

BRT projects in Indian cities as inclusive transport systems? An assessment

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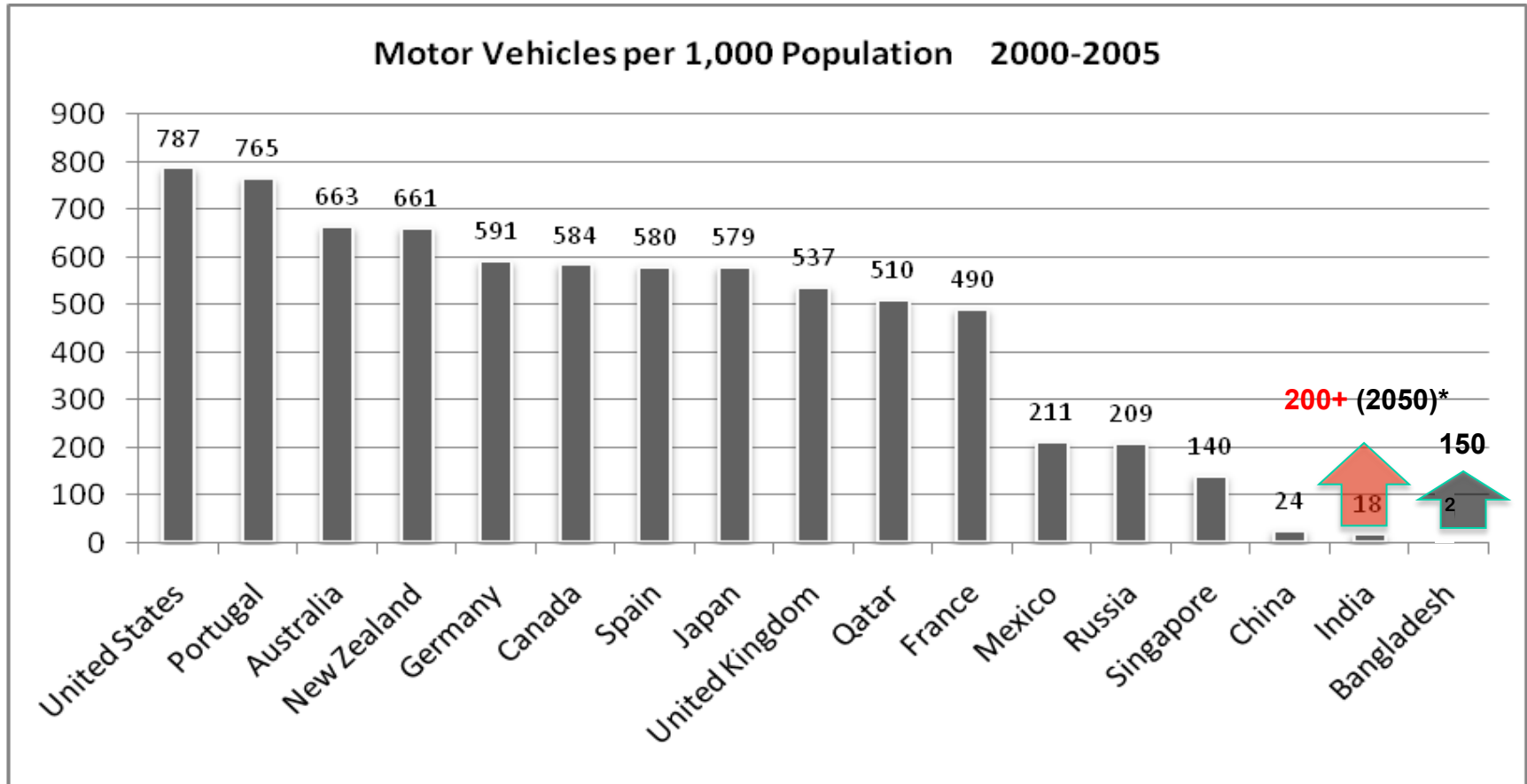
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CEPT University**

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Motor vehicles/ Population



Source: Population Reference Bureau: World Population Datasheet 2008

* 2050 estimate is based on Chamon (2005) by IMF/Uni. of Virginia

Motorisation in developing countries

- Motorisation is a process of continuous increase in the number of motorised vehicles along with rising income levels fueled by rapid industrial-commercial activities.
- Political demand for wider roads, fly-overs, uninterrupted traffic flow from the cities.
- In addition, cheap auto-mobile loans, free parking, demand of cheaper fuel etc.



