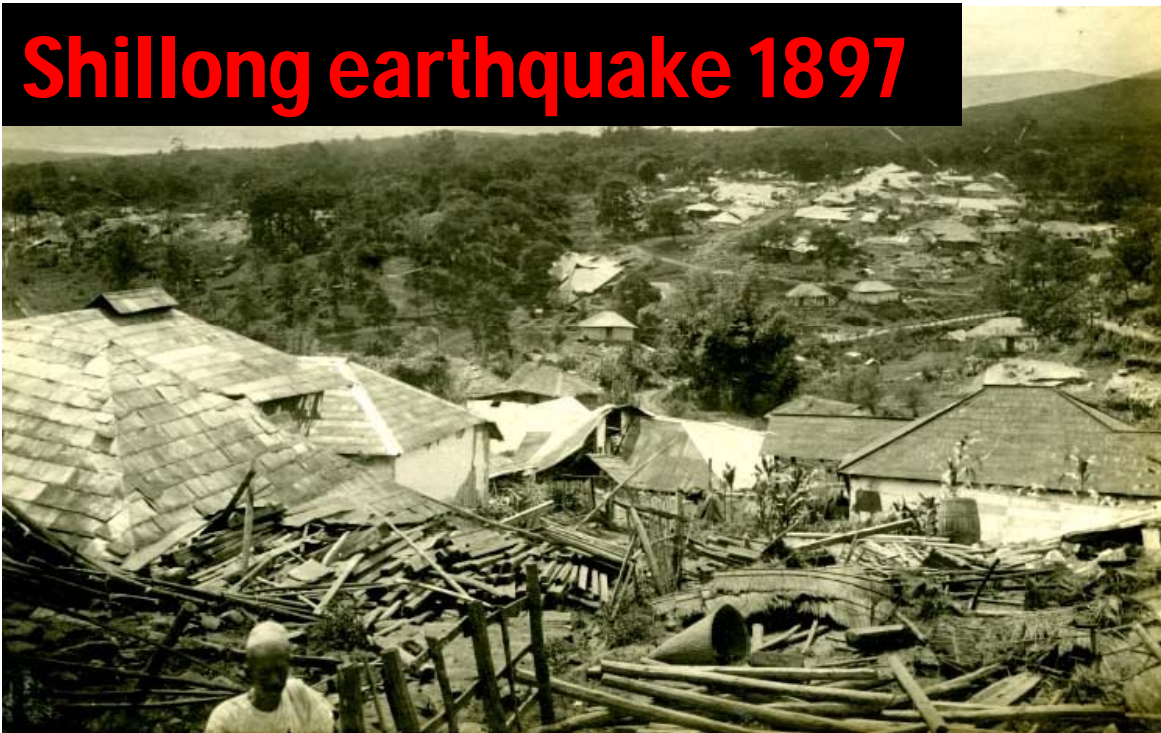
Source: Environmental Design solutions 2010/CW

McKinsey 2009 has estimated built up area of one billion m<sup>2</sup> of commercial buildings that is expected to grow to four billion m<sup>2</sup> in 2030. The ECO-III also predicts that 70% of building stock that will be there in 2030 is yet to come up in the country

## Nepal earthquake 2015



## Shillong earthquake 1897



Shillong, has witnessed several earthquakes including the one that occurred in 1897 during which most of the town was destroyed. Some of the buildings that survived the earthquake included some traditional Khasi houses

**Need locally appropriate safe structure.**



# Highrise in Himalaya: No taller than G+3 storey



Meghalaya Government is amending the byelaws restricting the height of the buildings from the present 19 meters without basement to 14 meters.

