Transportation

Challenges and Opportunities for Green Growth in South Asia

Chhavi Dhingra
EMBARQ’s mission is to catalyze and help implement environmentally and financially sustainable transport solutions to improve quality of life in cities.

Centers work together with local transport authorities to reduce pollution, improve public health, and create safe, accessible and attractive urban public spaces.
CURRENT TRENDS

- Challenges: Cost of car oriented development
- The opportunities of sustainable transport: Lower costs, more employment, value to the regional economy
Rapid Urbanization: 100 Million to 200 Million in the last 20 years

By 2031, it is projected that there will be 6 cities with a population greater than 10 million. A key question is how many Indians would live in how many medium and small towns - the bridge between a transforming rural and urban India?

Source: Source: IIHS Analysis based on Census of India. (Satellite Map, Google Inc.)

Urban India 2011: Evidence
November 22, 2011
Exponential growth travel demand

Total Urban Travel Demand in India, 2011 - 2031
(Million Trips Daily)

Source: EMBARQ India Analysis
Increase in energy and emissions..

Estimated Growth in Emissions from Urban Transport – 2000 to 2030

Source: Schipper et al 2008
<table>
<thead>
<tr>
<th>City</th>
<th>Two wheelers per 1000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mumbai</td>
<td>50</td>
</tr>
<tr>
<td>Jakarta</td>
<td>150</td>
</tr>
<tr>
<td>Bhopal</td>
<td>100</td>
</tr>
<tr>
<td>Kuala Lumpur</td>
<td>200</td>
</tr>
<tr>
<td>Chennai</td>
<td>180</td>
</tr>
<tr>
<td>Taipei</td>
<td>250</td>
</tr>
<tr>
<td>Bangkok</td>
<td>280</td>
</tr>
<tr>
<td>Indore</td>
<td>300</td>
</tr>
<tr>
<td>Bangalore</td>
<td>320</td>
</tr>
<tr>
<td>Delhi</td>
<td>350</td>
</tr>
<tr>
<td>Pune</td>
<td>370</td>
</tr>
<tr>
<td>Ho Chi Minh</td>
<td>400</td>
</tr>
<tr>
<td>Jaipur</td>
<td>420</td>
</tr>
<tr>
<td>Ahmedabad</td>
<td>450</td>
</tr>
<tr>
<td>Mysore</td>
<td>470</td>
</tr>
<tr>
<td>Rajkot</td>
<td>500</td>
</tr>
<tr>
<td>Surat</td>
<td>520</td>
</tr>
</tbody>
</table>

High density inside administrative boundary (200+ hab/ha), but declining in most places.
Low density sprawl happening in all cities (<40 hab/ha)
Short to medium average trip lengths (2-12 km/trip)

Based on CMPs 2006-2007
High to very high non-motorised modal share (25-55%)

**Non-Motorized Transport Mode Share**

- **Chennai**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Delhi**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Mumbai**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Ahmedabad**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Bangalore**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Pune**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Bhopal**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
- **Indore**: Walk (red), Bike (pink), Metro Cities (yellow), Millenium Bloomers (brown), Now Exploding (orange)
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Based on CMPs 2006-2007
Low to medium public transport modal share (12-60%)
What do we usually do?

Capital intensive solutions vs. Cost effective ‘local’ solutions

• Give greater capacity to the road network to relieve congestion

USA Highway
Photo: FPPQQ
Bangkok developed an extensive roadway network, but road construction could not keep up with demand. Road building is an expensive way of dealing with travel demand. We cannot build our way out of congestion!

Karl Fjellstrom
What can we do instead?

Change paradigms

• Restrict indiscriminate motorization
• Give priority to non motorized transport and bus-based public transport

Amsterdam, The Netherlands
Photo: FPPQQ
DEFINING GREEN TRANSPORT
ASI FRAMEWORK
The A-S-I approach

AVOID
the distance or number of trips

SHIFT
towards lower emitting modes of transport

IMPROVE
technological and operational efficiency of vehicles

BENEFITS
Air quality, health, safety, climate, economy, development, etc.
The push and pull

Measures with push-effects
Area-wide parking management, parking space restrictions in zoning ordinances, car limited zones, permanent or time-of-day car bans, congestion management, speed reductions, road pricing...