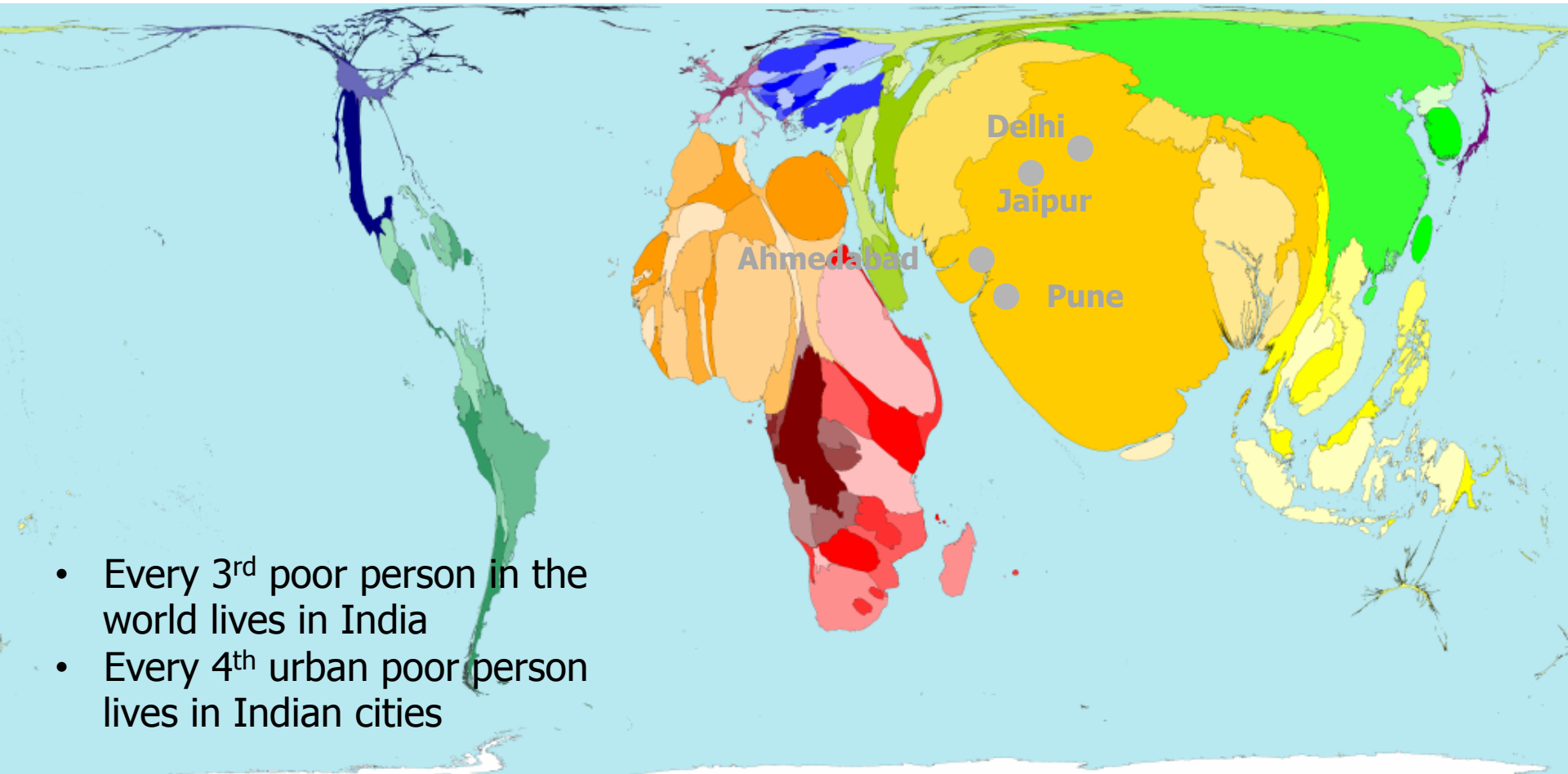
Photo: David Kong Hug



Urban Transport – Some national trends

- 2-wheelers are increasing at the rate of **12% per annum in last two decades**. Car ownership in the country is still very low (>50/1000 ppl) compared to other industrialized countries (<300/1000ppl).
- Operating public bus services in cities on congested roads is difficult and the fleet size across the country has decreased. Most cities have with **negative annual growth rate of their bus fleet** (except B'lore -9.4%).
- Modal share of Cycling has **decreased from 30% in 1994 to 11% in 2008**. Only 30% city roads have space for pedestrians in most cities.
- With these average travel speed decreases - Below 20kmh in cities with population above 20 lakhs – not always a bad thing!

Global poverty mapping



(Income) Poverty in the world

Territory size shows the proportion of the world population living in poverty

(calculated by multiplying population by one of two poverty indices based on the UNDP 2004 Human Development Report.

Source: <http://www.worldmapper.org/display.php?selected=174> (accessed on 5.10.2011)

Low-carbon mobility project

- Assessment of BRTS as inclusive transport systems
 - 1. Rapid assessment of BRT experience Indian cities**
 - Planning issues
 - Implementation issues
 - Bottlenecks

 - 2. Detailed assessment of one case study (Ahmedabad)**
 - Public Transport user's survey
 - Survey of travel needs of the urban poor and vulnerable groups
 - Outcomes/outputs: travel needs of the urban poor, users preferences for better transport system, recommendations for inclusive transport system.

Some stand-points – Public Bus

- Public buses are mass transit!
- Bus systems are an integral part of the urban transport system around the world...even in cities where other public/private modes dominate.
- No single system can ease out a city's all traffic issues. The public system needs to be integrated in terms of physical access, fares, ticketing and marketing (and in terms of institutional co-ordination).

Some stand-points - BRT

- “BRT is a key to absorb traffic displaced by road capacity losses.” (Cervero, 2010)
- Mass transit (public buses) becomes ‘rapid’ only when they are given priority in terms of dedicated space.
- There can not be a singular 'successful' model of BRT. Each city will have to evolve and adopt the concept of BRT (prioritized bus corridor with adequate walking-cycling paths) in many different ways. The policies and funding should allow and encourage that.
- However, there is a greater consensus about building BRT along the central median dedicated corridors. Much more policy debates are about the open vs. closed systems.

Inclusive BRT system

- Safe(r) physical access to the bus stops
- Easy boarding to the bus
- Dedicated bus corridors with NMT infrastructure
- Priority to the bus-cycling-walking in road space and in the junction design
- Seamless transit between public modes (buses, rickshaws, rail)
- Equally good quality of walking-cycling infrastructure and lighting
- Affordable fares
- Road-ways integrating the street-hawking activities
- Minimizing project displacements and rehabilitation that improves people's life.

