Low Carbon Mobility Plans for Cities

Geetam Tiwarii

(TRIPP)/ Civil Engineering Department, Indian Institute of Technology

Workshop Promoting Low CarbonTransport in India,12 th November, 2010 ,Delhi

Low Carbon Transport Mobility Plans

Reconciling development and GHG agenda

Access to goods and services for all inhabitants of the urban area

Global concern of CO2 and local health concerns

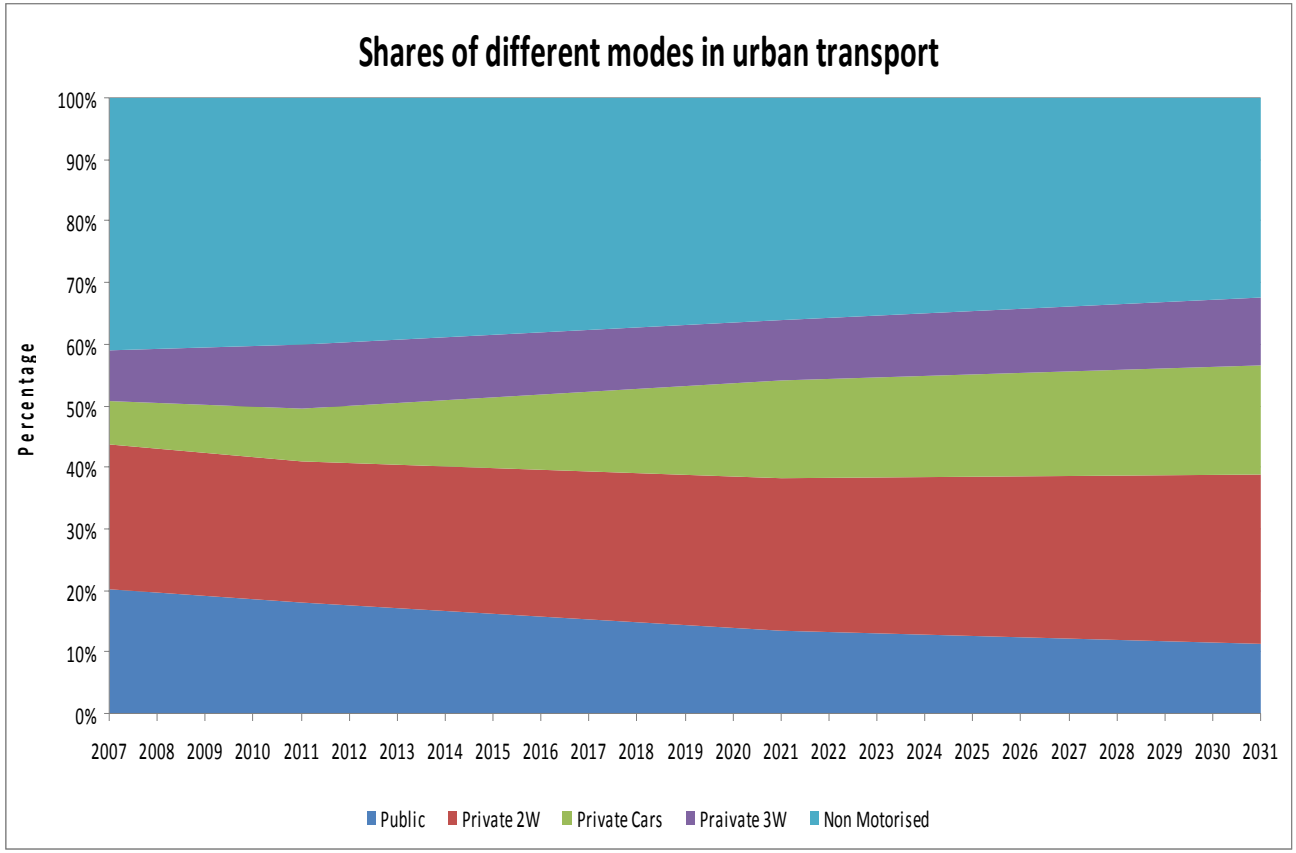
Modal share trends in BAU 2007-2031

BAU: Road expansion in cities

investment in rail based public transport

Bus and NMV share expected to decrease (~25% & 30%)

