

# Climate Change Mitigation Initiatives in Urban Transportation – Assessment of Retrofitting Strategies to Promote NMT in Indian Cities

**UNU-WIDER Conference on Climate Change and Development Policy**

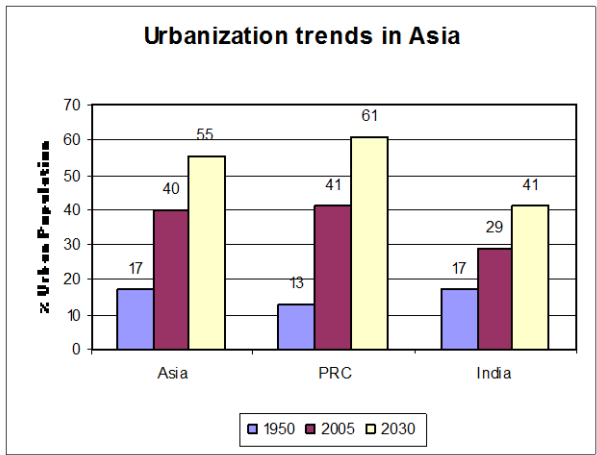
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# Asia is "Growing" and Urbanizing

Almost 2/3 of world population (6.6B) lives in Asia and more than 1/2 of it lives in China & India



Currently 35% of Asian population is URBAN and Expected to reach 50% by 2025

Number of mega cities is growing fast in Asia

Seven out of top 10 "BIG" cities are in Asia

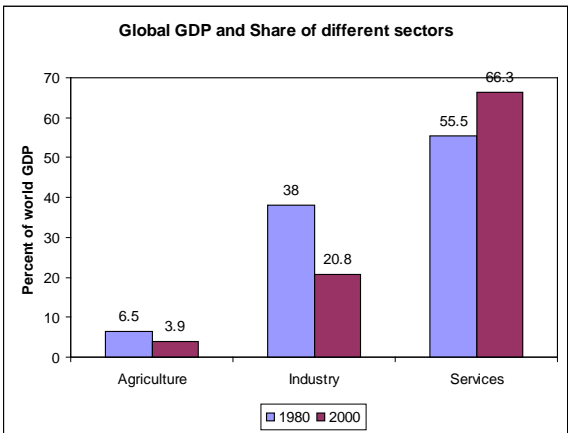
Population densities are 50% higher compared to world averages

No. of Mega Cities	1950	1975	2000
World	1	5	17
Asia	0	2	11

Economic contribution of cities is on rise

	Urbanization and Economic Output									
Country	Malaysia	Thailand	Philippines	PRC	Indonesia	Sri Lanka	B'desh	India	Vietnam	Pakistan
Urban Share of GDP (2004)	90	90	86	85	83	83	79	78	78	77

Contribution of service sector is on rise which is essentially "urban centric"

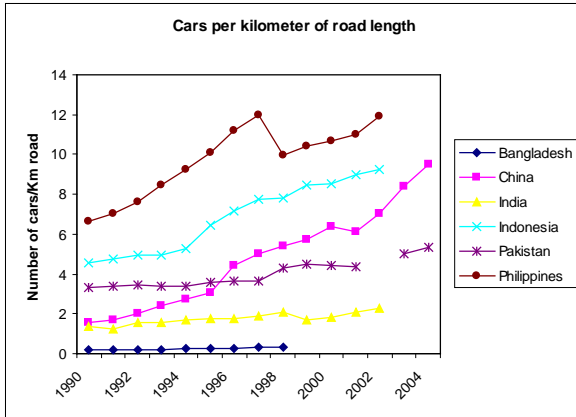


Transportation infrastructure development is prioritized in the Asian developing countries

Increasing services sector results in increased transport activity in urban centers

Urban Transportation infrastructure needs huge investments - South Asia's new investment needs for the period 2005-10 are 28.1 billion USD @3.06% GDP