CITIES SELECTED FOR THE STUDY

The cities selected for the study are following
Cities with Operational BRTs

-Delhi

-Pune

-Jaipur

Detailed Case Study

-Ahmedabad

Cities constructing BRT, yet to be operational

-Indore

Methodology

- Documentary analysis
- Interviews with the stakeholders
- Primary elements
 - Users needs, feedbacks and perceptions
 - Systems performance surveys –
 - Bus frequency
 - Boarding –alighting survey – time / number of commuters
 - Speed and delay survey (on board)
 - NMT facility assessment

Urban Transport in India - Policy Frameworks and Flow of Funds

Government of India
 MoUD (Ministry of Urban Development)
 MoHUPA (Ministry of Housing and Urban Poverty Alleviation)
JNNURM (Jawaharlal Nehru Urban Renewal Mission) 24 bn \$

50/80 %

**National Urban
 Transport Policy 2006**
*"Streets for people not
 roads for vehicles"*

State Government (in case of Gujarat)
 Urban Development & Housing Department
 Gujarat Urban Development Mission (JnNURM Projects)
 Gujarat Urban Development Company Ltd. (Special Projects)
 Gujarat Infrastructure Development Board (Infrastructure projects)
 Road Transport Organization (Licensing, vehicle tax etc)
 Ahmedabad Urban Development Authority (Peri-urban governance and planning)

15/10 %

**City
 Development
 Plan**

City Government (in case of Ahmedabad)

Ahmedabad Janmarg Ltd. (BRT company)
 Ahmedabad Municipal Transport Services (public bus service)
 Traffic Police (under the state govt home dept)

**Comprehensive
 Mobility Plan**

35/10 %

BRTS APPROVED UNDER JnNURM

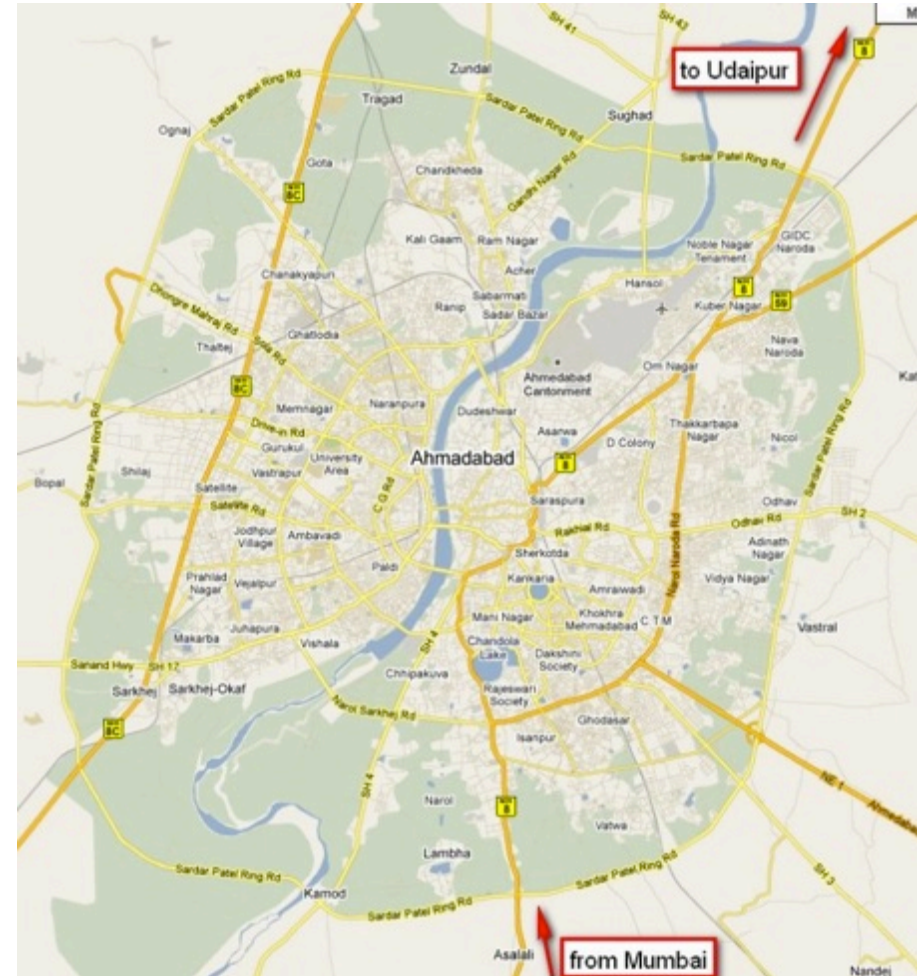
| No. | City | Approved Kms. | Sanctioned Cost (in Rs. Crores) | GoI share (in Rs. Crores.) |
|-----|-----------------------------|---------------|---------------------------------|----------------------------|
| 1 | Ahmedabad | 88.50 | 981.35 | 343.71 |
| 2 | Rajkot | 29.00 | 110.00 | 55.00 |
| 3 | Surat | 29.90 | 469.00 | 234.51 |
| 4 | Bhopal | 21.71 | 237.36 | 18.88 |
| 5 | Indore | 11.45 | 98.45 | 49.22 |
| 6 | Pune & Pimpri Chinchwad | 124.77 | 1363.14 | 681.57 |
| 7 | Vijaywada | 15.50 | 152.64 | 76.32 |
| 8 | Vizag | 42.80 | 452.93 | 226.46 |
| 9 | Jaipur | 26.10 | 219.19 | 109.61 |
| | Total | 389.73 | 4084.06 | 1895.28 |
| 10 | Delhi (Not under JnNURM) | 14.2 (121) | 153.00 | - |