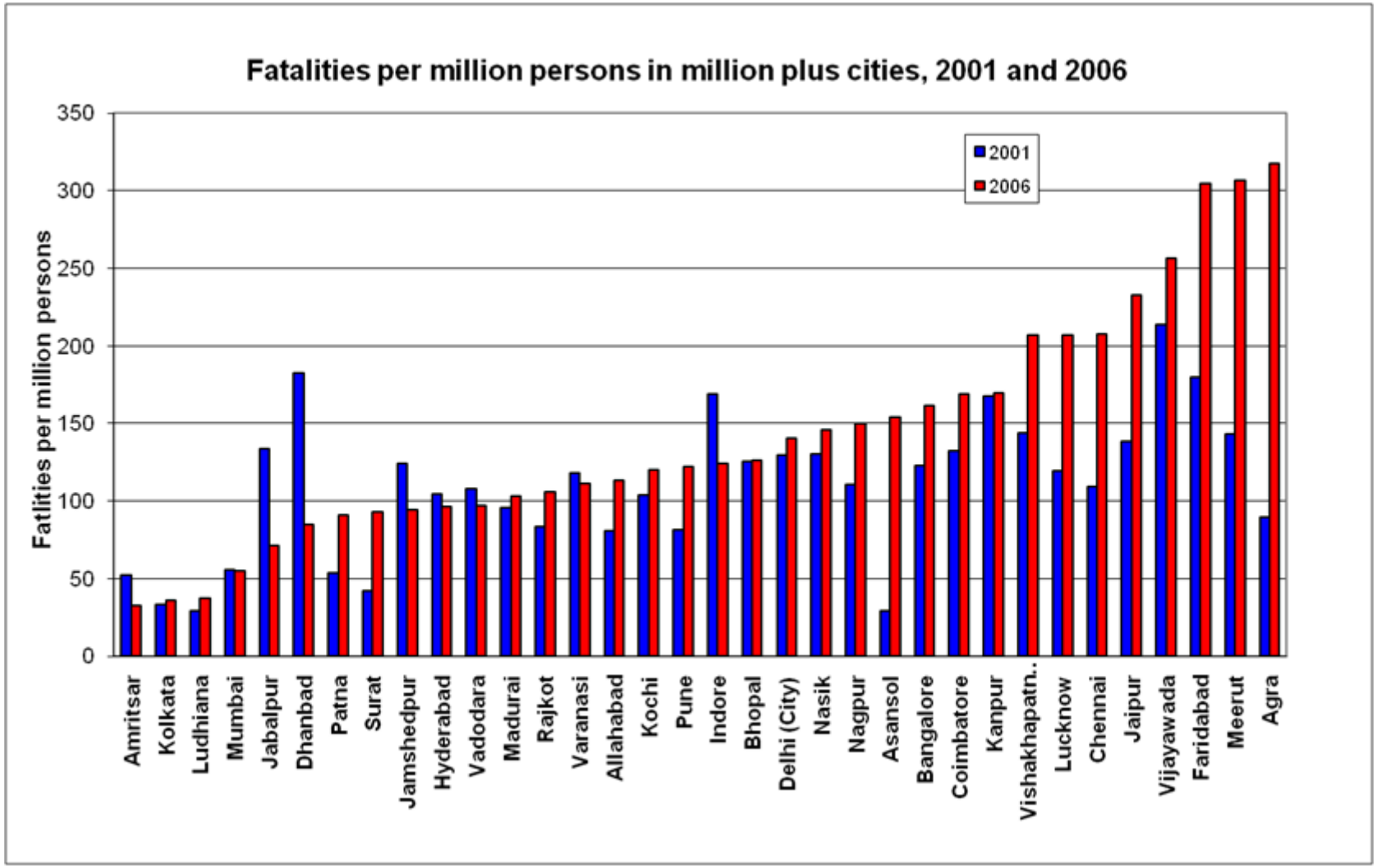
Car and two wheelers expected to increase (~20% and 25%)



Does the modal share trend meet sustainability criteria?

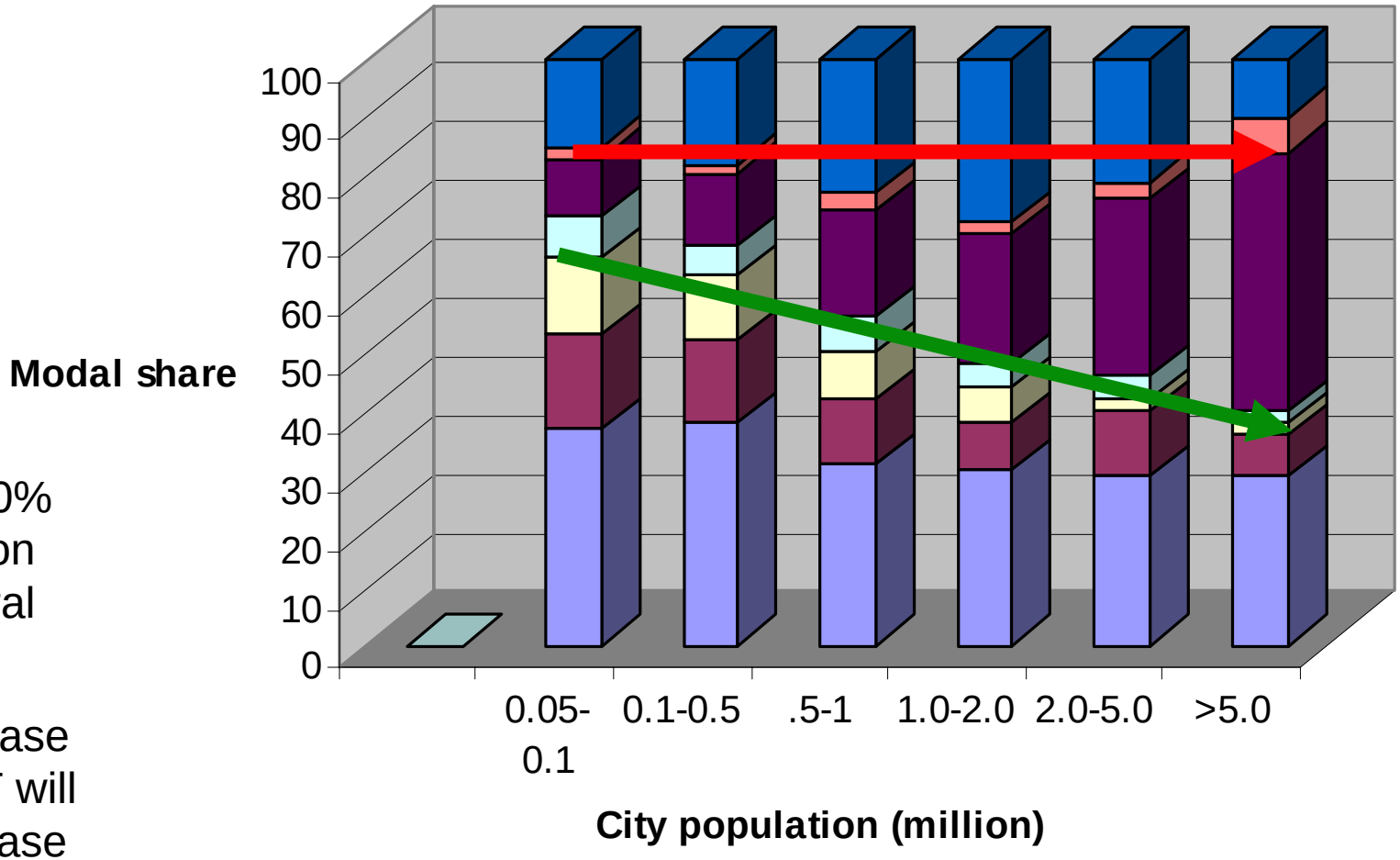
Local Health concerns?