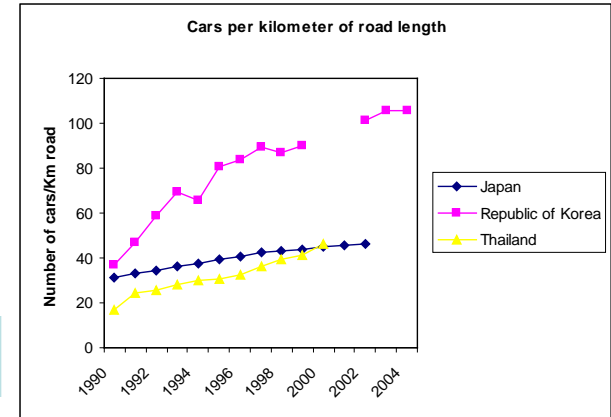
# Urban Transportation in Asia



Car ownership is growing disproportionately

Cars/km road length is increasing

Leads to severe congestion

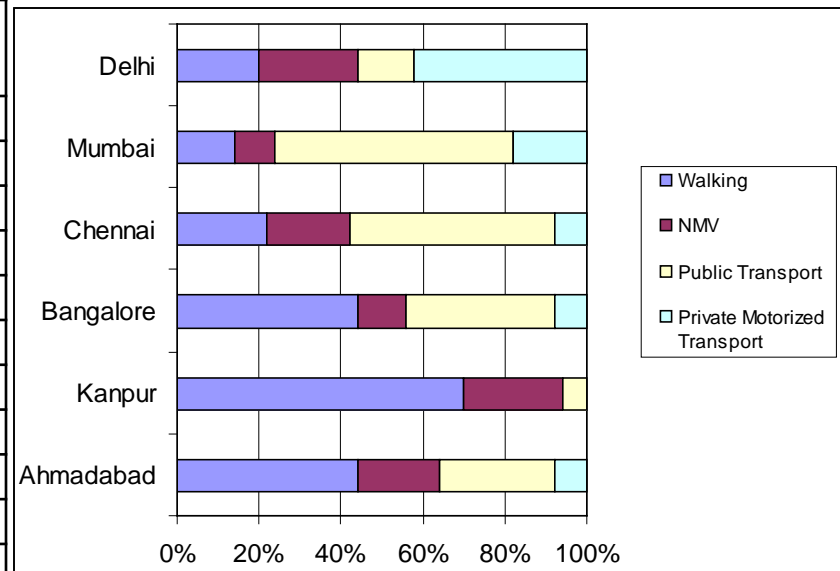


About 40% urban population in this region lives in Slums (540M)

In South Asia 31% population (2002) lives at a daily income less than 1\$ and 77% at less than 2 \$

Major modes of mobility for these sections of people are public transport and "walking"

Share of Population Living in Slums	
Country	%
Malaysia	2
Thailand	2
PRC	38
Philippines	44
Sri Lanka	14
Indonesia	23
India	56
Vietnam	47
Pakistan	74
B'desh	85



Predominant NMT & PT

Due to the change towards motorization, Transportation Sector in Asia is growing as a major GHG contributor (with 24% of total emissions from fossil fuels source)

# Infrastructure Development – Locking into Un-sustainability

Infrastructure is motor vehicle oriented →  
Completely marginalized non-motorized modes of transportation in infrastructure development plans

Lack of long term urban planning

Lack of integration with land use pattern, urban transportation planning and city planning

Car-centric infrastructure development results in *in-sufficient* and *in-efficient* public transport leaving “weaker sections” of the societies unattended of their mobility needs (*issue of equity*)

INFRASTRUCTURE

Infrastructure provides foundation for the present and future production and consumption patterns

Infrastructure determines energy consumption and environmental emissions (including GHG)