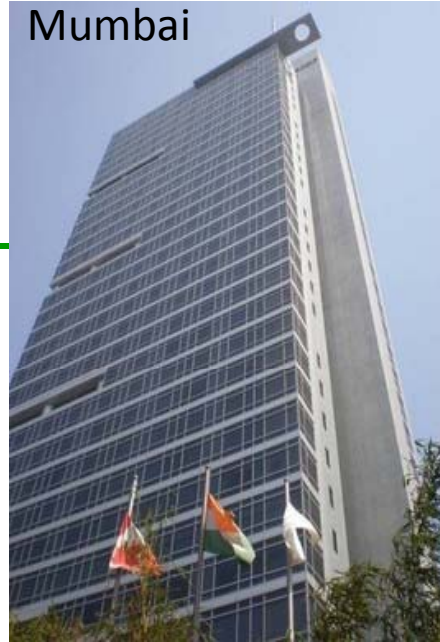
As per the amended byelaws, with basement, the maximum height of buildings can be only up to 17 metres

**HC orders sealing of all 24 high-rise buildings**

Chandigarh



Mumbai



Kolkatta



Gurgaon



Noida



Chennai



Bangalore



**Where does this belong? Are we making climate sensitive buildings**



## Where does this belong?

Shillong



Gauhwati



Gauhwati



FRONT VIEW OF THE BUILDING

Agartala





# Northeast! ...This has identity





**But local designs are sensible,  
Sensitive to local climate, resource efficient**



**Kolkata**



**Leh**



**Jaipur**



**Chennai**



## Good examples of modern buildings built sensibly.....



### **Example of good practices: LE DeG Trainees' Hostel:** Architect: Sanjay Prakash and Associates

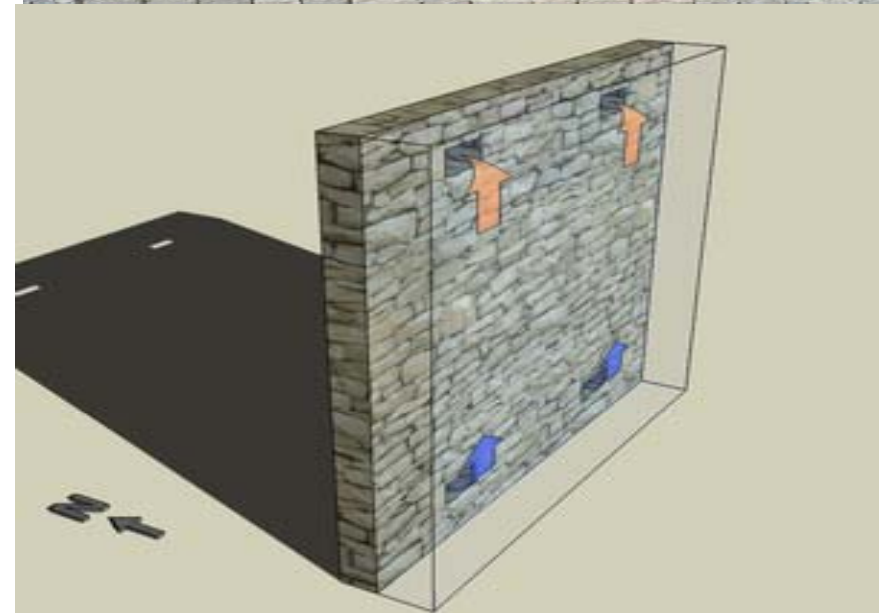
Traditional materials and methods modified and adapted for energy efficiency  
South exposure with no overhangs for maximum winter gains. Entrance lobby designed as solarium on south side. Bedrooms with Trombe walls for direct heat gain and for passive heating.

**Result: Temp inside sleeping room above 8 degree C when outside temp was - 17 degree C in moderate winter**



The south façade with Trombe walls caters to heating needs of the rooms

Copyright © TERI



# Tradition under pressure...

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- How do we blend traditional techniques with modern architecture?