Global CO2 Concerns?


Fatalities per million persons in million plus cities, 2001 and 2006
Fatlities per million persons
350
300
250
200
150
100
50
0
2001
2006
Amritsar
Kolkata
Ludhiana
Mumbai
Jabalpur
Dhanbad
Patna
Surat
Jamshedpur
Hyderabad
Vadodara
Madurai
Rajkot
Varanasi
Allahabad
Kochi
Pune
Indore
Bhopal
Delhi (City)
Nasik
Nagpur
Asansol
Bangalore
Coimbatore
Kanpur
Vishakhapatn..
Lucknow
Chennai
Jaipur
Vijayawada
Faridabad
Meerut
Agra

Urban Mobility

PT and NMV based, MTW majority personal vehicles



60-30% carbon neutral trips

Increase in PT will increase carbon!

Heterogeneity within Urban Areas

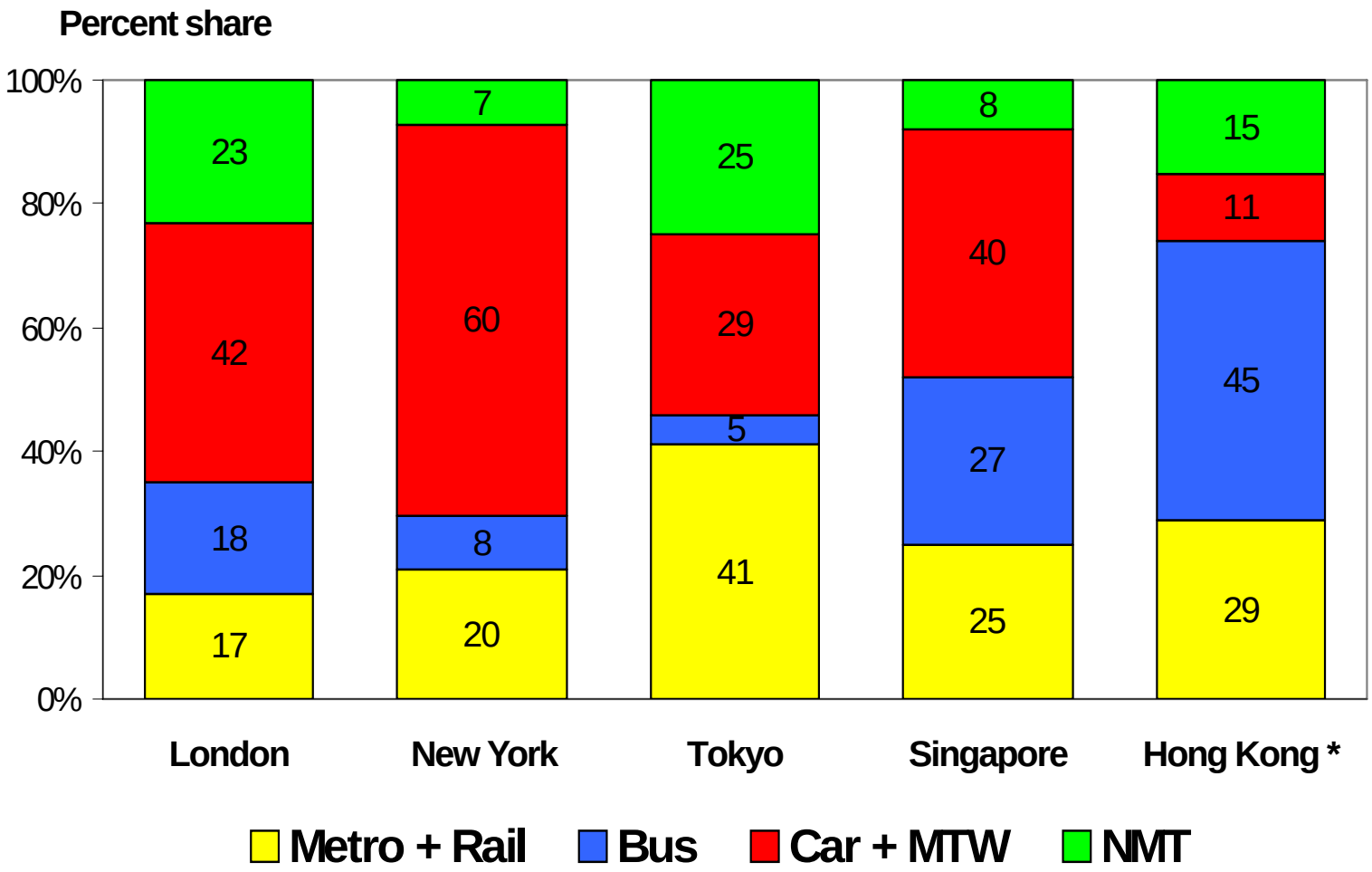
City category (population in million)	CO_2 tons/ person/ year	ratio of CO_2 tons/ person/ year wrt megacities	Total no. of cities	% of Total population in different cities	CO_2 tons/year	% of total CO2 emission in different cities
1(<.5)	0	1073.5	4208	53	3983350	0.2
2(.5-1)	0.05	6.5	39	10	1575900	6.4
3(1-2)	0.09	3.5	22	10	2196706	11.7
4(2-4)	0.07	4.6	6	6	1456916	5.2
5(4-8)	0.12	2.8	4	8	2634193	12.3
6(>8)	0.34	1	3	15	11218937	64.2