Direct affects by means of intensive resources use

Indirectly by locking into consumption patterns of people for longer periods

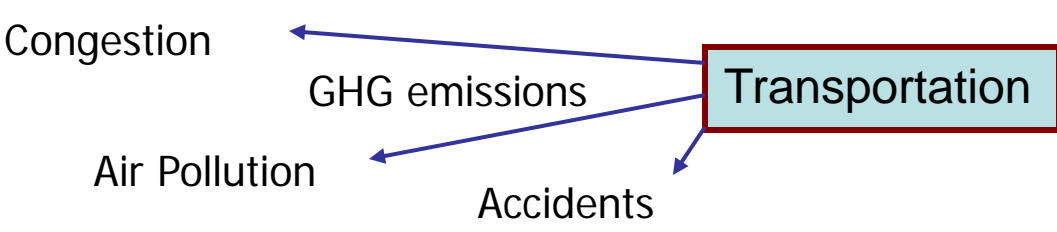
Lack of integrated planning and investment in public transportation can result in high social and economic costs

Choice is very important for efficient delivery of services to people and also to have control over environmental impacts

Asian developing countries with rapid economic growth patterns have been pooling up for infrastructure development → with the present approach of infrastructure development, Cities which are responsible for 75% energy use and GHG emissions and housing 40% populations in slums can chock themselves into un-sustainable patterns of energy consumption and pollution and GHG emissions

*Poor planning and development of infrastructure can turn Asian cities into “centers of un-sustainability”*

# How to Address Transportation Sector ?



Lack of finances to support the infrastructure needs

$$\text{CO2 Emissions} = \text{A: Number of vehicles} \times \text{B: Distance traveled} \times \text{C: Emissions per VKM}$$

Technology oriented response strategies are limited to supply side Mng. whose derived CO2 benefits are easily offset by the surging vehicular stock and travel activity

Build Infrastructure for sustainable mobility rather than for mobility of cars

Promote NMT, Augment public transport, and facilitate "walking"

Integrate transportation infrastructure development with city planning and changing land use patterns

De-centralization, de-congestion, urban forestry etc.

Ensure equity in investment

Increase the share and quality of public transport while avoiding "free riding" by personal vehicle owners

Apply economic instruments to control the use of personal modes of transport

Development of paid parking lots; proper pricing of public transport services, auctioning of licenses, toll, congestion tax etc.

# Transportation and GHG – Co-benefits Approach

Integrate energy conservation and climate change concerns into infrastructure planning and development

Develop infrastructure in a way to control travel activity; promote efficient technologies; develop infrastructure for cleaner and climate friendly fuels and engine technologies; develop infrastructure to ensure proper O&M of vehicles

Consider long terms energy, environmental and climate implications while planning for long term infrastructure investments in urban transportation

Inefficient Urban transportation infrastructure can lead to higher GHG emissions, negative effects on economic growth; contribute significantly to air and noise pollution; result in inefficient use of resources

Infrastructure to –

- Promote NMT
- Control travel activity
- Improve engine efficiency
- Improve fuel quality

With least incremental cost

Co-benefits approach

(Evaluate all ancillary and co-benefits)

Sustainable mobility;  
Contributions towards Eco-efficiency of cities;  
Control of GHG emissions;  
Augmenting econ. growth

*Short term (Retrofitting) measures*

Long term planning  
(includes integrated infrastructure development for sustainable mobility)

Sustainable  
Mobility

Assess co-benefits and conduct inclusive BCA of various retrofitting measures to the existing projects

