



# Urban challenge in high altitude



**Anumita Roychowdhury**

**Centre for Science and  
Environment**

***Understanding  
environmental issues for  
better reportage***

**A media briefing for local  
journalists and water reporters  
LMO and CSE**

**Leh, Ladakh April 8, 2013**



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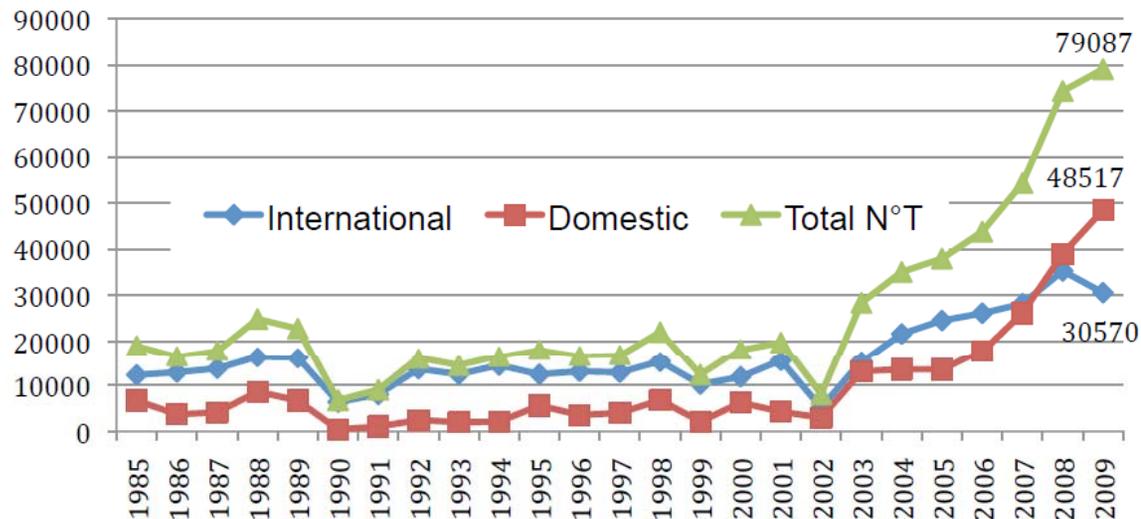


## Tourism led growth This growth will transform urban landscape



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

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))

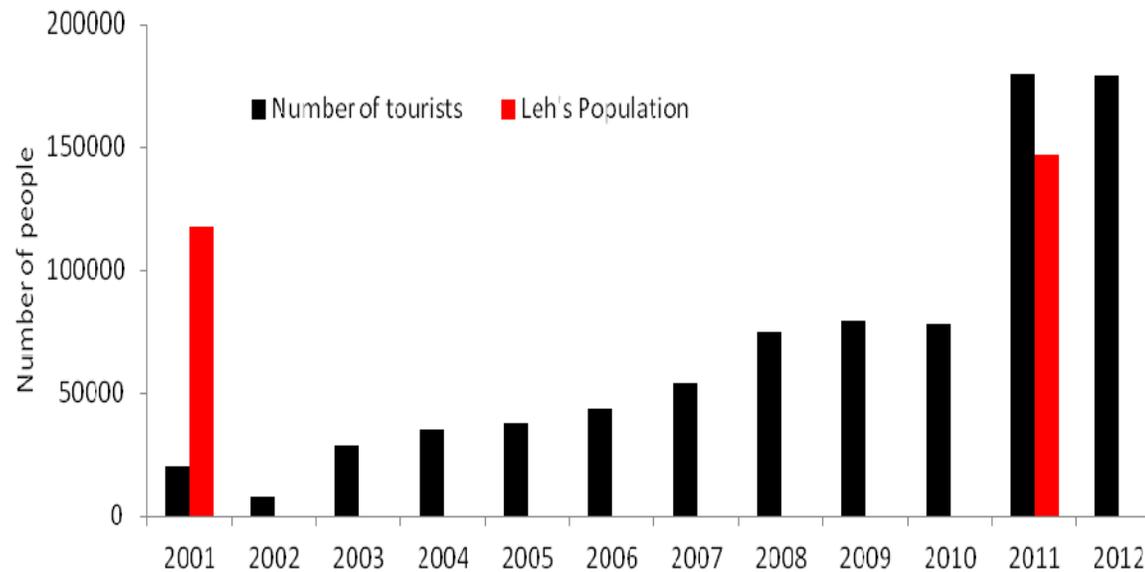


## Tourists -- more than local population



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

No. of tourist arrivals and population



Source: Based on INTERNATIONAL ASSOCIATION FOR LADAKH STUDIES , February 2013 and Census 2001 and 2011



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**What is the emerging air  
pollution story in the region?**



## 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.

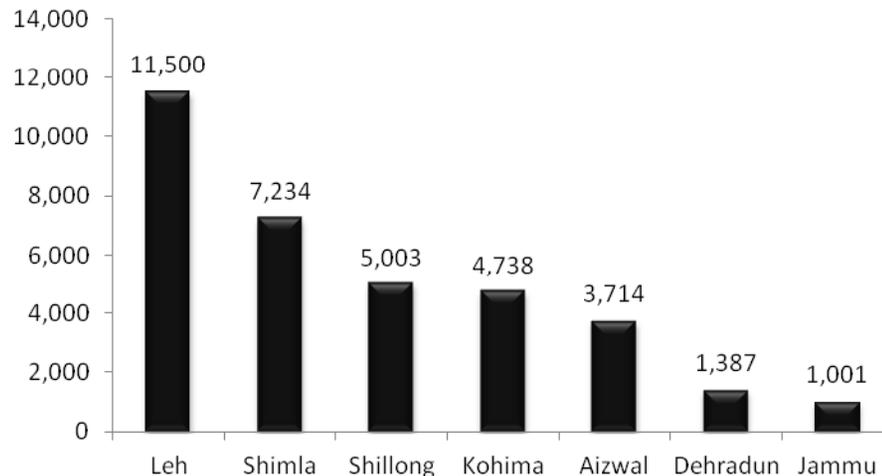
The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured this image of the region on October 30, 2008. The pale beige color of the haze near the India-Pakistan border suggests that some of the haze might also result from dust blown into the region from the west. Image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



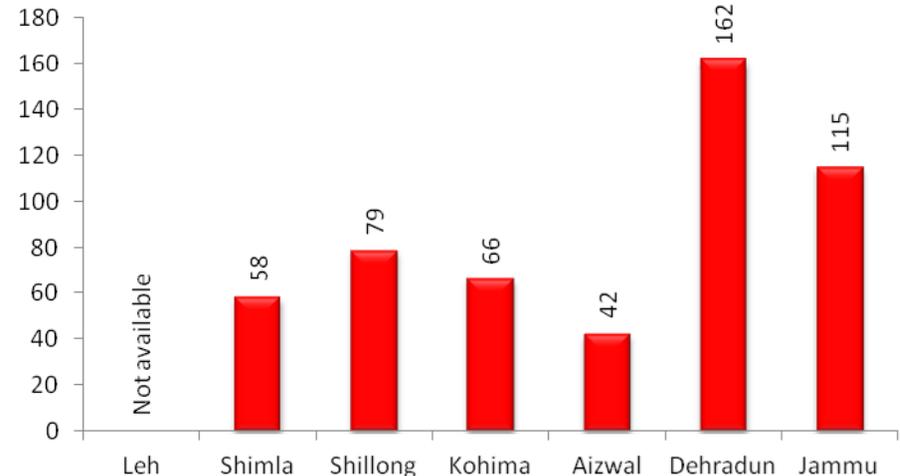
## Do we monitor air in our hill cities? Limited and not in high altitude.....