Large cities(> 8 mill.) have 15% population and contribute 64% of CO2 emissions, .34 tons/person/year, 1000 times more than the smallest category cities (53% population)

Medium size cities(2-4 mill.) have 14% population, CO2 emission 3-4 times less, high growth rate in private motorised trips

Small cities(.5-2 mill) are dependent on paratransit modes (motorised and non motorised)

Travel patterns – old world cities



Lessons from International Experience

- **"Sustainable" cities in Europe have high car use**

	Modal share, percent		
City	Car + MTW	PT	W&C
Bristol, UK	65	12	23
Leeds, UK	61	36	3
Nantes, France	58	14	28
Helsinki, Finland	54	20	26
Marseille, France	53	12	35
Edinburgh, UK	52	29	19
Newcastle, UK	48	19	33
Brussels, Belgium	44	18	38
Frankfurt, Germany	42	21	37
Stuttgart, Germany	36	25	39
Amsterdam, Neth's	32	16	52

NO INDIAN CITY HAS CAR USE MORE THAN 15%

Interventions for different cities

- Category 6 requires intervention in PT and NMV systems. Current users are captive users likely to shift to other modes with increase in incomes vehicle ownership.

- Category 5 cities account for low per capita emissions at present, however, these are witnessing fast growth in ownership and use of motorized two wheelers. Modal share of bicycle has been reducing in the last 20 years

- Category 2, 3 and 4 cities are dependent on bicycles, rickshaws and intermediate public transport systems. These cities require improvement in infrastructure for non motorized vehicles and improvement in the technology and operations of intermediate public transport systems.

Possible strategies for Level 6 cities

Large cities(> 8 mill.) have 15% population and contribute 64% of CO2 emissions, .34 tons/person/year,

1000 times more than the smallest category cities (53% population)

Possible Impact on CO2

(woodcock J et al, Lancet, 2009)

London Population 2006 = 7.5m 2030 = 9.0m Delhi Population 2004 = 14.8m 2030 = 26.0m	**London**			**Delhi**		
	Aggregate Transport CO2 Emissions (tonnes)	Transport CO2 Emissions Per Person (tCO2/ person)	CO2 Emissions Reduction on 1990 (%)	Aggregate Transport CO2 Emissions	Transport CO2 Emissions Per Person (tCO2/ person)	CO2 Emissions Increase on 1990 (%)
2006 London 2004 Delhi	9,647,900	1.3	-2.50%	6,146,651	0.4	97%
2010 BAU	9,935,897	1.3	0%	8,268,298	0.5	165%
2030 Scenario 1 BAU	10,381,318	1.2	4.80%	19,550,693	0.8	526%
2030 Scenario 2 LCD	6,480,565	0.7	-39%	17,069,668	0.7	447%
2030 Scenario 3 AT	6,120,306	0.7	-43%	10,458,736	0.4	235%
2030 Scenario 4 ST	3,608,226	0.4	-65%	9,327,207	0.4	199%

Possible scenarios for Delhi

- **Business as usual scenario:** Projection of existing trends and no coherent strategy to reduce the increase in the use of cars, but ***includes an anticipated increase in rail use***.