JANMARG

AHMEDABAD

AHMEDABAD: CITY CHARACTERISTICS

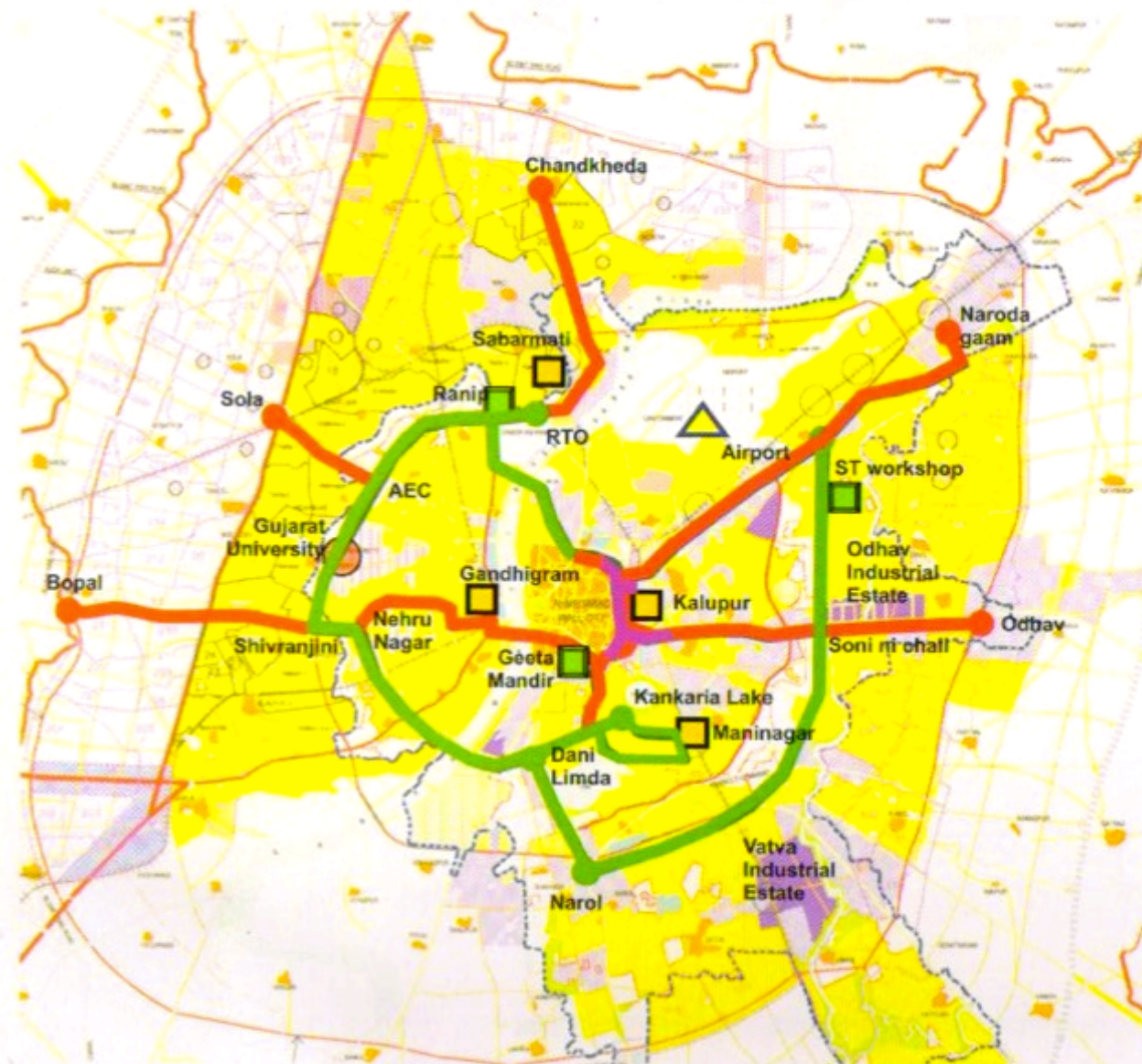
- 7th largest urban agglomeration and 5.5 millions urban population
- Area: 490 sq kms
- 1.4 millions vehicles growing at the rate of 0.1 million every year.
- Almost 1 million passengers use buses (8.6 mil municipal buses + 1.4 BRT)
- Avg trip length 5.8 kms.
- 61% affected modes in fatal accidents are pedestrians and cyclists



Source: Compiled from various reports including Ahmedabad CDP, DPR for Ahmedabad BRT phase 1&2.

JANMARG- Ahm BRTS

- Ahmedabad BRTS Project (Janmarg) construction started in the Year 2007 and the first phase of 12.5 Kms. was opened in October 2009.
- The cost of the Project is Rs. 981.35 Crores, out of which the share from the Govt. of India under JnNURM is Rs. 343.71 Crores.
- It is a median bus lane type BRT system, which runs exclusive buses on the corridor.
- 78 Buses are catering more than 1,40,000 passengers everyday during 6:00 a.m. to 11:30 p.m.
- The total revenue collection is an average Rs. 7,30,000 (USD 16250) daily.
- It is managed by a Special Purpose company
- Buses are owned and operated by a private operators.
- Ticketing is done on the stations. (Pre-boarding)



- Total BRTS network - 88.8 kms
- █ Operational corridors - 43 kms
(With 67 bus stops)
 - RTO to Maninagar loop - 22.5km
 - Danilimda to Naroda - 16.5km
 - Bhavsar hostel to Delhi Darwaza - 4km
- █ Under construction corridors - 5.3 kms
- █ Elevated BRT corridor - 4.5kms