Elevation (Height above mean sea level in ft)



PM10 levels in microgramme per cu.m

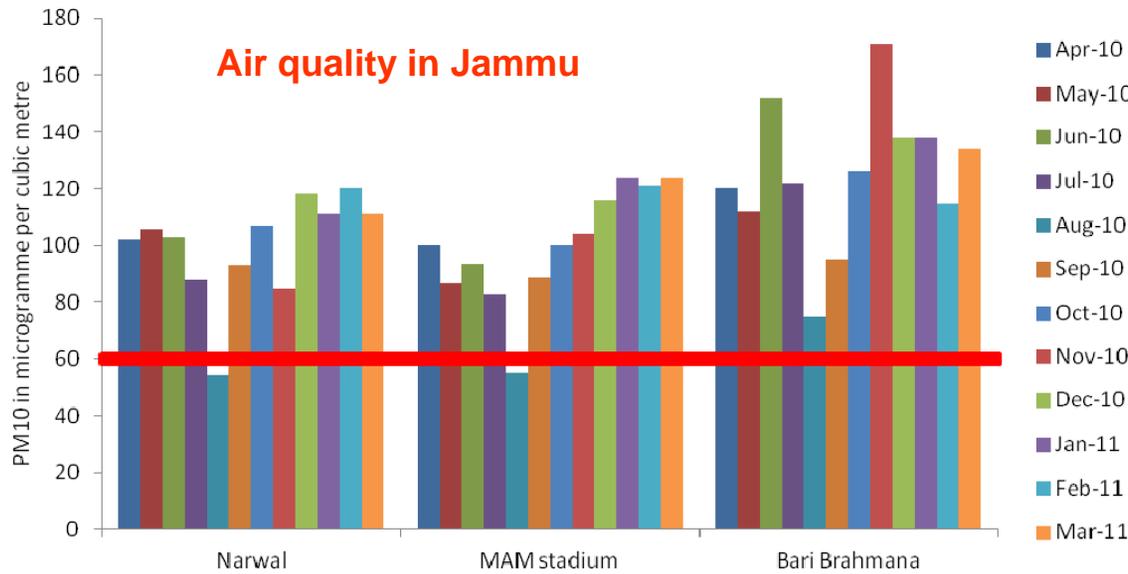


Source: CSE compilation, data sources CPCB, others

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

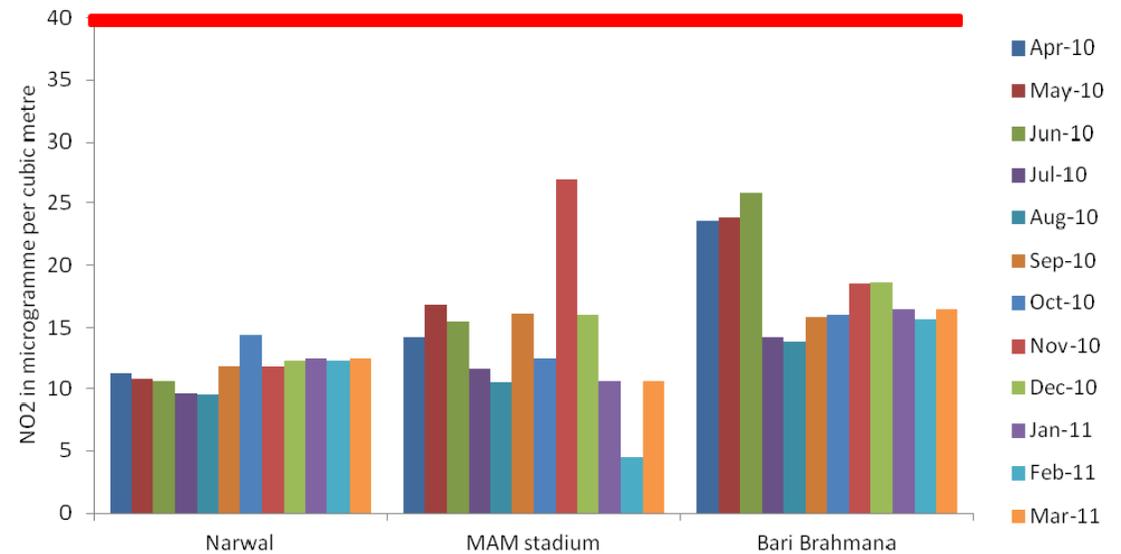


# Valley effects can be high



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

NO2 also signs of rising



Source: Based on J&K SPCB data  
<http://jkspcb.nic.in/Content/Amibient.aspx?id=223>



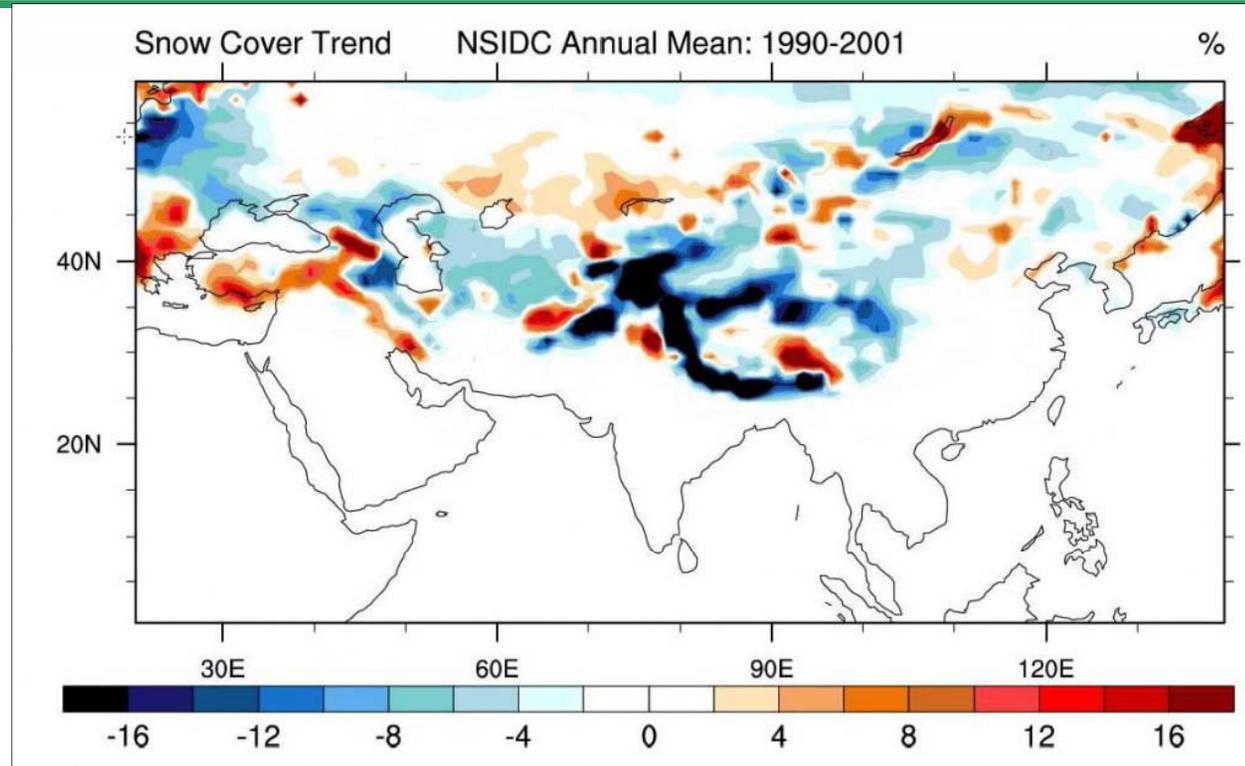
## Emerging science links local air pollutants and global warming....