- **Lower-carbon-emitting vehicle scenario:** relies on implementation of vehicle technologies along with alternative fuel usage and ***an anticipated increase in rail use.***

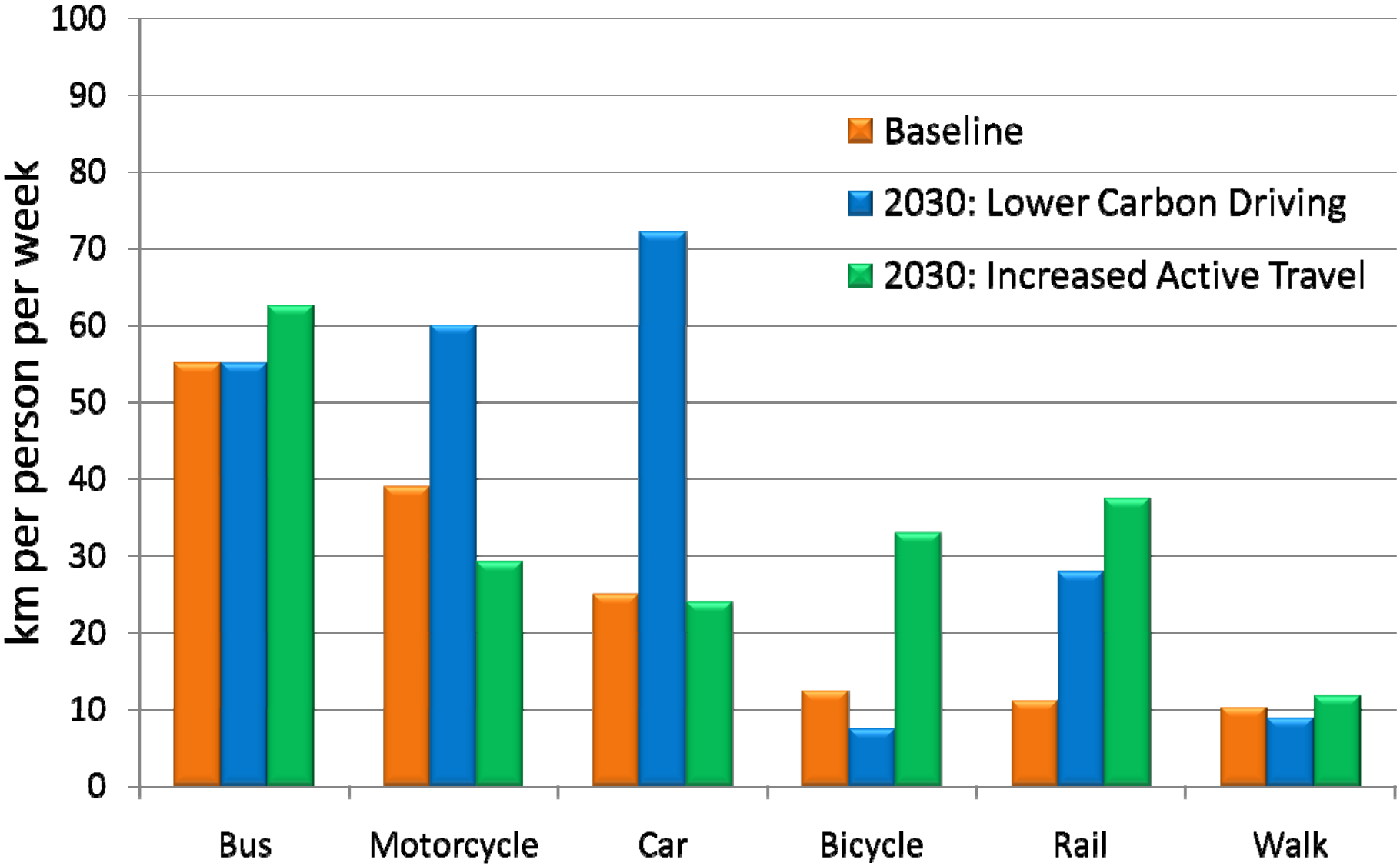
- **Increased active travel scenario (walk and cycle):** a reversal of present trends is assumed with a small increase in the distance walked and more than double increase in distance cycled, ***a large increase in rail use*** and small increase in bus use. Policy interventions include substantial investment in infrastructure designed for pedestrians and cyclists rather than for cars, carbon rationing, road pricing, traffic demand management, restrictions for car parking and access, reduced speed limits

Possible scenario for Delhi cont.