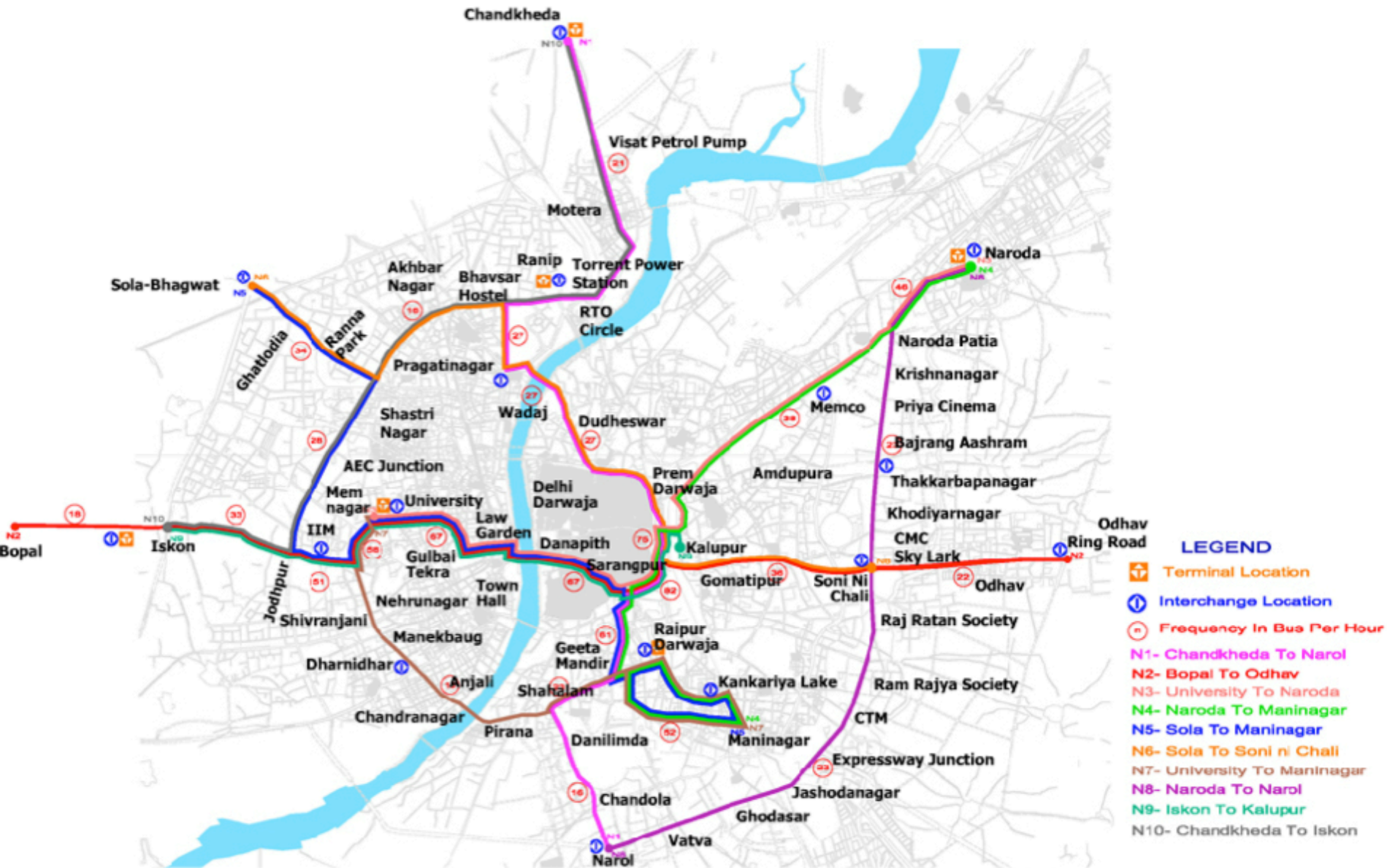
- LEGEND
- ▲ Airport
 - Railway Stations
 - GSRTC Terminals
 - University/educational campus
 - Industrial estates
 - Residential
 - Industrial
 - Institutional

Diagram of proposed integrated transport system of Ahmedabad (43 km operational)

Source: Ahmedabad Municipal Corporation's Brochure for JANMARG (2011)

OPERATIONAL & UNDER CONSTRUCTION JANMARG ROUTES FOR AHMEDABAD

BRT ROUTES AND FREQUENCY



Source: <http://www.ahmedabadbrts.com/operationplanmap.html> accessed on 12.09.2011

PLANNED JANMARG ROUTES FOR AHMEDABAD

Ahmedabad BRT System



BUS FREQUENCY AND STOPPAGE TIME

Primary Survey observations:

Observed frequency of the Bus at Peak Hours on Akhbar Nagar junction.

- Bus Frequency on RTO-Maninagar route- 3-4 Minutes
- Bus Frequency on RTO-Naroda Route- 7-8 Minutes