- **Local pollution can enhance warming ....**
  - HC + NO<sub>x</sub> lead to regional ozone but also to background **hemispheric ozone**
  - CO becomes CO<sub>2</sub> but consumes OH radicals along the way increasing **methane CH<sub>4</sub>**
  - Diesel PM increases PM<sub>10</sub> & PM<sub>2.5</sub> & ultrafine PM but also **black carbon**
  - **IPCC has listed several short lived pollutants that have warming impacts**
- **Warming gases can enhance local public health impacts as well...Eg**, each increase of 1 degree Celsius caused by carbon dioxide, can enhance PM and ozone build up. The resulting air pollution can lead thousands of additional deaths and many more cases of respiratory illness and asthma etc. (Mark Jacobson 2008)



# Climate change and Himalayan Snow Cover Trend



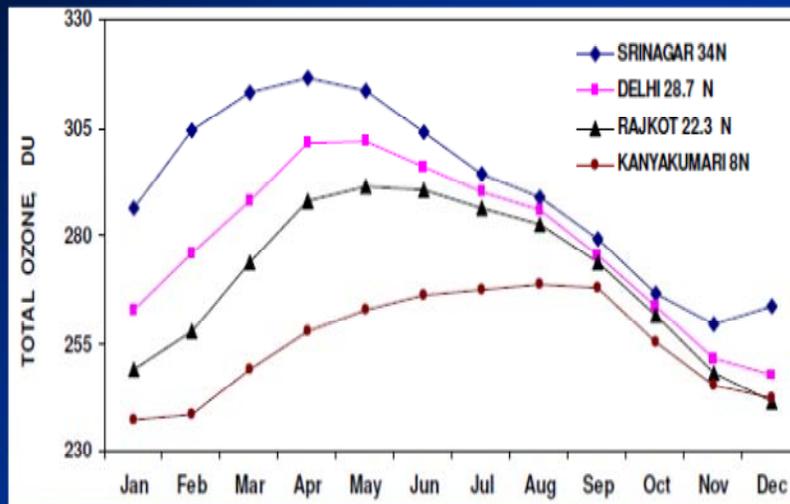
The thick blue band across the Himalayas shows snow cover declining by at least 16 percent.  
Source: Surabi Menon, LBL



## 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....**



## 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.*

Source: UNEP and WMO 2011 – Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers.



## 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 Leh.....?



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

Source UNEP and WMO





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**-- What about our health?  
Local evidences connected with Global  
Burden of Disease**



## 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)



## Reduce emissions from transport and cut indoor smoke to protect health

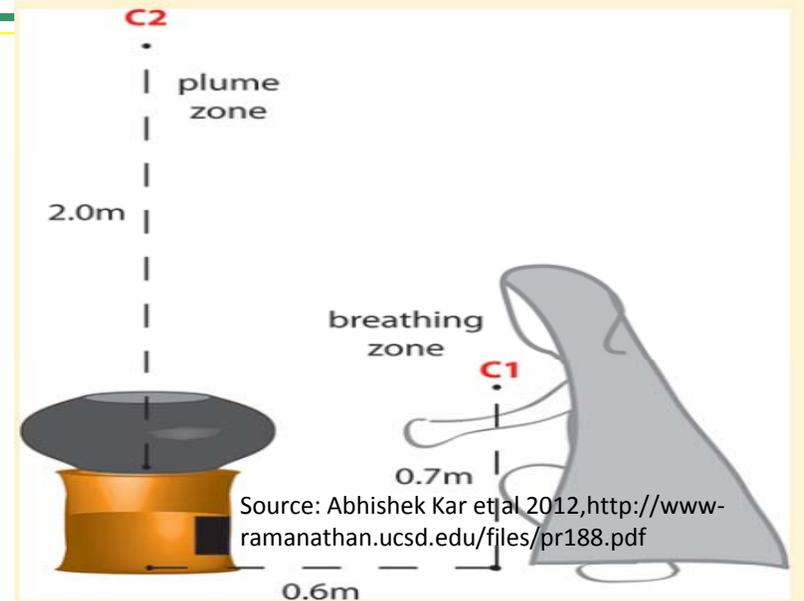


**Cut indoor air pollution:** Use improved biomass cookstoves; Eg, Forced draft stoves, which employ an external fan to force air into the combustion chamber to reduce plume BC concentration by a factor of 4 (compared to 1.5 for natural draft stoves).

- Promote technological innovation; availability; address technology adaptation challenges

Need clean vehicle technology and fuels

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





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## **Mobility challenges.....**

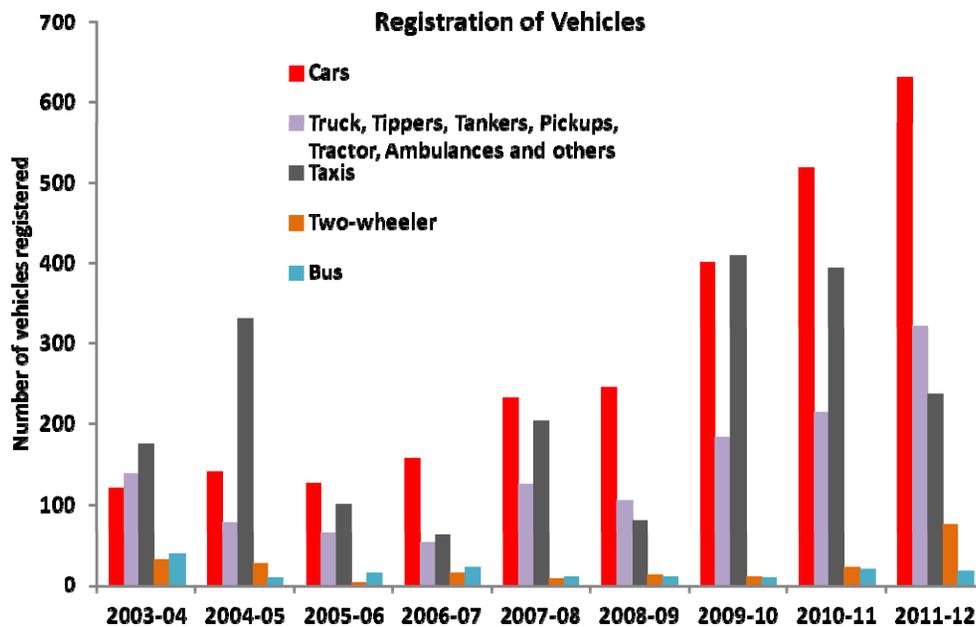


## High Motorisation in Leh dominated by cars, jeeps and taxis

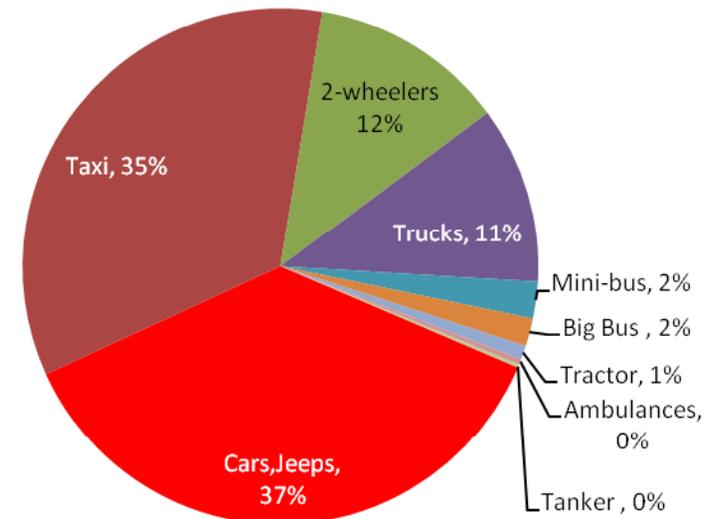
Booming Cars numbers outnumbers all other vehicles (registration of vehicles per year)