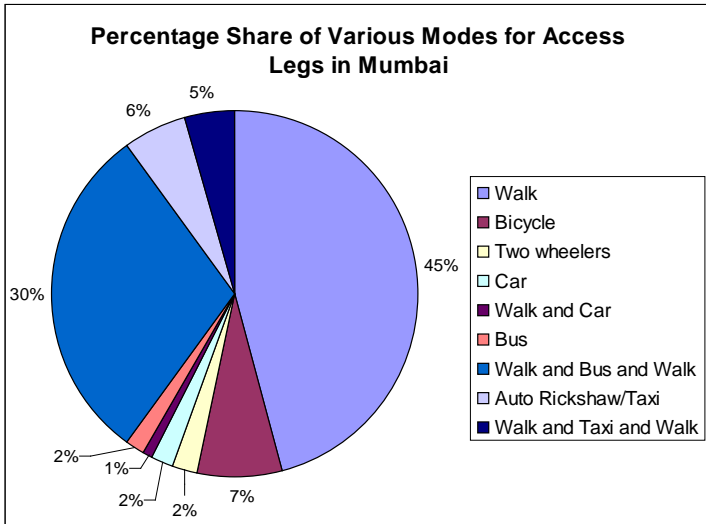
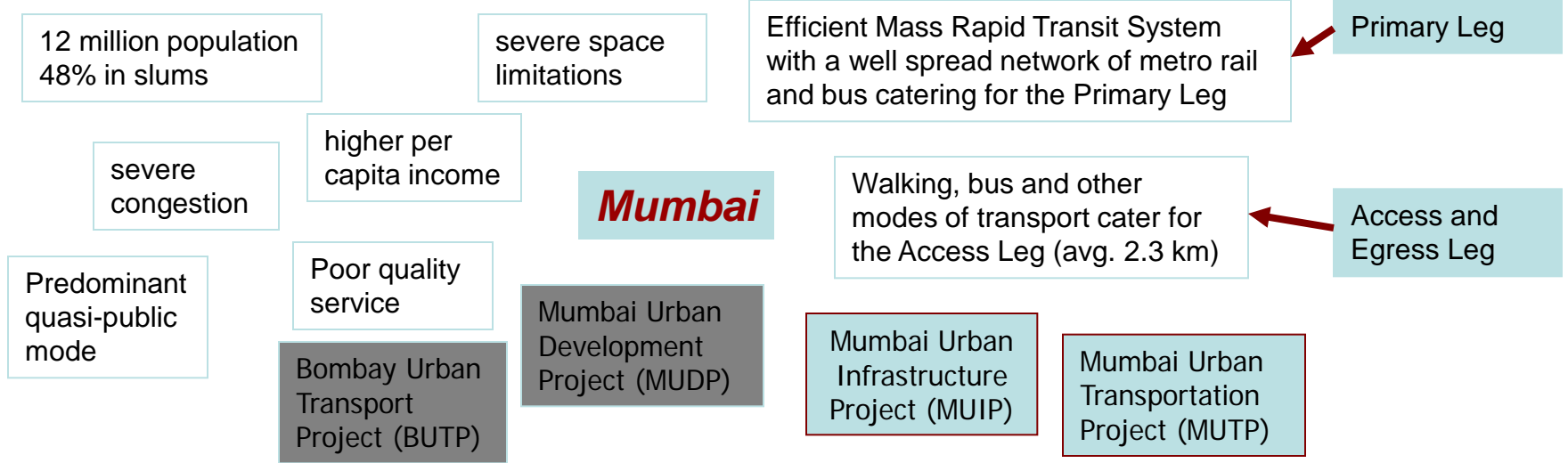
Incorporate NMT specifics in the road construction

Augment with NMT support elements such as bicycle parking at public transport points; rent a bike schemes etc.

ongoing transportation infrastructure projects

GHG benefits at a very low MAC

# GHG Mitigation – Strategies to Promote NMT



With very insignificant share of daily trips coming from the bicycles, the Access Leg (and to an extent Egress Leg) provides a wide scope for furthering NMT usage in Mumbai

## Retrofitting measures MUTP/MUIP in Mumbai

- footpaths and bi-cycle lanes on all roads (1973 km)
- providing bi-cycle stand at all rail stations (146)
- improving road intersections for NMT
- Capacity building measures

Incremental Cost Analysis to find the "COST"

Road construction under MUTP/MUIP without NMT is the *baseline*

Improving roads to NMT compliance is considered from 10-100%

GHG benefits are calculated as equivalent 3-W reduced due to NMT use for access leg and Egress Leg

# GHG Mitigation – Strategies to Promote NMT

## Cost of “retrofitting” and Marginal Abatement costs

%road converted to NMT system	Cost in USD			
	Road widening	Bicycle stands	Modernization of intersections	Total
10	5,100,130	1,586,957	8,360,870	15,047,957
..	..	..	..	..
100	51,001,304	1,586,957	83,608,696	136,196,957

NMT Scenario	GHG emission reductions (tons)
10% reduction in no. of 3W over 5 years	7,631,236
...	...
75% reduction in no. of 3W over 5 years	19,800,556