Time taken to reach from RTO-Maninagar Station (22.5 Kms) – 40-48 Minutes

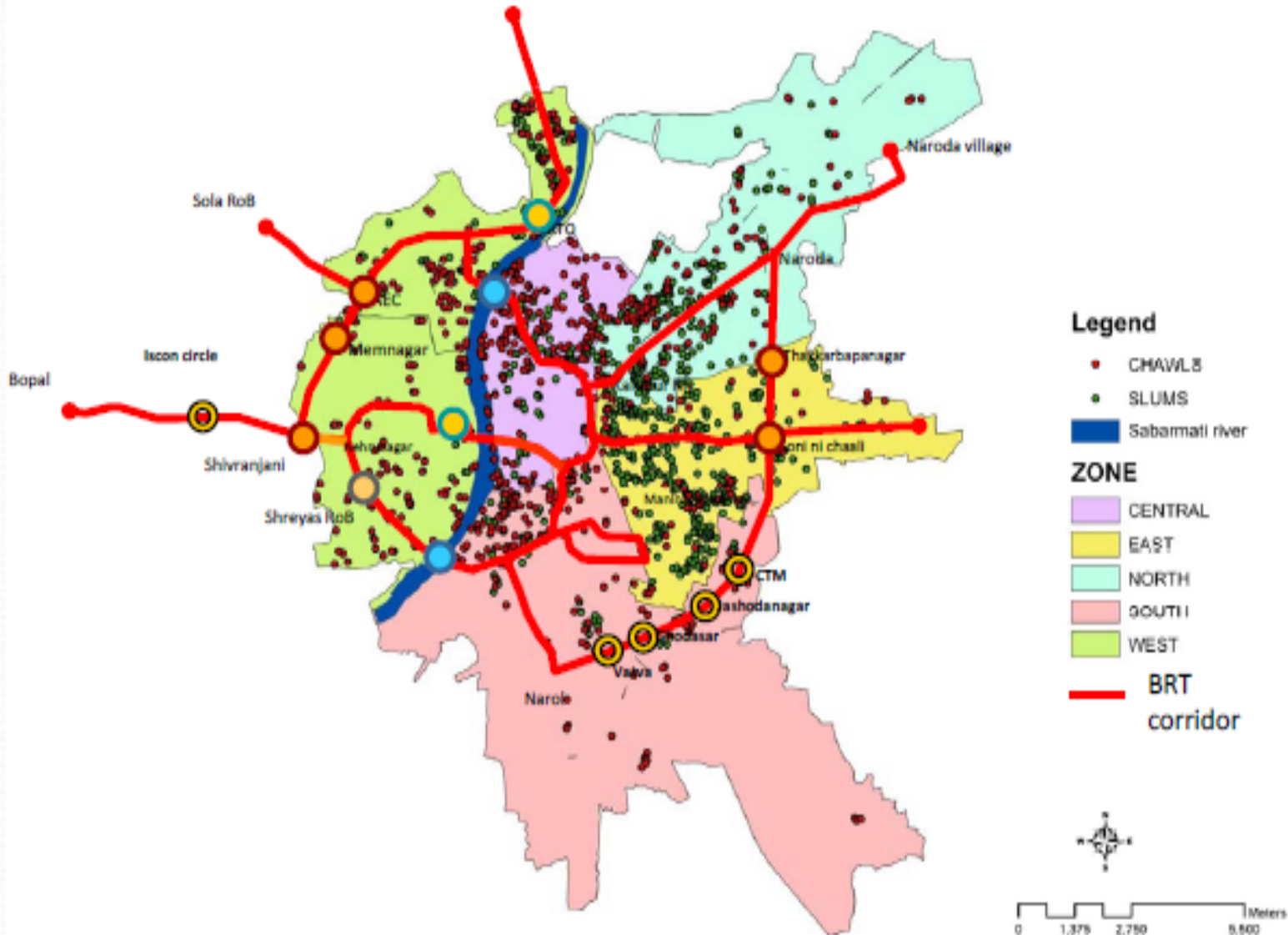
- Average Speed of the Bus 20-35 Km/h

Time taken to reach from RTO-Naroda (33 Kms) -62-69 Minutes

- Average Speed of the Bus 25-30 Km/h
- Bus Stoppage for Boarding/De-Boarding: 18-25 Seconds

SOCIAL IMPACTS OF BRTS

Ahmedabad – Location of Slums and chawls



How 'inclusive' is being 'exclusive'?

- BRT is not integrated at all with the existing municipal bus services, in terms of...
 - route structuring and operational planning
 - access and egress
 - ticketing and fare collection
 - institutionally

- No other buses are allowed in the BRT corridor – not even ambulance services.

- Where is the blue-print for integrated multi-modal transport system for the city?

- Is being too 'exclusive' an enemy of anything 'inclusive'?