Leading to loss of identity

**New buildings designed by architects and engineers** – Not all are sensitive to and aware of the local practices. It is not uncommon to find buildings in the mountains similar to those in the plains

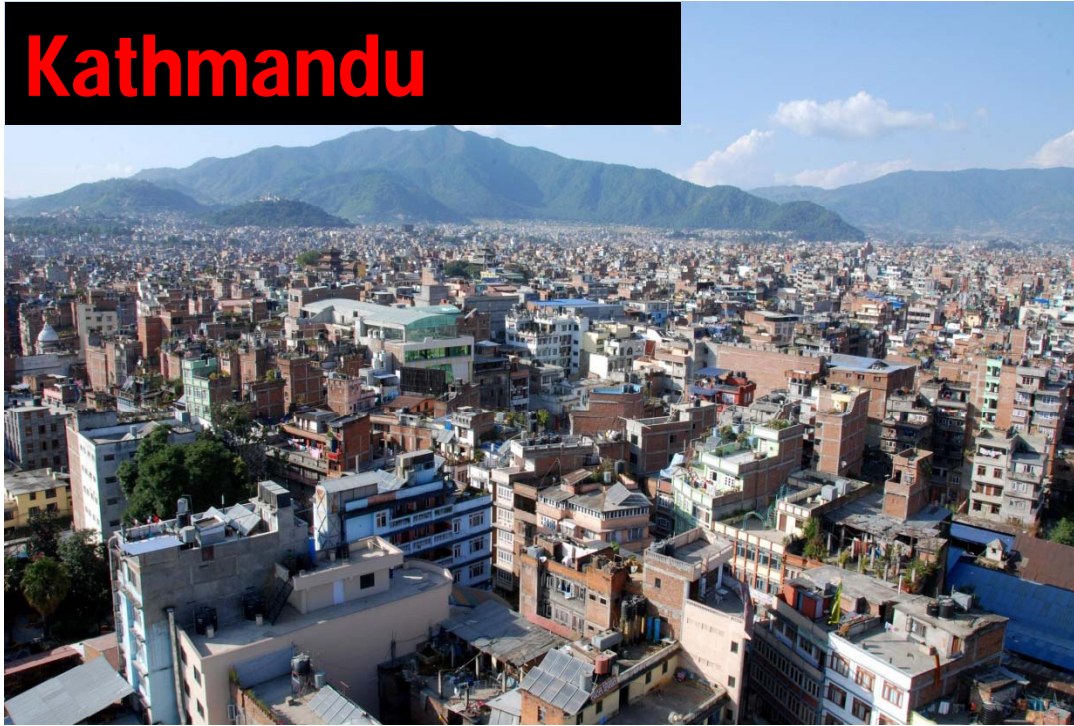
- **Advent of new material and technique:** Since galvanized iron sheets were introduced value. Add to this indiscriminate use of glass in walls – Result -- buildings are hot in summer and cold in winter. --- Newer buildings require more heating than traditional buildings. Thermal comfort and energy savings are compromised
- **Glass can be used effectively for solar passive heating of buildings, but more commonly it is seen that this new material is not used judiciously:** So the resulting buildings are thermally inferior to the unglazed ones, though they may be better lit. for educational facilities, hotels, factories, and other functions which did not exist earlier.
- Local skills will have to be protected and promoted **Timber and local material in short supply**







# Kathmandu



**...But city needs its identity and aesthetics**

**Urban Concrete Jungle: Shillong should not turn**

# Shillong





**Shimla**



**Shillong**



**Turin, Italy**



**Losing Identity and charm, will  
effect tourism**



1. Pattinapakkam Beach



# Construction waste – another manifestation of urban growth -- severing water bodies and ecologically sensitive regions



2. Yamuna, Delhi



6. Keelkattalai Lake, Chennai



3. Ram Nadi, Pune



4. Mangroves, Navi Mumbai



7. Coimbatore



5. NRI Complex, Mumbai



# Challenge of construction waste



Shillong is one of the few cities in India that recognizes and has quantified C&D waste.