### Take preventive steps



Total registered vehicles 8,297 (As on March 2012)

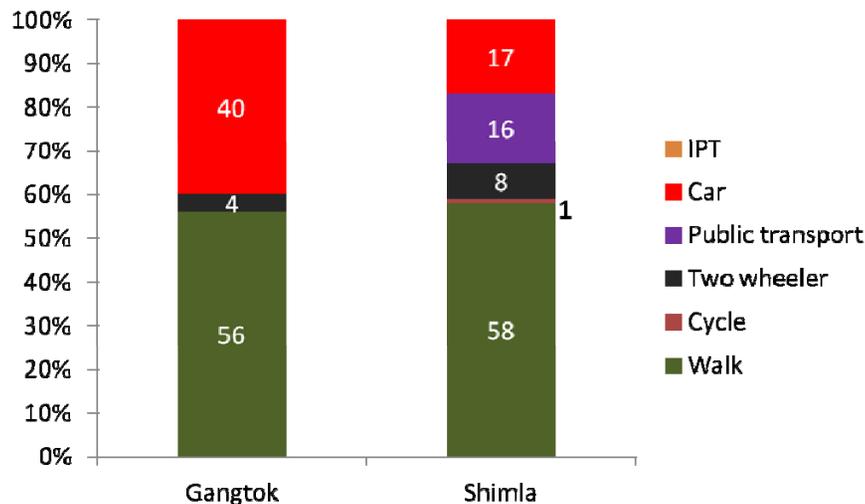




## How people travel in hills? They mostly walk: Zero emitters



- **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.**
- **Two-wheelers naturally are much less than cars.** For instance, Gangtok' car share is 40% and two wheeler share is only 4% of motorised trips. Shimla has 17% and 8%, respectively. Public transport share (17%) in Shimla -- equal to car share (17%).
- **Small trips length:** Average trip length is 2.1 km for Gangtok and 3 km for Shimla—makes them highly walkable.
- Yet **Gangtok and Shimla** scored the lowest on walkability, indicating the poor conditions and availability of pedestrian facilities. Clearly pedestrian infrastructure, amenities and services are neglected in hilly cities.





## High altitude urban planning is still not on the policy radar



- Only 13 towns of Indian Himalayan Region are included in the category of eligible cities to receive fund through JNNURM (Itanagar, Shimla, Imphal, Shillong, Aizawl, Kohima, Gangtok, Agartala, Dehradun, Nainital, Haridwar, Jammu, Srinagar)
- **Hill cities and high altitude towns will require special and separate focus**

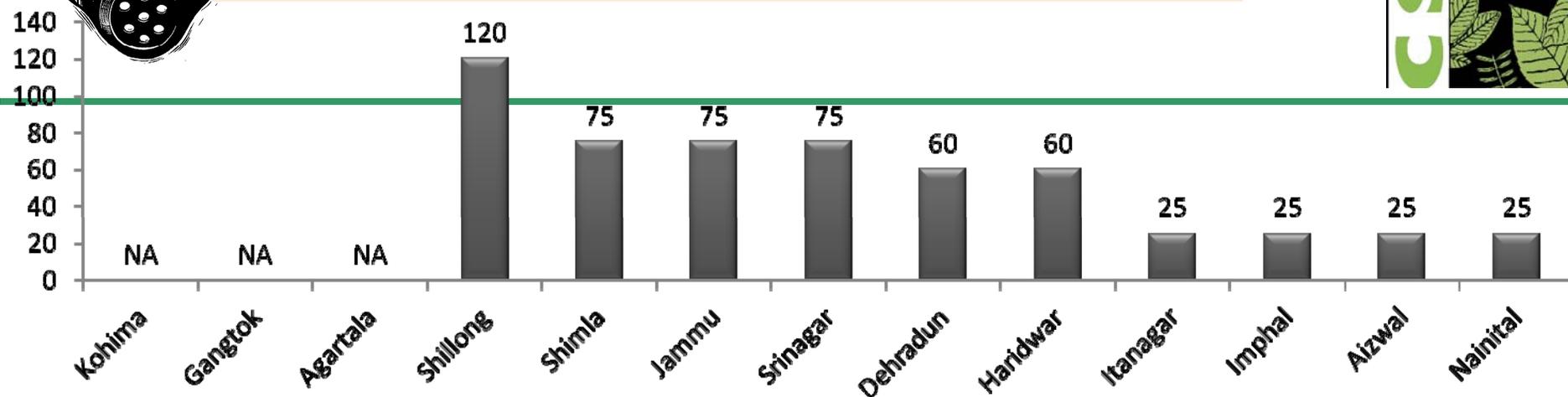




## Status of buses and modal share of public transport in cities in the northern hill region

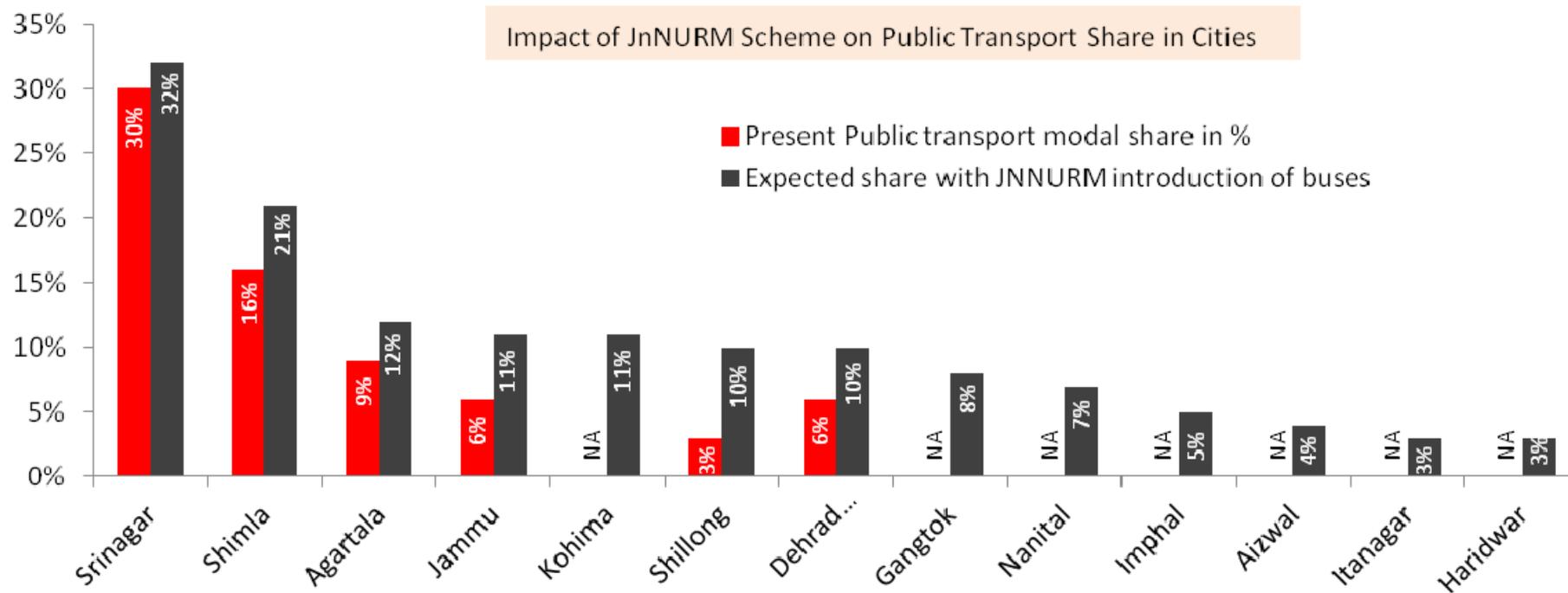


No. of buses approved for cities in the Indian Himalayan Region [IHR] (Total 565)



Source: Based on <http://jnnurm.nic.in/wp-content/uploads/2013/01/Updated-RELEASES-under-BUS-FUNDING-excel-table.pdf>

### Impact of JnNURM Scheme on Public Transport Share in Cities



Source: Based on <http://jnnurm.nic.in/wp-content/uploads/2012/02/booklet-on-transforming-City-Bus-Transport-in-India.pdf>



## Mobility in Leh



- **Very high walk trips:** Many destinations in the city centre can be conveniently reached on foot.

