Induced Demand

- People don’t travel for the sake of travel – it is derived from the need or desire to do something else
- Travel or trips are associated with economic activity
Accessibility vs. Mobility

Accessibility refers to number of opportunities also called activity sites within a certain distance or travel time.

Mobility refers to the ability to move between different activity sites.
Accessibility vs. Mobility

Off 100 Feet Road – Indiranagar, Bangalore
Accessibility vs. Mobility

- Grocery
- Barber
- Restaurant
- Mall
Many trace the dawn of the modern civil rights movement in the United States to events that transpired on a city bus in Montgomery, Alabama, on December 1, 1955, when Rosa Parks refused an order from a municipal bus driver to give up her seat to a white man. Her arrest and the subsequent Montgomery bus boycott (1955–1959), in which blacks refused to patronize the segregated city bus system, proved the power of collective action and brought Martin Luther King, Jr., to prominence. That the civil rights movement should have been born on a city bus is just one measure of how urban transportation is woven into the fabric of U.S. life.
What is Choice?

[ Bus (10), Bicycle (3), Auto Rickshaw (40), Motorcycle (10) ]

[ Bus, Bicycle, Auto Rickshaw, Motorcycle, Car, Metro ]
What is Choice?

- Cost
- Convenience
- Reliability
- Comfort
- Safety
- Security
- Ability to use (access)
The 2001 National Household Travel Survey (NHTS) confirms most of the same travel trends and variations among socioeconomic groups documented by its predecessors, the Nationwide Personal Transportation Surveys (NPTS) of 1969, 1977, 1983, 1990, and 1995. The private car continues to dominate urban travel among every segment of the American population, including the poor, minorities, and the elderly. By comparison, public transport accounts for less than 2% of all urban travel. Even the lowest-income households make only 5% of their trips by transit. The most important difference in the 2001 NHTS is the doubling in modal share of walk trips in cities, due to a much improved survey technique that captured previously unreported walks.

While the private car dominates travel, there are important variations in auto ownership and travel behavior by income, race, ethnicity, sex, and age. Overall, the poor, racial and ethnic minorities, and the elderly have much lower mobility rates than the general population. Moreover, the poor, blacks, and Hispanics are far more likely to use transit than other groups. Indeed, minorities and low-income households account for 63% of the nation’s transit riders. Different socioeconomic groups also have different rates of carpooling, taxi use, bicycling, and walking. In addition, they travel different distances and at different times of day. Many of these socioeconomic variations in travel behavior have important consequences for public policy.

John Pucher, 2005
Why is the Household Important?

- Economic Activity relates back to the household and household characteristics
  - Income
  - Vehicle Ownership
  - Household size
Key Assumptions

- Trip Lengths
- Per Capita Trip Rates
- Modal Shares
# Ahmedabad Scenarios

<table>
<thead>
<tr>
<th></th>
<th><strong>Today</strong></th>
<th><strong>2041</strong></th>
<th><strong>2041</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Automobility</td>
<td>Sustainable Transport</td>
<td>Sustainable Transport</td>
</tr>
<tr>
<td>Population (millions)</td>
<td>5.4</td>
<td>13.2</td>
<td>13.2</td>
</tr>
<tr>
<td>Trips (millions/yr)</td>
<td>5.6</td>
<td>39.75</td>
<td>39.75</td>
</tr>
<tr>
<td>Area (Sq. Km.)</td>
<td>1330</td>
<td>6484</td>
<td>3242</td>
</tr>
<tr>
<td>Emissions (million Tons CO2/yr)</td>
<td>0.33</td>
<td>12.32</td>
<td>1.97</td>
</tr>
<tr>
<td>Traffic Fatalities (per yr)</td>
<td>175</td>
<td>5,232</td>
<td>1,225</td>
</tr>
</tbody>
</table>
## Trip Rates

<table>
<thead>
<tr>
<th>Trip Rate</th>
<th>Participation in workforce</th>
<th>Workers</th>
<th>Non Workers</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.09</td>
<td></td>
<td></td>
<td>1.04</td>
</tr>
<tr>
<td>2011</td>
<td>0.15</td>
<td>2.00</td>
<td>0.50</td>
<td>1.08</td>
</tr>
<tr>
<td>2021</td>
<td>0.20</td>
<td>2.70</td>
<td>1.00</td>
<td>1.70</td>
</tr>
<tr>
<td>2031</td>
<td>0.30</td>
<td>3.30</td>
<td>1.50</td>
<td>2.32</td>
</tr>
<tr>
<td>2041</td>
<td>0.40</td>
<td>4.00</td>
<td>2.00</td>
<td>3.01</td>
</tr>
</tbody>
</table>
MOBILITY ISSUES IN THE DEVELOPING WORLD

In the large cities of the developing world, travel times are generally high and increasing, destinations accessible within limited time are decreasing. The average one-way commute in Rio de Janeiro is 90 minutes. In Bogota it is 60 minutes. The average vehicle speed in Manila is 7 miles per hour. The average car in Bangkok is stationary in traffic for the equivalent of 44 days a year.