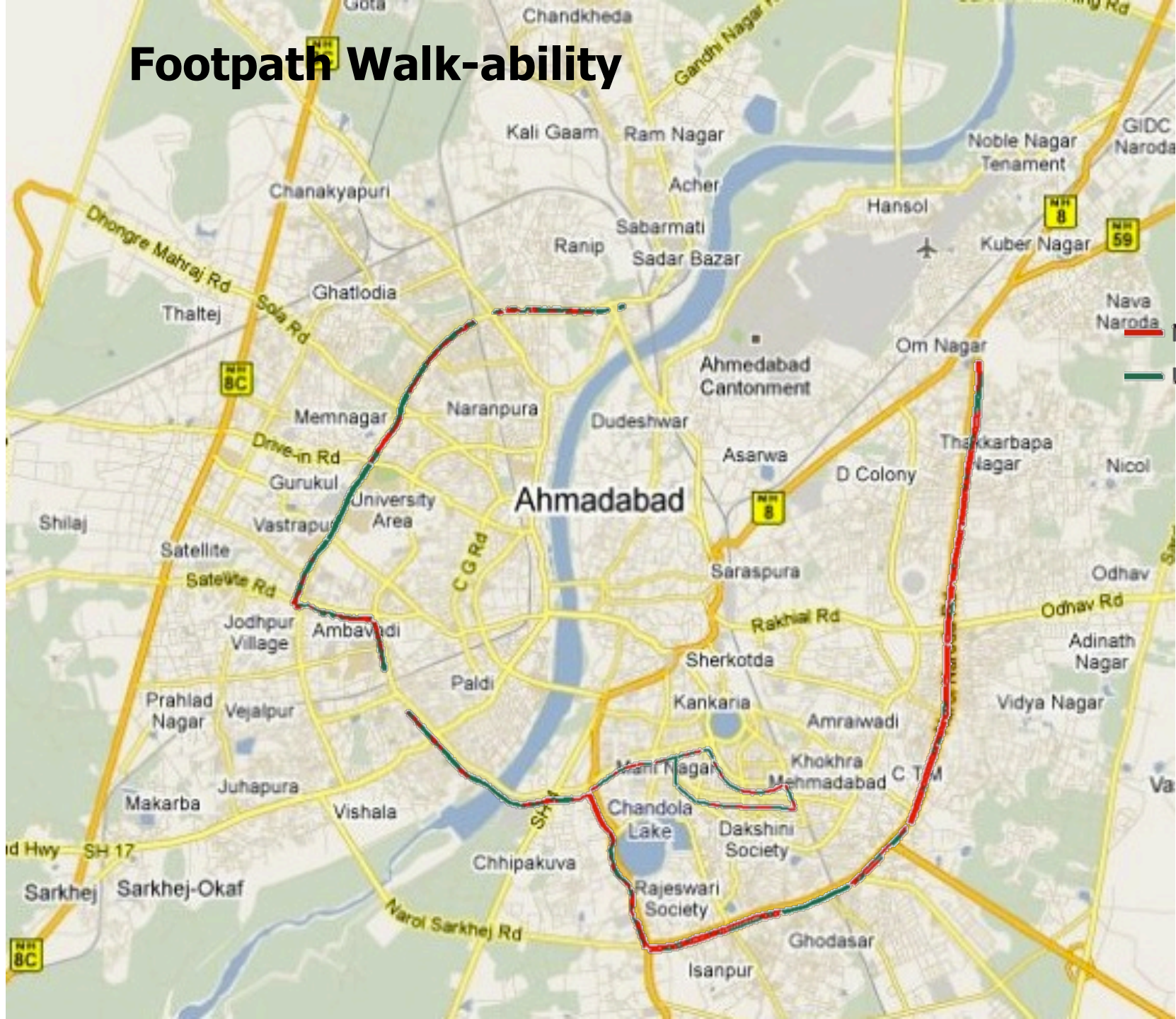
BRT Operational Route



Footpath Availability

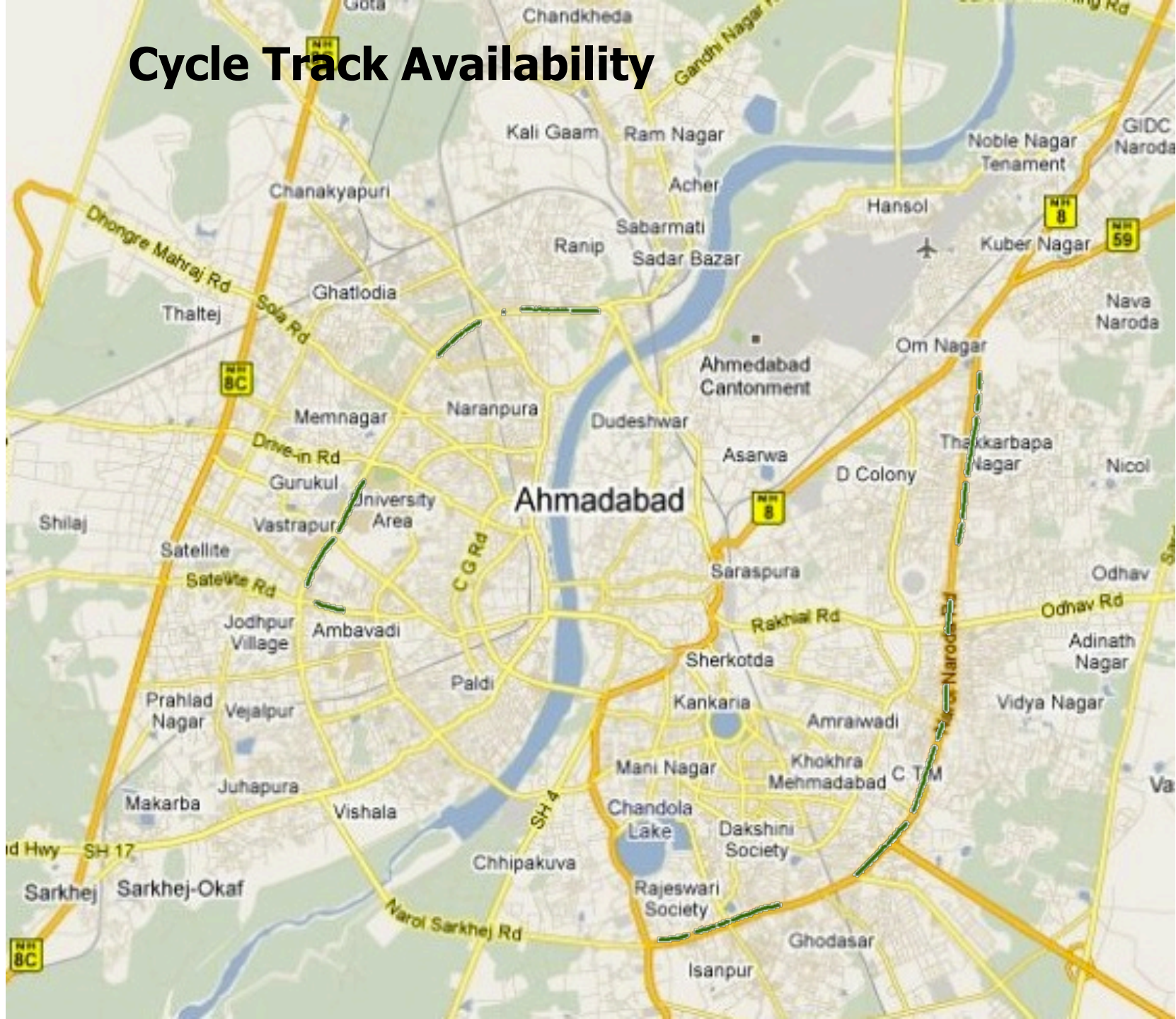


Footpath Walk-ability



— Not Useable
— Useable

Cycle Track Availability



Cycle Track Usability



Not Useable

Useable

BRT Pedestrian Route: AHMEDABAD




Legend

 BRT Route

**Footpath
walkable**

 N

 Y

0 25 50 100 150 200
 Meters

BRT Cycle Track: AHMEDABAD



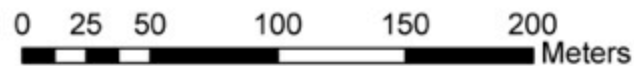
Legend

— BRT Route

Cycle Track
Cyclable

— N

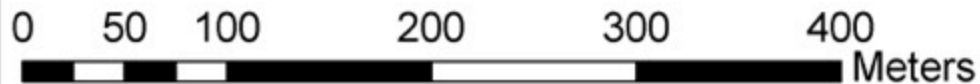
— Y






Cycle Track and footpath on BRT Route: AHMEDABAD



Discontinuous cycle track
visible

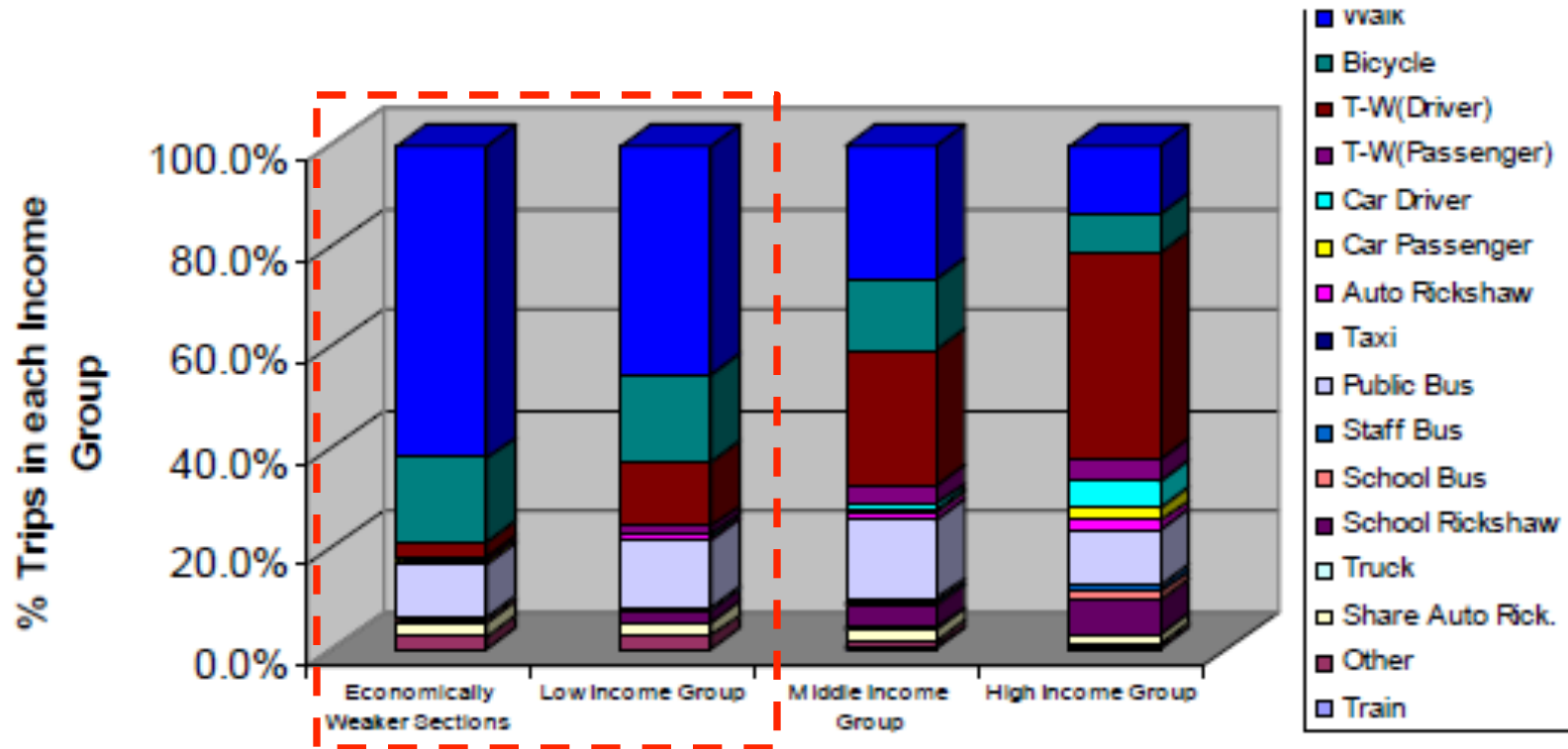


Legend

-  BRT_Stand
-  Footpath
-  Cycle_Track
-  BRT_Road

BRT without NMT?

Fig 5-3: Mode Choice and Household Income