**There is a public bus system; Private car ownership is low but rising.**

- Leh District is connected to the block headquarter by roads, through a network of roads. The average distance of the block headquarter from Leh is 180 Kms. Bus services and other means of communication is very poor.
  - Public Works Department has constructed and maintained substantial road network in the district. Out of 113 villages of the district, 97 stands connected with the motorable road by ending March 2009.
- **Leh is facing traffic congestion. Traffic is a bane in land constrained city of Leh**
  - **Improve walkability, pedestrianisation, zero emissions connectivity, and public transport connectivity, to reduce the number of cars and pollution**



## Ladakh 2025: A Roadmap for Progress and Prosperity: Says traffic and pollution are a problem

A Vision Document by Ladakh Autonomous Hill Development Council



- **Vision statement 2005: “Protect air- Curb air pollution caused by vehicles; Stop open burning of solid waste; Reduce dust emission. (excerpts)**
  - In urban centers like Leh and in villages along Ladakh’s main transport corridors, an ever-increasing proportion of the population is settling down in places where pollution is reaching alarming levels.
  - Air pollution from vehicles needs to be checked urgently in Ladakh, particularly in urban centres. ..monitor the quality of fuel used by vehicles, curb fuel adulteration. Check and improve fuel combustion in engines. ...People should be encouraged to use public rather than private transport. option of electrical vehicles could also be explored.
  - Under no circumstances should waste be burned in public places,... Incinerators currently operating in Leh town should be moved out.
  - Dust emission should be reduced, by banning off-road driving, and locating new roads and quarries away from habitation centres in such a way that hill slopes are not destabilised. ...use of stone crushers should be regulated..not be allowed to be set up near villages.

**A step forward – need detailing and guidelines**



# Parking challenge.....

Land is infinite. Cars are infinite



**Parking devours valuable land.** Current fleet of cars using up land area more than 6 football fields.  
-- About 600 cars and jeeps are registered every year. Additional demand for land for parking new is about 14,513 sq m -- equivalent to one international football field (about 10,800 sqm). Parking will erode open public spaces and capture free pedestrian ways. Can Leh cope with this?

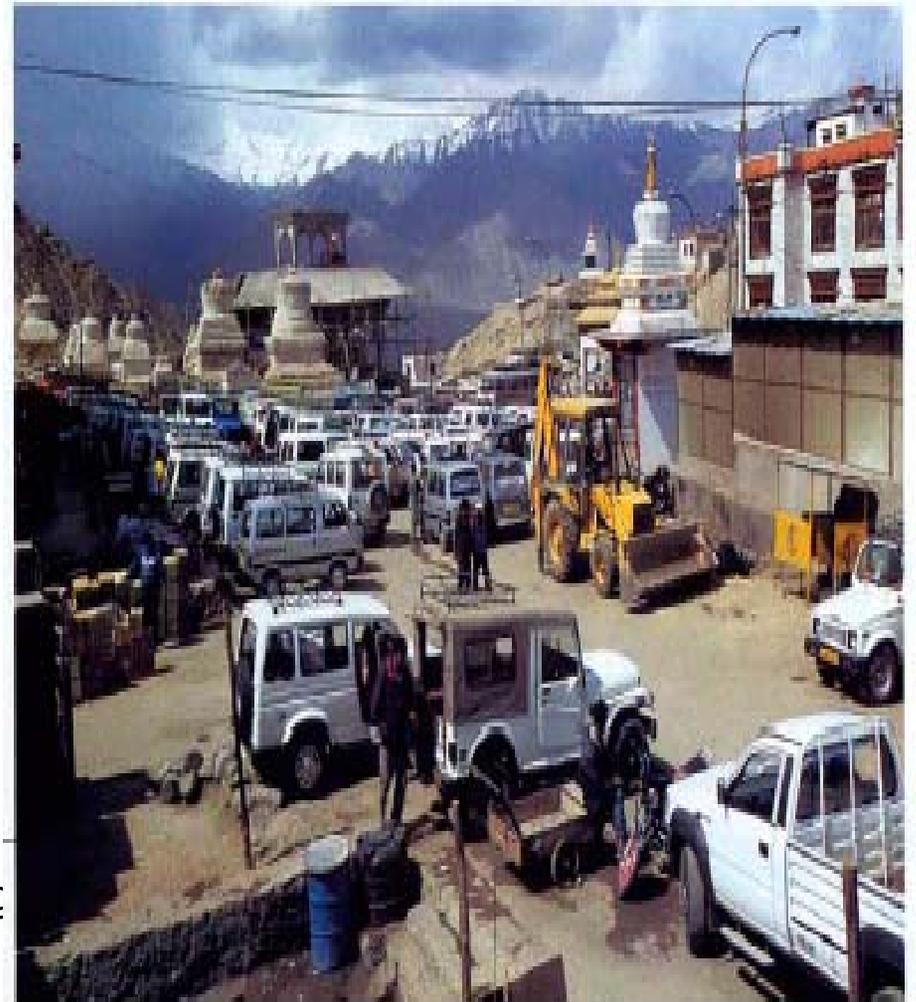
**Leh has introduced priced parking. Make it effective....**