Indicative estimation of cost benefits of initiatives to promote NMT viz. capacity building and provision of infrastructure revealed that promotion of NMT has substantial benefits both in the form of GHG and local emissions control

Retrofitting initiatives to provide basic infrastructure like converting the existing roads into NMT friendly ones, bicycle stands at all rail stations and modernizing road intersections for NMT usage was found to be costing in the range of US\$ 15 to 136 million

Marginal Abatement cost was found to be in the range of US\$ 2-7 per ton of carbon reduced (for scenarios of 10 – 100 % of roads improved to NMT compliance)

Promoting non-motorized modes not only reduces GHG emissions, but also air pollution, noise, accidents and energy consumption. All such co-benefits need to be assessed inclusively in order to justify *retrofitting* of ongoing infrastructure projects



# Strategies to Promote NMT– Barriers and PAMs

## Barriers

lack of proper infrastructure for NMT users

lack of institutional arrangements to integrate NMT in transportation planning

lack of legal basis for NMT usage

poor attitudes of motor vehicle riders and the law enforces

unsafe conditions for NMT users

poor social acceptability

lack of national NMT strategy

lack of affordability and affordability to motor vehicle ride

## Policies

Integrate NMT with public transport system planning at local level

Incorporation of standards for the bicyclists and pedestrians provisions in new road infrastructure design

Provide NMT friendly infrastructure

Conduct promotional campaigns

Multi-Stakeholder Opinion Survey

Formulation of national strategy for NMT as a facilitating framework for local plans

Provide soft loans and relaxing excise duty on importing bicycles/bicycle parts

Make regulations safeguarding NMT users



Cyclists at risk



Pedestrian space being used for garaging and cleaning of vehicles ...



Pedestrians at risk

# Strategies to Promote NMT– Barriers and PAMs

*Multi-stakeholder group assessment based on multi-criteria*

} *Administrative cost      Financiability*  
*Administrative capability      Political willingness*  
*Environmental and other social benefits*

## Policy Category

highest priority



Policies to create awareness and capacity (building)

campaigning

second priority



Policies to integrate NMT with the public transport system at city/municipality level

Short-term

third priority



Policies to incorporate standards for the bicyclists and pedestrians provisions in new road infrastructure design in their order of priority

Long-term

Retrofitting measures proved to be effective in controlling GHG – An inter-model integration model may be attempted in Mumbai with the following measures

- ❖ Clear footpaths and signaled intersections/overpass crossings covering entire access leg
- ❖ Partly separated lane (painted) for bicycles with designated bicycle parking without fee, next to the rail/bus stations
- ❖ Bicycle rentals adjacent to the rail/bus stations with parking fee integrated into the monthly train/bus pass and partly separated (painted) bicycle lanes
- ❖ Increase in the initial fare of auto-rickshaws and provide indirect access to transit points with shorter routes ear-marked for bicycles with a parking space next to the rail station

# Points to Make !!!

Controlling GHG emissions in Asian Mega Cities need to re-orient UT infrastructure development for **MOBILITY** rather than for “**MOTORS**”

While Infrastructure development for Inter-modal transport system may be considered for long-term planning, **retrofitting measure** to the ongoing infrastructure projects may be considered for short-term solutions

Such short-term measures needs an inclusive BCA of retrofitting interventions and “Co-benefits approach” provides the needed justification for such initiatives

Providing separate (painted) bicycle lanes, bicycle parking places at all metro (rail) and bus stations and improving intersections for NMT in Mumbai proved to control significant GHG emissions with attractively low marginal abatement cost

Both MUTP and MUIP in Mumbai considers only “moving vehicles” → Retrofits to promote NMT by targeting Access Leg and Egress Leg would make these infrastructure initiatives more sustainable and *Climate Friendly*

Simple but effective measures to control motorized traffic may be incorporated in the ongoing infrastructure projects subjected to their minimal incremental costs

Global Environmental Facility (GEF) projects can be encouraged as this would involve substantial GHG reductions

# Thank You

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