But its estimation at 2% of solid waste stream seems under-estimation

**TABLE 4.8: SOURCES OF SOLID WASTES IN SHILLONG**

Waste generating source	Proportion of wastes (%)
Residential	56
Commercial	23
Hotels and Restaurants	7
Hospital Waste	1
Industrial Solid Waste	4
Construction and Demolition Waste	2
Other wastes (Street sweepings & Horticulture, etc.)	7



**Hill towns need recycling Plant**  
**Today there are mobile equipments available to carry out recycling on site**

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# Construction waste is not a waste: It resource



Construction  
waste  
being  
recycled  
in Delhi



## Water?

**Dry hills .....** Rainfall below 100 ml per year.



**How will Leh cope if  
tourist – more than the  
local people – demand  
regular shower and flush  
toilets**

t



## **Tourists**

### **Perception, myth and reality**

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**Swaraj Foundation survey on the gap between what tourists want and the local perception**

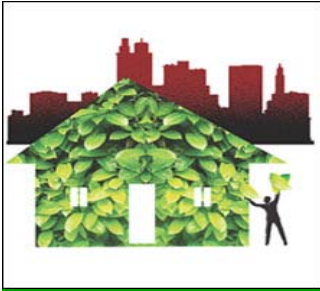
#### **Surveys have shown:**

- most Ladakhi hoteliers believe that their guests need water flush toilets, while a majority of foreigners said they actually preferred or could accept Ladakhi compost toilets.
- A majority of Ladakhis believed tourists want a TV in their hotel room, while in fact a majority of foreign tourists said they did not need a TV.
- Many locals assume that tourists prefer imported, packaged and refined products to the traditional, fresher whole foods. But the opposite is true.
- Ladakhis believe that tourists have a preference for modern industrial products like concrete, plastic, and steel. But the majority of tourists strongly prefer the charm and beauty of traditional architecture made of natural materials.

**Expose the myth. Build public support for sustainable solution. Need sustainable tourism for the overall well being of the local inhabitants.**

Source: ISEC Survey – Eco friendly guidebook for Leh city





## Way forward



- Assess problems – air quality, water quality and availability, land resources and waste
- Adopt sustainable urban and transportation design and planning
- Promote sustainable mobility – walking, para transit based on clean fuels and technology, public transport connectivity, reduce personal vehicle usage and parking demand, create pedestrian zones and accessibility, introduce clean diesel
- Adopt laws for locally appropriate energy and resource efficient buildings material, promote local skills, prevent resource guzzling buildings
- Need integrated approach to town building and peoples' participation in planning, -- Carry out water, waste and energy audits
- Expand renewable energy application
- High altitude dry sanitation experiments etc -- experiments near Amarnath shrine
- Capacity building for architects, engineers, developers; understanding of local requirements; technical tools for execution