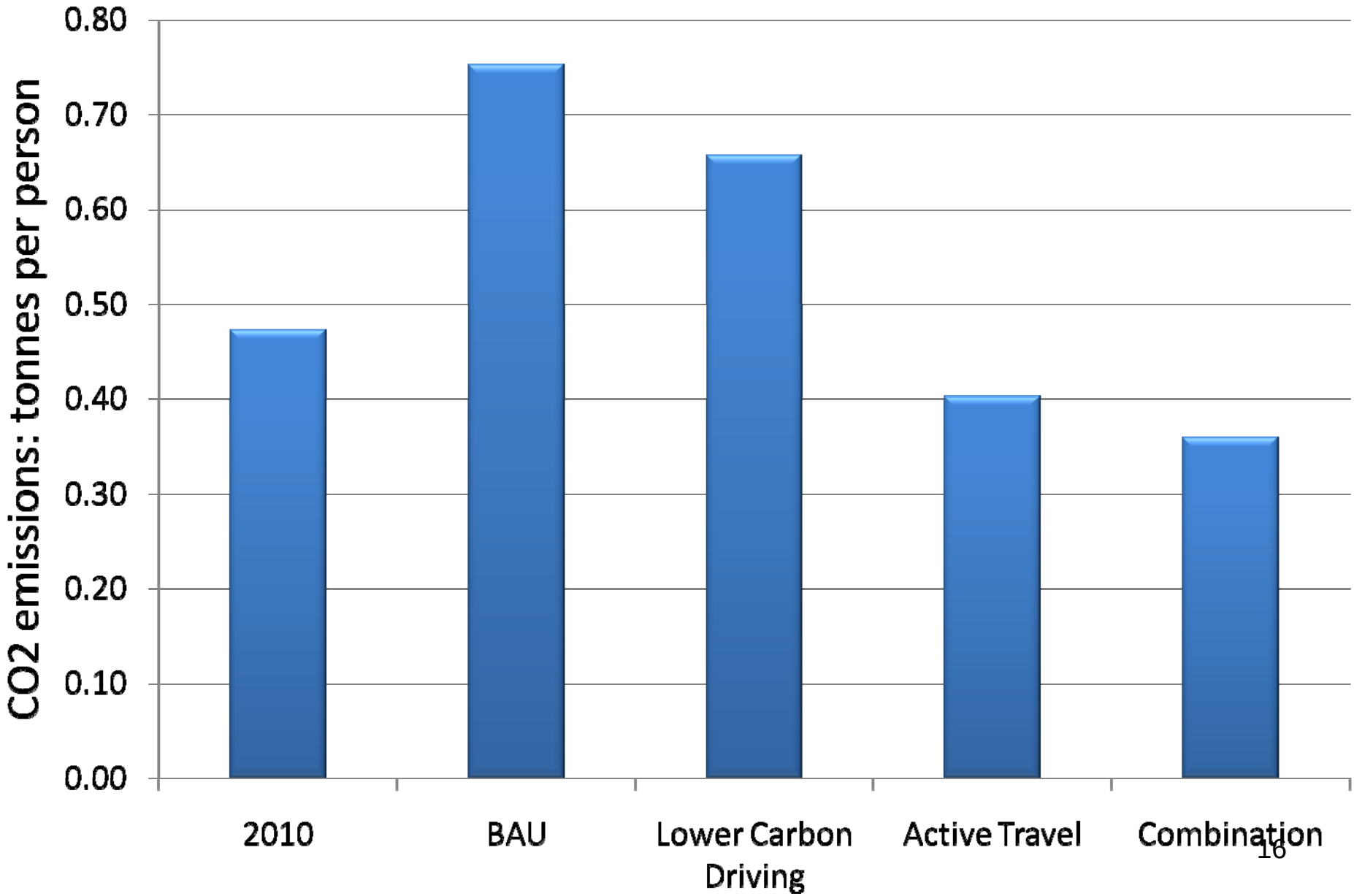
- **Sustainable transport scenario:** lower emissions from motorized vehicle and low car use from active travel scenario. Policy change would require high-intensity implementation and effectiveness of all measures. Further reduction could occur through use of electric vehicles with energy from low-carbon sources; shorter-distance trips; and continued shift from car use to walking or cycling.

- **Short distance active travel scenario**: In this scenario, it is assumed that the same motor vehicle distances are travelled as in the sustainable transport scenario but only half the increase in distances walked and cycled. This scenario represents less travel and shorter travel distances than in the other scenarios.

Delhi travel patterns



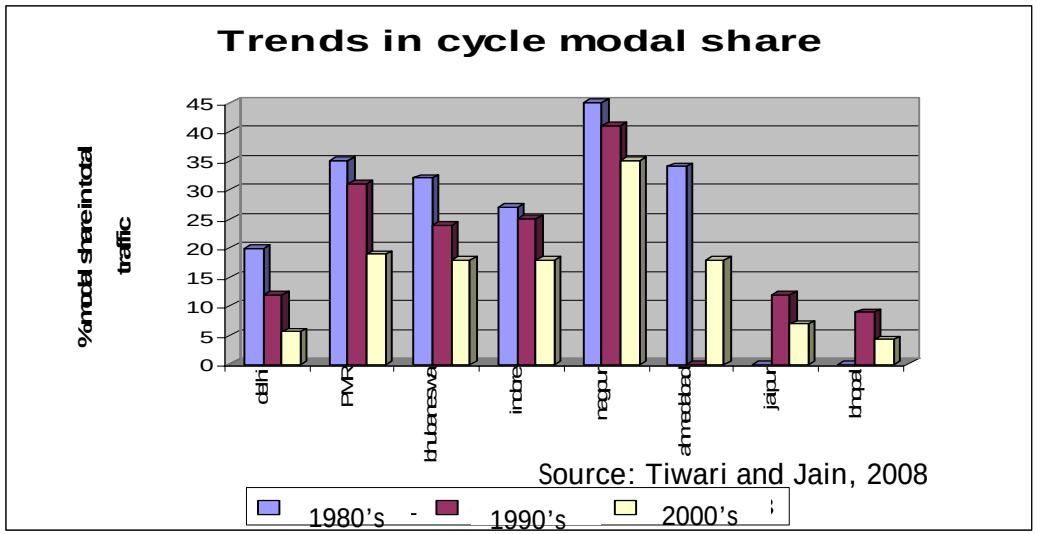
Delhi CO2 emissions transport



Possible strategies for Level 5 & 4 cities

Medium size cities(2-4 mill.) have 14% population, CO_2 emission 3-4 times less, high growth rate in private motorised trips, declining bicycle shares