This is happening because vehicle registrations are growing fast on the basis of increased populations, increased wealth, increased commercial penetration, and probably an increasingly persuasive picture in the developing world of international lifestyle in which a car is an essential element. Accordingly, in much of the developing world the number of motor vehicles is increasing at more than 10 percent a year—the number of vehicles doubling in 7 years. The countries include China (15 percent), Chile, Mexico, Korea, Thailand, Costa Rica, Syria, Taiwan, and many more.

What is the shape of increasing congestion and declining mobility? There are no widespread measures available for comparative purposes because decline in mobility is complicated. Congestion is always localized in time and space. A few things are nonetheless evident.
Review of Indicators
Current trends of supply and demand
Predictions and Perceptions of Future
Policies & Programs in India
Comprehensive Mobility Plans
Average Trip Length

kilometers

Chennai
Delhi
Mumbai
Ahmedabad
Bangalore
Pune
Bhopal
Indore
Jaipur
Mysore
Rajkot
Surat

Talk
Moving People
Not Vehicles
Trends
ROAD & RAIL continue to be the PARADIGM
Bangalore – Transport Financing Plan

PROJECTED TRANSPORT SECTOR ALLOCATIONS

BANGALORE

CTTP October 2007
Chapter 9
Cost Estimate | Pages 20-21

Amount in Crores

- Namma Metro: 19921
- Monorail: 5100
- Namma Railu: 3060
- BRT: 3498
- Improvement in Buses: 5721
- Pedestrian Infrastructure: 281
- Parking Infrastructure: 380
- Integrated Freight Terminal: 270
- BTRAC: 500
- Road Infrastructure: 8213
2011-12
PUNE TRANSPORT SECTOR BUDGET

Break up of Transportation Budget

- MV: 61%
- NMT: 9%
- PT: 18%
- General: 12%
Source: http://rto.kar.nic.in/
## Vehicle Ownership - Monthly Household Expenditure

<table>
<thead>
<tr>
<th></th>
<th>Avg. Monthly Expenses</th>
<th>Bicycle</th>
<th>2 Wheeler</th>
<th>4 Wheeler</th>
<th># of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slums-Core</td>
<td>3,682</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Slums-Periphery</td>
<td>5,556</td>
<td>1</td>
<td>0.6</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Lower-Core</td>
<td>7,239</td>
<td>0.8</td>
<td>1.8</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Lower-Periphery</td>
<td>8,485</td>
<td>0.8</td>
<td>1.1</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Middle-Core</td>
<td>15,863</td>
<td>0.6</td>
<td>1.6</td>
<td>0.4</td>
<td>14</td>
</tr>
<tr>
<td>Middle-Periphery</td>
<td>10,321</td>
<td>0.7</td>
<td>1.5</td>
<td>0.2</td>
<td>16</td>
</tr>
<tr>
<td>Upper-Core</td>
<td>56,598</td>
<td></td>
<td>1.5</td>
<td>3.5</td>
<td>2</td>
</tr>
<tr>
<td>Upper-Periphery</td>
<td>67,126</td>
<td>0.8</td>
<td>2.3</td>
<td>1.1</td>
<td>8</td>
</tr>
</tbody>
</table>

Household Survey Indore
Share of Trips by cycles, two wheelers, Four Wheelers (private) and PTS

- Personalized Vehicle (Two Wheelers): 47%
- Personalized Vehicle (Cars): 22%
- Cycles: 27%
- Public Transport and Intermediate Public Transport: 4%
Metro Rail – 17 Bil USD
Bus Rapid Transit – 1 Bil USD
City Bus Procurement – 3 Bil USD
Terminals, Technology, Elevated Structures) – 0.2 Bil USD
Policies & Plans for the Future

- National urban transport policy should be the basis
- Cities to develop comprehensive mobility plans (CMP)
- All projects in the city should be a part of CMP
- Dedicated urban transport fund to be created
- Set-up an Unified Authority to plan and oversee all transport project
Recommendation for next JnNURM

500 Billion USD
Key Statutory or Legal Documents

- Central Motor Vehicles Rules
- India Road Congress documents for Cities
- Street Design Guidelines in Cities
Comprehensive Mobility Plan
### Table 5-2: Travel Characteristics