Measures with pull-effects
Priority for buses and trams, high service frequency, passenger friendly stops and surroundings, more comfort, park-and-ride, bike-and-ride..., area-wide cycle-networks, attractive pedestrian connections...

Measures with push- and pull-effects
Redistribution of carriageway space to provide cycle lanes, broader sidewalks, planting strips, bus lanes..., redistribution of time-cycles at traffic lights in favour of public transport and non-motorized modes, public-awareness-concepts, citizens’ participation and marketing, enforcement and penalizing...

Example of ASI- Shopping

Starting point: A household requires a wide range of goods, At various times of the day

First decision: How far do you have to go?

Second decision: Which mode of transport will you (have to) use?

Third decision: Which type of vehicle + use?

- Compact land-use planning: Reduces need for motorized travelling
  AVOID

- Encourages use of non-motorized and public transport over cars
  SHIFT

- Improves vehicle technology and uses cleaner fuels
  IMPROVE

Source: GIZ
ASI strategies in practice
Avoid: Landuse Transport Integration

- Non-Motorised Transport
- Public Transport
- Public Spaces
- Density and Mixed Uses
- Urban Form
- Parking, Demand Management and Road Safety
- Participatory Planning
### Ahmedabad

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>Automobility</th>
<th>2041</th>
<th>Sustainable Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>5.4</td>
<td>13.2</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>Trips (millions/yr)</td>
<td>5.6</td>
<td>39.75</td>
<td>39.75</td>
<td></td>
</tr>
<tr>
<td>Area (Sq. Km.)</td>
<td>1330</td>
<td>6484</td>
<td>3242</td>
<td></td>
</tr>
<tr>
<td>Emissions (million Tons CO2/yr)</td>
<td>0.33</td>
<td>12.32</td>
<td>1.97</td>
<td></td>
</tr>
<tr>
<td>Traffic Fatalities (per yr)</td>
<td>175</td>
<td>5,232</td>
<td>1,225</td>
<td></td>
</tr>
</tbody>
</table>
Bus Rapid Transit
What is a Bus Rapid Transit system?

“Is a flexible, rubber-tired form of rapid transit that combines stations, vehicles, services, running ways and ITS elements into an integrated system with strong identity”

“It is a high quality public transport system, oriented to the user that offers fast, comfortable and low cost urban mobility”
*BRT Planning Guide – ITDP, 2007*
Bus Rapid Transit (BRT)

- Centralized Control
- Large Buses Multiple Wide Doors
- Distinctive Image
- Stations with Prepayment and Level Boarding
- Segregated Median Busways
About 68 systems in developed and developing countries

- 11 USA-Canada
- 15 Latin America
- 20 Europe
- 2 Africa
- 16 Asia
- 4 Australia-New Zealand
Financial Benefit-What a city can have for 1Bn US$?
Make a choice…

- 426 kilometres of BRT
- 14 kilometres of elevated rail
- 7 kilometres of underground rail
- 40 kilometres of LRT

* Source: GIZ - Actual data from systems built or proposed in Bangkok, Thailand
Non-Motorized Transport
Pedestrians represent 78% of road fatalities in Mumbai
Main Public Health Interventions

Helmets

Alcohol

Seat-belts

Speed

Visibility
Health and Road Safety improvement – a holistic view

Avoid: Add mass transport, walking and biking trips rather than vehicle trips that can cause more crashes, sedentary life

Shift: Reduce driving and crashes through moving people to mass transport, walking, biking

Improve: Mainstream road safety, emission technologies, facility designs, public space
Sustainable Transport is a public health strategy
Traffic Demand Management
Transportation Demand Management
Congestion Pricing: A key emerging TDM strategy
Public Space

The public space tells you who has priority (City-centre Popayán)

10.5 m: 1.25 8.00 1.25

(City-centre Bogotá)