**Earmark only essential public, priced and common parking....**

**Plan off site and remote tourist parking and improve connectivity with the city**

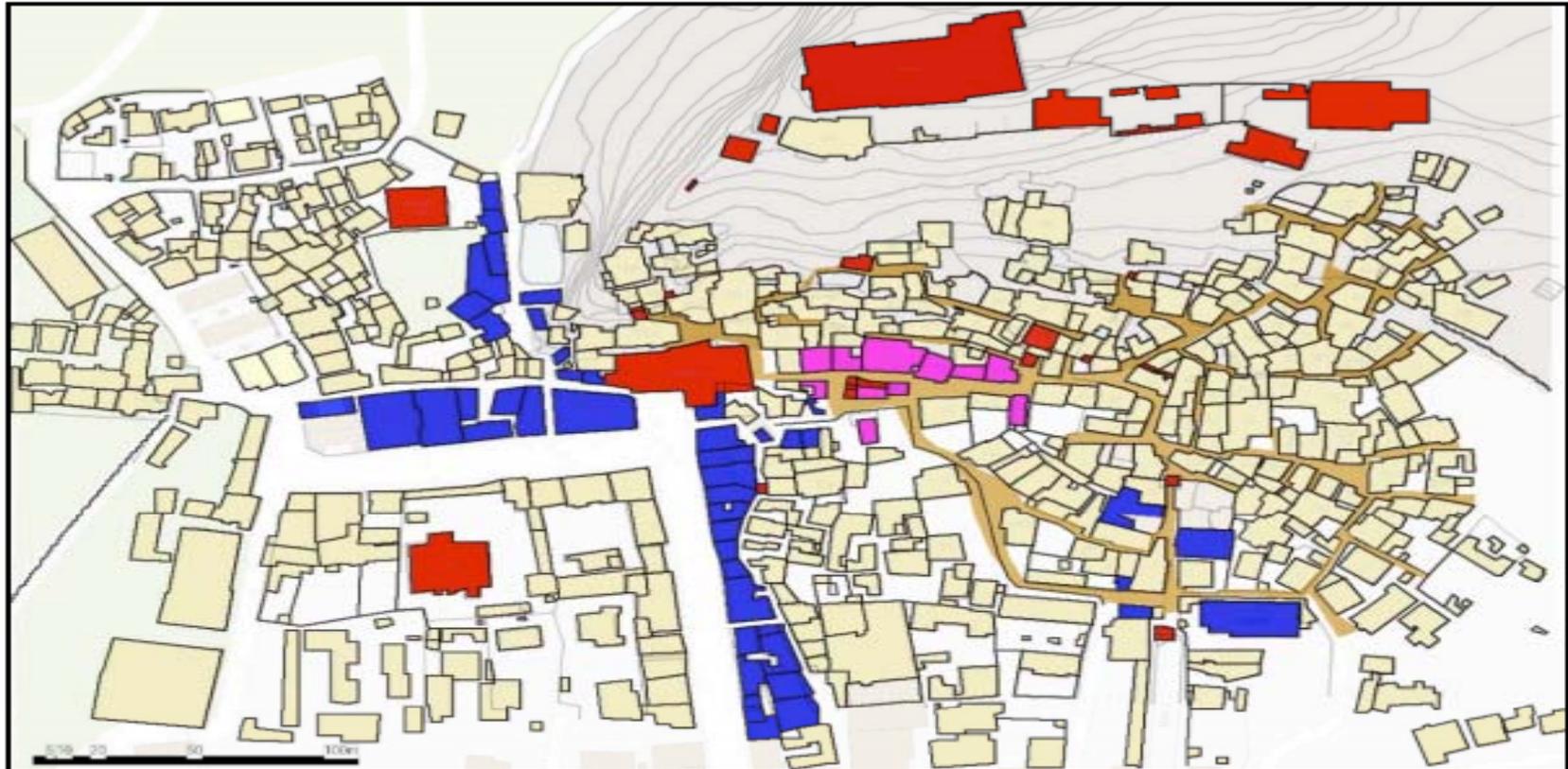
**Aizawl and Rajasthan – mandated proof of parking space before buying a car**

**Tourist want good walking experience and accessibility.**





**Inherent advantage of Leh**  
**Compact, mixed-landuse. Walkable pathways in the old town: Build on this strength**



- Key**
-  *Religious use*
  -  *Commercial use*
  -  *Mixed use*
  -  *Residential*
  -  *Pathways in the old town*

*Source: author, based on THF survey and map.*

Source: [http://www.tibetheritagefund.org/media/download/leh\\_conservation\\_aa.pdf](http://www.tibetheritagefund.org/media/download/leh_conservation_aa.pdf)



**A spotlight on urban planning issues**  
**Ladakh 2025 A Roadmap for Progress and Prosperity**  
A Vision Document by Ladakh Autonomous Hill Development Council



- **The Vision Document by Ladakh Autonomous Hill Development Council proposes:**
- **On planning:** To improve the traffic and transport facilities in Leh town, the first step should be to divide Leh into zones. Each zone to have a node at its center, and self sufficient in most respects. Each zone will have its own market so that the main market in Leh is decongested.
- **Improve Current Infrastructure Facilities**
- **Better traffic and transport facilities**
- **Adopt nodal town planning model**

**It also says -- Construct new roads; Build new parking spaces... But this will have to be planned well and with caution**



## Initiatives on walking Leh bazaar to be no traffic zone



- **Proposed plan to bring in strict traffic regulations in the Leh town before opening of roads to control chaos and congestion during peak summer months.** Some of the major steps include:
  - Make the main street of the Leh market no traffic zone
  - Create alternative routes through the Old Leh town
  - Enforce one-way traffic regulation system with specific entry and exit points on different roads leading to the main market.
  - Also vehicles from outside do not enter the town

**Do not focus only on finding more space for motorised vehicles. Need careful assessment.... Land is limited and finite**

- Under discussion -- Removal of buildings, trees, walls coming in the way of widening of roads at some important points such as protruding wall of Moravian Church and trees, govt. and private buildings in old town etc.



## Other reforms



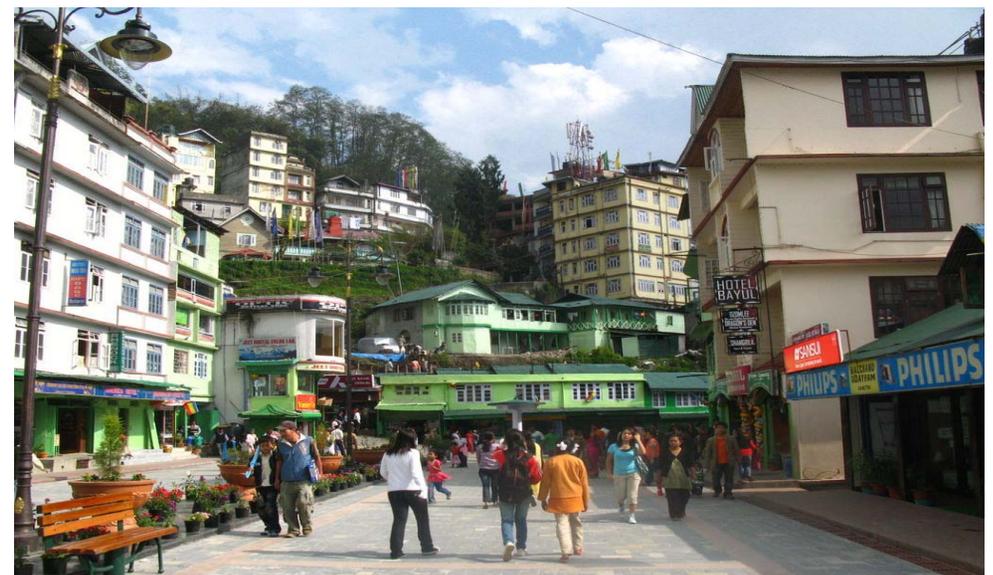
- The Ladakh Autonomous Hill Development Council (LAHDC) is working towards streamlining the traffic in the main markets of the town.
- **No traffic zone and parking management:** Under the drive, parking lots have been streamlined and new parking sites have been opened to decongest the traffic in the markets. The main markets have been declared no traffic zone.
- **Footpath improvement:** Municipal Committee has also asked the LAHDC to create new pavements and tile the old pavements in the main markets.
- **Develop street design guidelines**
- **Others:** There are plans to install benches for the convenience of visitors is also a part of the drive, which will be completed soon. To maintain cleanliness in the markets, shopkeepers of the town have been asked to install dustbins individually or collectively near their areas. Etc



# It is possible to change the urban experience



- Changes are happening in other hill towns
- Snapshots of pedestrianised M G Road, the central road of Gangtok, Sikkim





## **Next steps.....**

Need guidelines for improved and well designed street and pavement network

Planning of pedestrian precincts

Limit personal vehicle movement inside the city. But bring alternative small public service modes.

Regulate taxi service – to improve quality of service and accessibility.

Need clean fuel and clean diesel. Bring zero emissions mode on hydel and solar based electricity

Link Leh city with outer region with good bus system



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**Impact on our habitat.....**



## Reduce energy impact of new development



### Energy deficit region

The demand for power in Ladakh: 59MW (a substantial portion for the Army).