<table>
<thead>
<tr>
<th></th>
<th>CRRI</th>
<th>CRRI</th>
<th>CES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Survey</td>
<td>1988</td>
<td>2004</td>
<td>2005</td>
</tr>
<tr>
<td>Households surveyed</td>
<td>5340</td>
<td>9000</td>
<td>12000</td>
</tr>
<tr>
<td>Trip Rate-Total</td>
<td>1.02</td>
<td>1.31</td>
<td>1.13</td>
</tr>
<tr>
<td>Trip rate-Motorised</td>
<td>0.55</td>
<td>0.78</td>
<td>0.73</td>
</tr>
</tbody>
</table>

#### Percentage Trips by Mode

<table>
<thead>
<tr>
<th>Mode</th>
<th>CRRI</th>
<th>CRRI</th>
<th>CES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>45.35</td>
<td>42.04</td>
<td>35.28</td>
</tr>
<tr>
<td>Bus</td>
<td>5.44</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td>0.23</td>
<td>0.13</td>
<td>0.84</td>
</tr>
<tr>
<td>Car</td>
<td>1.28</td>
<td>2.58</td>
<td>1.47</td>
</tr>
<tr>
<td>Two-Wheeler</td>
<td>21.28</td>
<td>28.39</td>
<td>29.3</td>
</tr>
<tr>
<td>Bicycle</td>
<td>19.24</td>
<td>13.44</td>
<td>9.88</td>
</tr>
<tr>
<td>Autorickshaw</td>
<td>7.17</td>
<td>10.81</td>
<td>20.98</td>
</tr>
<tr>
<td>Others</td>
<td>0.01</td>
<td>0.31</td>
<td>2.25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

#### Percentage Trips by Purpose

<table>
<thead>
<tr>
<th>Purpose</th>
<th>CRRI</th>
<th>CRRI</th>
<th>CES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Trips</td>
<td>50</td>
<td>52</td>
<td>57</td>
</tr>
<tr>
<td>Education Trips</td>
<td>29</td>
<td>39</td>
<td>29</td>
</tr>
<tr>
<td>Shopping Trips</td>
<td>21</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Travel Characteristics – From OD Survey

### Table 4.18: Distribution of Vehicle Trips by Purpose (%)

<table>
<thead>
<tr>
<th>Type of Movement</th>
<th>Purpose of Trip</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Work</td>
<td>Business</td>
</tr>
<tr>
<td>I-E</td>
<td>43.4</td>
<td>25.0</td>
</tr>
<tr>
<td>E-I</td>
<td>40.0</td>
<td>25.2</td>
</tr>
<tr>
<td>E-E</td>
<td>29.6</td>
<td>23.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37.7</strong></td>
<td><strong>24.5</strong></td>
</tr>
</tbody>
</table>

Note: I = Internal, E = External, Internal to Internal trips are not included
(Source: CES Survey)

Example from Rajkot CMP

### Table 7-8: Existing and Future Travel Demand (Excluding Walk Trips):

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Passenger Trips Internal</th>
<th>Passenger Trips External</th>
<th>Total</th>
<th>Good Trips PCU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>3,607,596</td>
<td>0.75</td>
<td>0.5</td>
<td>4,509,495</td>
<td>80,000</td>
</tr>
<tr>
<td>2011</td>
<td>4,499,000</td>
<td>0.80</td>
<td>0.5</td>
<td>5,848,708</td>
<td>101,226</td>
</tr>
<tr>
<td>2021</td>
<td>6,500,000</td>
<td>0.90</td>
<td>0.5</td>
<td>9,100,005</td>
<td>149,838</td>
</tr>
<tr>
<td>2031</td>
<td>8,500,000</td>
<td>1.00</td>
<td>0.5</td>
<td>12,750,000</td>
<td>201,370</td>
</tr>
</tbody>
</table>

Example from Surat CMP
Road & Transit Networks

- Demand Inventory – People, Bicycles, Vehicles
- Supply Inventory – Roads, Rails, Walking, Cycling Environments,
- Design Speeds, Actual Speeds
- Traffic Counts
How to Construct an OD

- Agree on a representative sample
- Conduct Household Surveys
Bangalore – Transport Financing Plan

PROJECTED TRANSPORT SECTOR ALLOCATIONS

BANGALORE

CTTP October 2007
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PUNE TRANSPORT SECTOR BUDGET

Break up of Transportation Budget

- MV: 61%
- NMT: 9%
- PT: 18%
- General: 12%
What did you learn?

- Travel; Induced Travel
- Accessibility vs. Mobility & What is choice
- Households,
- Trip Rates, Trip Purpose,
- Indicators
- How indicators add up to the city level
- Current trends in India
- Future Polices
- Comprehensive Mobility Plans