## Need better policy and public understanding



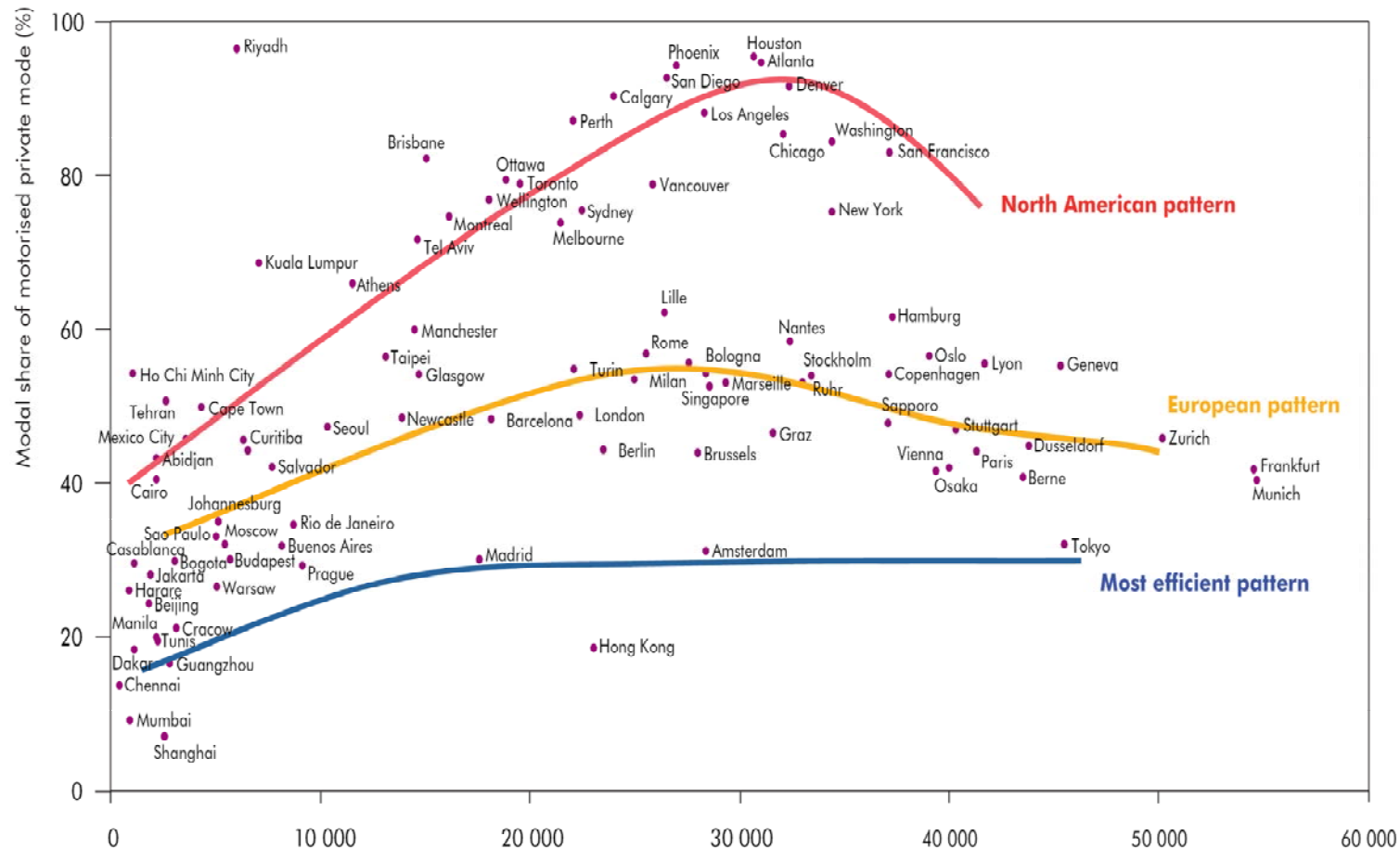
- **Media can change public perception** of what is sensible, appropriate, and yet modern
- **Write about the risks of new trends** and the emerging good practices
- **Evaluate the effectiveness of the new techniques**
- **Sensitize architects and engineers** who now build in mountains about usefulness of traditional techniques, use of new buildings materials, and use of solar energy for heating
- **Also -- even though traditional buildings are energy conserving, improvements are needed in indoor environment of these buildings.**
  - fuel efficient stoves for cooking and space heating need to be made available to the people in the mountains.

With climate change and disturbance in local rainfall pattern traditional building techniques based on mud, dung etc can come under stress. Need adaptive strategies for environmental changes



Change the practice for sustainable growth.....

## Rich cities have less cars..... Relationship between GDP per Capita and Individual Motorised Modal Share



Decoupling of economic growth and individual motorised transport achievable!

Source: IEA, Energy Technology Perspectives, Paris 2008



# Dutch Minister visits the queen

Source: GLZ



# Towards sustainability.....



Thank You