The Ladakh Vision 2025: estimated an annual rate of increase in power consumption of 7%. The requirement swelled to 94 MW in 2012, and 140.5 MW by 2025

Installed generation capacity in Ladakh is 13.5 MW (8.7 diesel, 4.8 hydel)

**Enormous gap between demand and supply .... Need alternative sources. Need to be energy prudent**



## Enormous potential to replace polluting diesel based electricity with solar power....



### Amazing best practice!

The 250 KVA Diesel Generator at Tangtse in Durbuk block of Leh district supplied electricity to three villages for domestic lighting.

**The diesel generator, a polluter and consumed an average 48,200 litres of diesel annually.**

Under the collaboration with India Canada Environment Facility (ICEF), MNRE, Ladakh Autonomous Hill Development Council (LAHDC) and people of Durbuk block, **TATA BP Solar a 4X25kWp solar photovoltaic power plant was installed at Tangtse village.**

**This has completely replaced the existing Diesel Generator set.**





## Integrate traditional wisdom to reduce energy impacts of new buildings



- **Abundantly available material is earth**, -- principal building material for walls, roofs, and floors.
- **In dry climate compacted earth walls are durable, mud-plastered surface requires little maintenance**
- **Three or four storied mudwall structures in Ladakh**, and some even higher. Roofs are generally flat and are constructed
- **Sometimes there is an enclosed yard on the ground floor where cattle is kept**
- Since glass was not available until recently, **windows are fitted with solid timber shutters**
- **letting in light as well as cold air, or of keeping both out.**
- **The window openings are limited to the sunny sides of the building**, and the sides exposed to cold winds have no openings

**Rammed earth** is an ancient technique used for hundreds of monasteries, castles and forts around Ladakh. These structures have survived, unprotected and exposed harsh nature for hundreds of years.



## Integrate local wisdom



Rebuilding of Druk White Lotus school:  
combines local wisdom

Source: SECMOL – The Students’  
educational and Educational and Cultural  
Movement of Ladakh

Insulation it does not need to be very  
expensive modern materials. The wood  
waste generated during the construction is  
filled in the ceiling to stop heat loss through  
the roof.



## Encourage locally appropriate technique and material



**Local techniques:** Top layer of the floor is lined with slates from the nearby mountains. This reduces the use of cement.

Slates also become a thermal mass or heat bank as they are now cut off thermally from the cold ground.

Source: SECMOL

Outer walls insulated by a jacket wall outside the main structural wall. Six inch gap between the walls - filled with low cost insulation: saw dust, wood shavings or sometimes paper and plastic garbage. Sometimes use cow dung as an insulating plaster. Right mix of earth and clay, it makes a strong and thermally effective plaster. 1 ft mud wall = 2 ft concrete = 4 ft stone = 1.5 inch of saw dust. = 1 inch of Thermocol, rockwool etc.



## Learn from locally proven energy efficiency measures

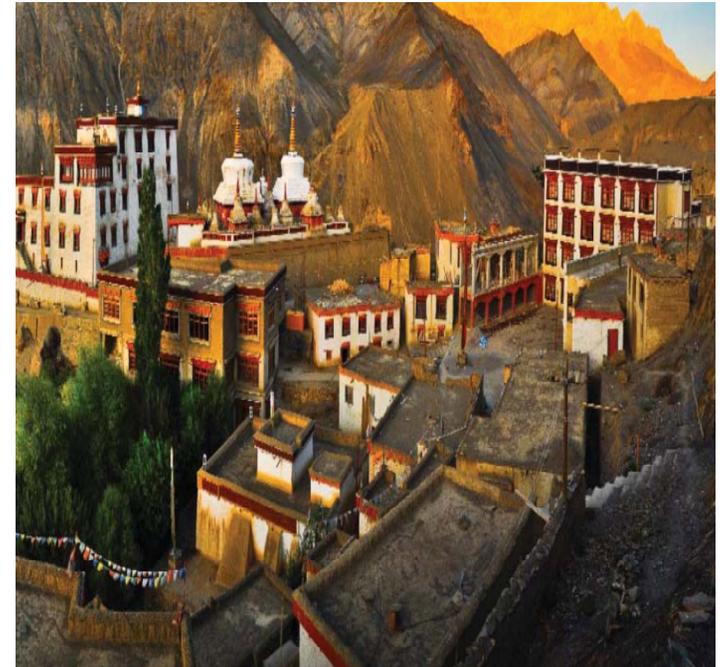


**Passive Solar Architecture** – Link energy conservation with clean energy

- **Conventional methods of room heating** -- use of kitchen stove fuelled with dung, wood and kerosene.
- **Trombe wall built on the principle of passive solar gain** and minimization of heat loss through various design and insulation techniques.
- **Trombe house can reduce reliance on heating fuels by about two-third, besides reducing indoor air pollution and health hazards.**
- **Installation of 75 solar retrofitted houses** in 1984, in collaboration with Ladakh project.  
(Source: HBF study)

Windows and skylights ensure that no place in the building needs electric lights in the day.

**Sources: Buildings of SECMOL – The Students Educational and Agricultural Movement of Ladakh**





## What may go wrong?



**BUT....**How do we blend traditional techniques with modern architecture?

There are new buildings being built out of concrete and cement.

Leading to loss of identity

Local skills will have to be protected and promoted

Chandigarh



Mumbai



Kolkatta



Gurgaon



Noida



Chennai



Bangalore



**Learn from the mistakes of other cities – Ignoring climate sensitive design -- Where do these buildings belong? Cut off from local roots, they become captive user of AC thought the year, energy guzzlers**



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



**Kolkata**



**Leh**



**Jaipur**



**Chennai**



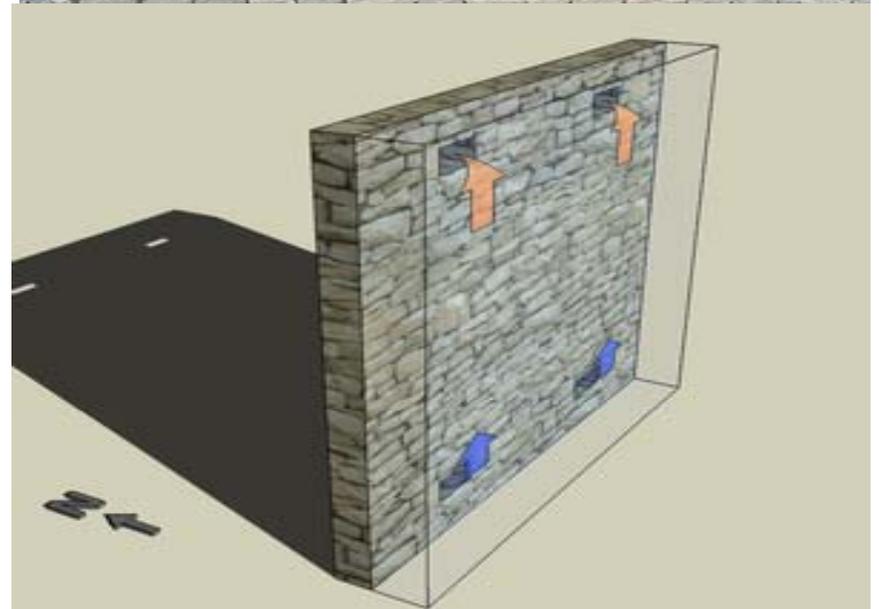
## Good examples of modern buildings built sensibly.....



### 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



## Tradition under pressure...



### Studies show:

- **Timber is in short supply and even good building stone is not easily available.**
- **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.
- **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 in Srinagar, earth roofs disappeared. Helped in roof waterproofing. But has little insulation 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
- Galvanized iron roofs can be insulated with a variety of materials and the insulation value of glazed walls can be improved. But these increase cost and increase dependence on import.