10.5 m: 3.50 2.75 4.25

Wide footpath

Source: Arora and Gadepalli, 2012
Clean Fuels & Clean Vehicles
Equity
Access for all

Physical accessibility – infrastructure for all, for the differently abled, location/spacing, weather resilient

Economic accessibility – cost

Temporal accessibility – frequency, hours, reliability

Safety and security – to and from station, on vehicles/space (especially for women and children)

Comfort – cleanliness, crowds

Longer term – environmental, financial, and political sustainability
Green Freight
What is the Government doing?
National Urban Transport Policy

- Focus on moving people not vehicles
- 1 Billion USD for BRT projects
- Over 1 Billion USD to procure buses

2006
Janmarg - Ahmedabad

- Opened Oct 2009
- 39 kms – 100,000 riders per day (Dec 2010)
- 90 kms – 400,000 riders per day (Dec 2014)
City Buses - Indore

- Opened Mar 2010
- 105 Buses
- 90,000 Pax per day
City Buses - Jaipur

- Opened May 2011
- 200 Buses
- 175,000 Pax per day
Rickshaws- Rajkot

2012
Namma Cycle - Bangalore
TOD in Naya Raipur

Various parameters of analysis of an existing sector to understand strengths / weaknesses

- FSI and densities
- Road network and hierarchy
- Urban Form
- Land use
- Open space/public space
- Dwelling unit density
- Junction hierarchy
## Naya Raipur – Comparative Indicators

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Original Design</th>
<th>Proposed Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit station adjacent density</td>
<td>100 ppH</td>
<td>600 ppH</td>
</tr>
<tr>
<td>Transit corridor density</td>
<td>300 ppH</td>
<td>500 ppH</td>
</tr>
<tr>
<td>Transit adjacent mixed use</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>5 min walk distance to transit stop</td>
<td>30% population</td>
<td>50% population</td>
</tr>
<tr>
<td>Walk trip distance to amenities</td>
<td>5 to 10 mins</td>
<td>2 to 5 mins</td>
</tr>
<tr>
<td>Hierarchy of greens</td>
<td>Centrally concentrated</td>
<td>Well distributed</td>
</tr>
<tr>
<td>Natural features and contour conservation</td>
<td>50%</td>
<td>80%</td>
</tr>
<tr>
<td>Population accommodated in sector</td>
<td>11,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Connectivity across quadrants</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Legibility of urban form</td>
<td>Poor</td>
<td>Good</td>
</tr>
</tbody>
</table>
Namma Metro – Improving Access

Indiranagar Metro Station on CMH Road
Namma Metro – Improving Access

Indiranagar Metro Station area

- Project area: 500m radius influence zone around the metro station, with a population 3.33 lakhs and 7,255 households.
- Detailed proposals focussed on a 150m radius around station.
- Surveys conducted for 350 residents, 180 visitors and 180 passersby.
<table>
<thead>
<tr>
<th>TOD Principles</th>
<th>Existing Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit</td>
<td>Metro station as trigger for development (Along commercial spines CMH Road and 100ft road)</td>
</tr>
<tr>
<td>Non Motorised Transport</td>
<td>Poor access to the metro station. No physical planning for transfer to feeders. No special treatment / lanes for bicycles.</td>
</tr>
<tr>
<td>Public Spaces</td>
<td>Exist, but not inter connected nor easily accessed through pedestrian routes</td>
</tr>
<tr>
<td>Density</td>
<td>Densification occurring along main roads. FAR not utilized completely on internal roads. FAR 4.00 being explored along alignment.</td>
</tr>
<tr>
<td>Mixed Use</td>
<td>Mixed use is increasing rapidly and is largely retail commercial and offices.</td>
</tr>
<tr>
<td>Demand Management,</td>
<td>No demand management. Widespread street parking. Internal streets used as thoroughfares</td>
</tr>
<tr>
<td>Parking &amp; Road Safety</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>No participation. Opposition from local businesses to metro alignment</td>
</tr>
</tbody>
</table>
Enigmas
- 12,000 Bicycles
- 2,000 Rental & Repair Shops
- Out of town vendors, day laborers
Way ahead
Thank you
PUBLICATIONS