Context – India medium (3-5 m) and large cities (5-8 m)



Source: Tiwari and Jain, 2008

Modal share for bicycle is going down

High bicycle related fatalities 8%-14%

No dedicated facilities for bicycles

Uncomfortable to ride a bike

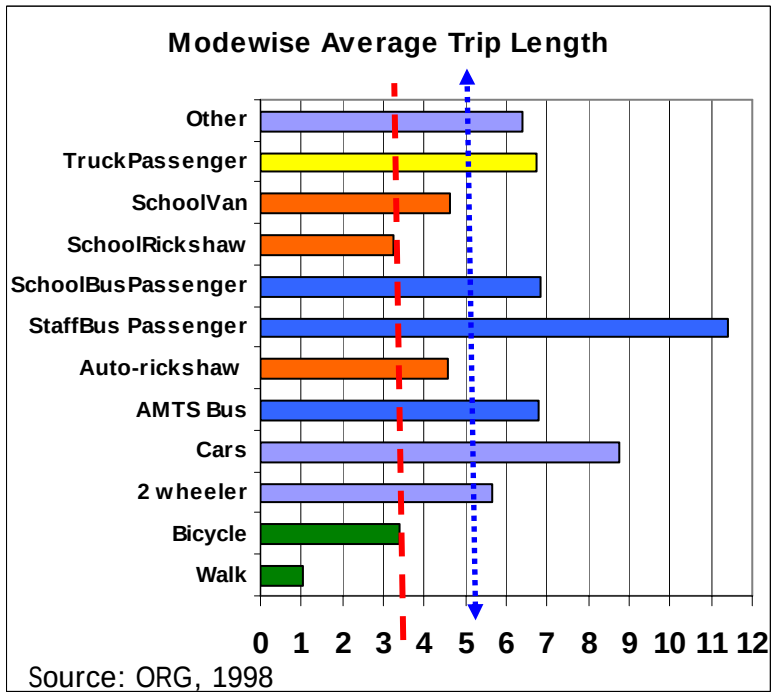
Travel pattern conducive to biking

Vehicular ATL - 4.2 – 6.9km

(excluding walk)