**Source: ISEC Survey – Eco friendly guidebook for Leh city**



## Need better policy and public understanding

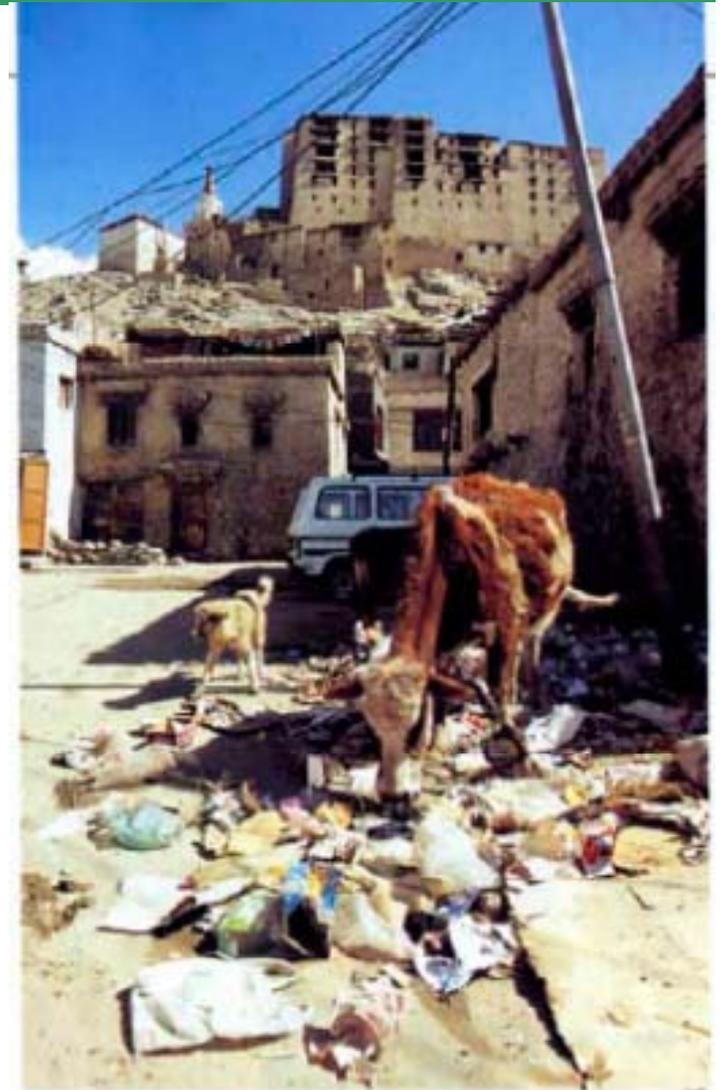
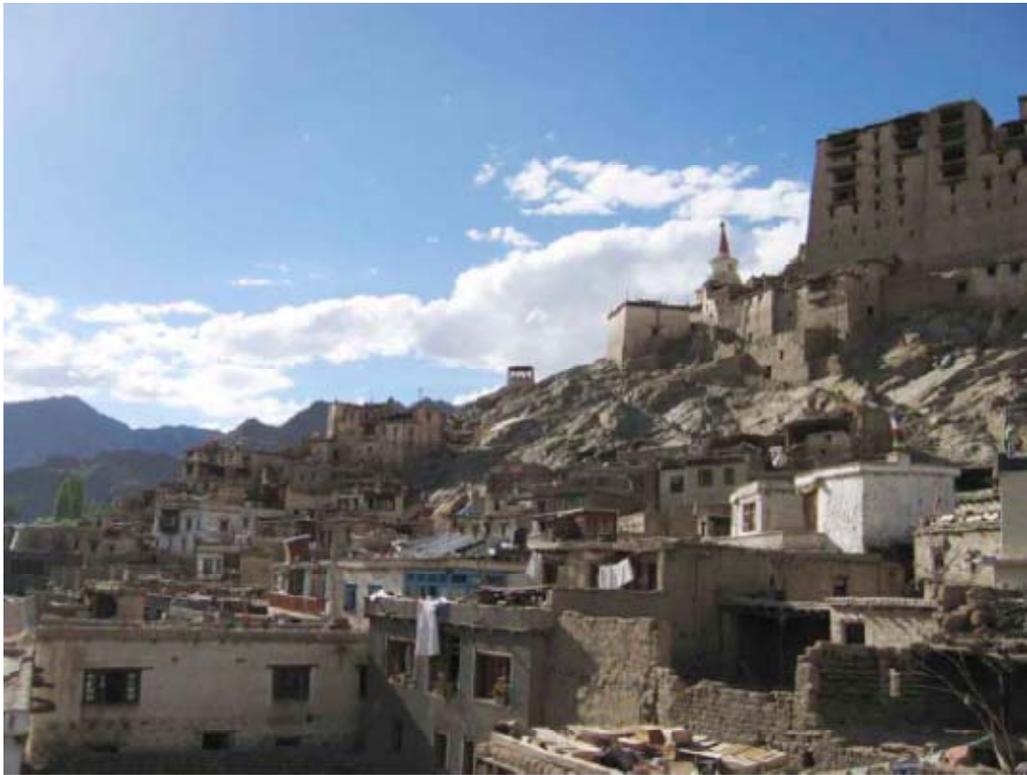


- **Media can change public perception** of what is sensible, appropriate, and yet modern
- **Write about the risks of new trends** and the emerging good practices
- **Evaluate the effectiveness of the new techniques**
- **Sensitize architects and engineers** who now build in mountains about usefulness 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



## Challenge of waste



Reportage in 2012 show that Leh generates 10-12 truckloads of waste each day and there is no waste recycling plant.



## Leh: world's highest zero waste town?



- Ladakh Ecological Development Group launched the alliance for a zero waste in Leh
- Participatory efforts – included poorest communities, tour and travel guides, environmental and women's group, and health specialists.
- There is almost no plastic bag available after a ban – demanded by citizens, came into place a few years ago and organic waste is collected and fed to the cattle, which almost every prosperous family owns. So maybe, given its attitude,
- Leh could well become the highest zero waste town in the world.
- Enforcement is a challenge
- *Need stringent regulations for tourists*

- [http://www.youtube.com/watch?v=M3Vch\\_WKgWo](http://www.youtube.com/watch?v=M3Vch_WKgWo))
- Source: B Chaturvedi, [http://gbpihedervis.nic.in/html/vol10\\_2/News.pdf](http://gbpihedervis.nic.in/html/vol10_2/News.pdf)



## Water?

Rainfall below 100 ml per year.



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

- Projected water requirement in town =150,000lcpd
- Only 5 taps (supplying approx 10,800lcpd) are there in the entire old town to cater the water requirement of the area, supplying only one 14th of the required amount



## Waste water?



*Stagopilog alley with Sofi house and gateway stupa, April 2005.*



*September 2005, the alleyway has been paved and fitted with drainage.*

Windows and skylights ensure that no place in the building needs electric lights in the day.



## Jigsaw of evidences on innovations from Leh



EcoSolutions built Dry Compost Toilets for Ladakh Environmental Development Group. These are excellent sanitation technology. but space is a constraint in Leh town. Flush toilets wastes precious water and sewage cannot be handled effectively. Septic tanks and cess pits polluting water courses and springs of meltwater in the town.

**Source: Work done by the Ladakh Ecological Development Group**

Seated urine diverting compost toilet in LEDeG staff guesthouse. Used EcoSolutions ecopans. Provision for collecting urine in insulated tanks were also made.



Toilets built inside homes





## Tourists Perception, myth and reality



### 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