Short Trips (< 5km)- 56 - 72%

ATL for bicycles - 3.1 – 4.5 km

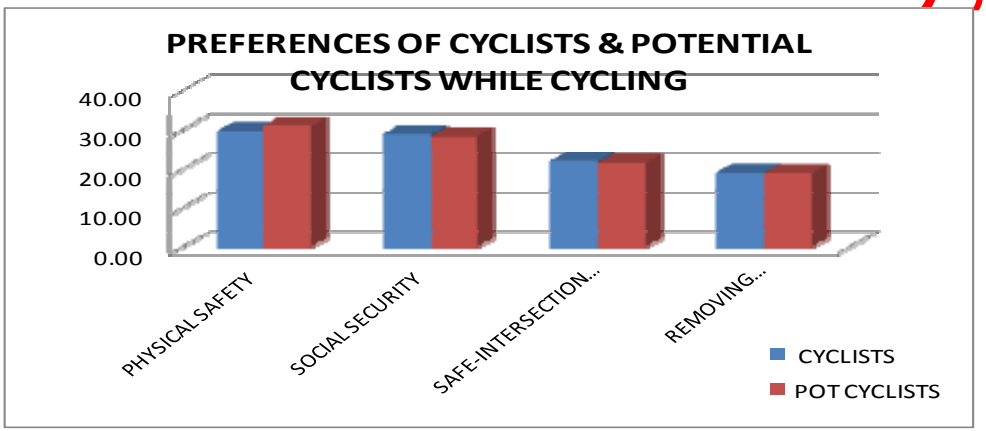


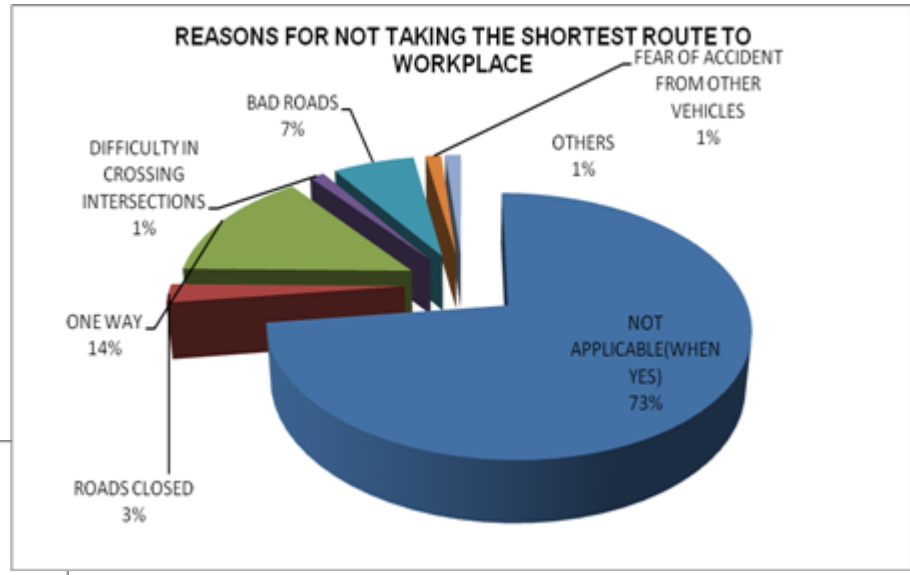
Source: ORG, 1998

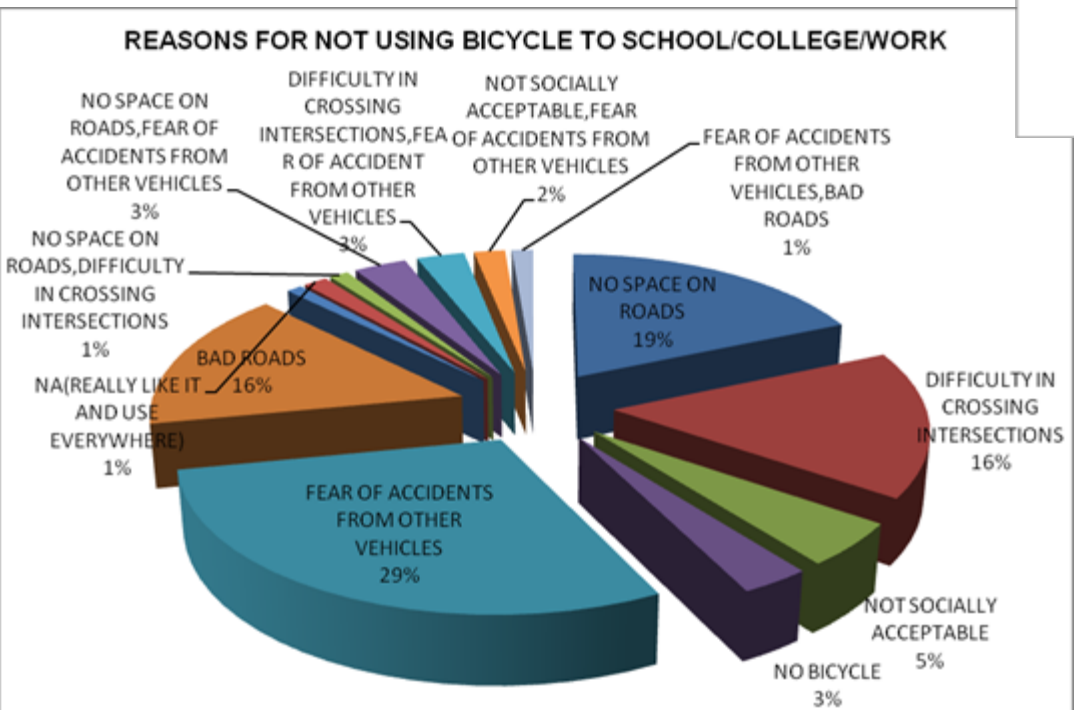
Predominant Barriers

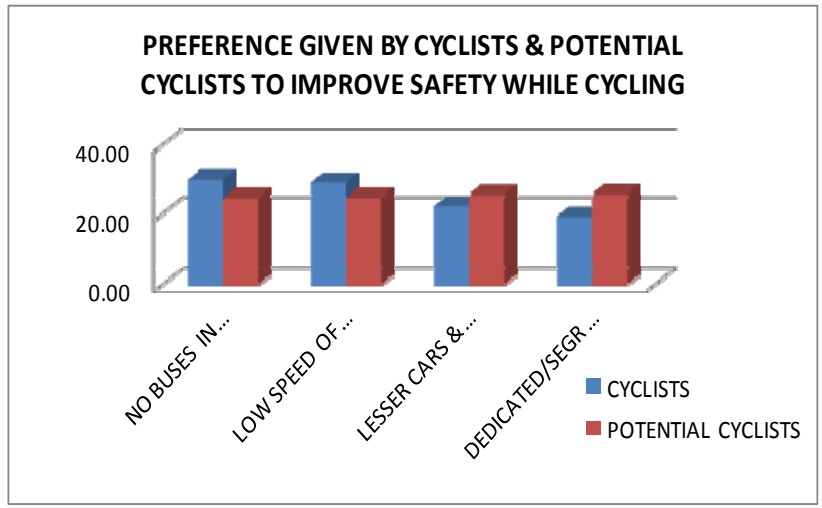
40% safety, 40% road

Potential Users









Preferences and choices
land use & street environment

- Importance of street vendors, hawkers and service providers –especially for current captive riders
- Against popular belief pedestrians on roads are not seen as barriers
- Medium density is the preferred environment
- In absence of bicycle infrastructure, higher order / wider arterials are preferred (may be short-direct routes)
- Land use mix seems to be irrelevant to cyclists and potential cyclists

Lessons for low carbon mobility plans

- Modal shares in favour of NMT and PT is more effective than technology alone:
  - Retain PT and NMT trips
- PT and NMT must be integrated
- Pedestrians and cyclists have the right to direct, pleasant and safe routes
- Restrict private motor vehicles:

– speed, road space and convenience

Low Carbon Transport & GHG challenges in Urban India

Development and modernity is associated with technology (fuel, automobile, metro rail)

External financing favours large construction projects (metro vs buses)

Zero emission modes, walking and cycling have no "market value" i.e. financing through land development or loans not possible, hence no takers!

Successful public transport projects are those which do not affect the cars adversely not just benefiting the bus commuters!