Derived from GIDB IPTS Study (2000) by LBA

Almost 80% of EWS and 60% of LIG Households Walk or Bicycle in the city, and therefore require better NMT Infrastructure to be included in the city level transport infrastructure. (Source: BRT DPR-1)

BRT WITHOUT NMT?

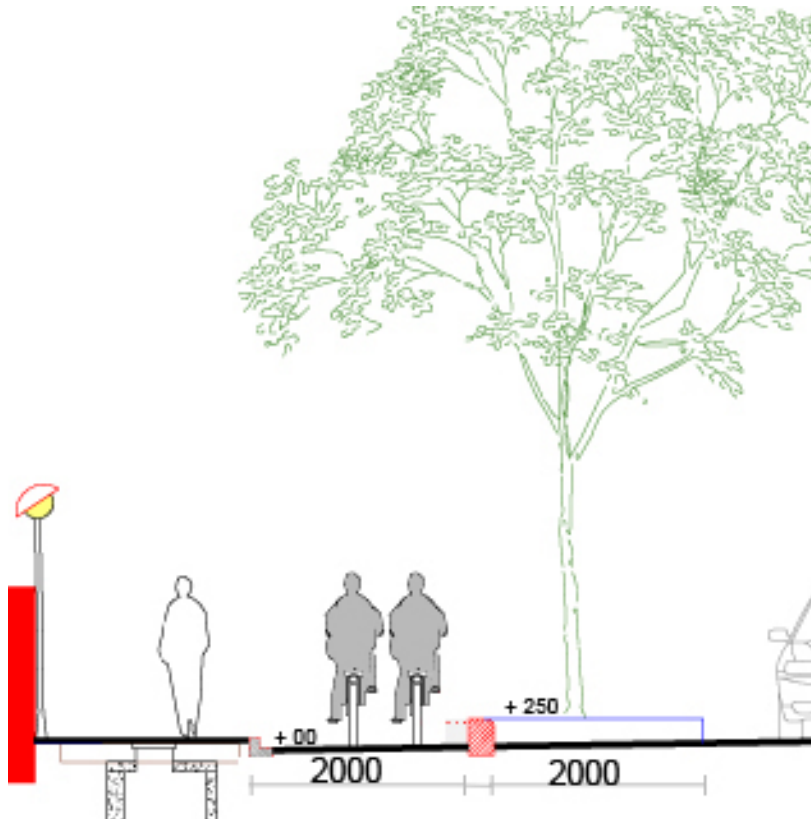
AVAILABILITY OF NMT INFRASTRUCTURE ON THE BRT CORRIDOR

| No. | Component | Length in Kms. | % Availability |
|-----|---|----------------|----------------|
| 1. | Length of Studied BRT Corridor (Except Akhbar Nagar-Delhi Darwaza Corridor) | 39.7 | 100 |
| 2 | Length of Unobstructed Footpaths (Available for Walking) | 14.7 | 37.0 |
| 3 | Length of Obstructed Footpaths | 17.7 | 44.6 |
| 4 | Length of BRT Corridor with No Footpaths | 7.3 | 18.4 |
| 5 | Length of Unobstructed Bicycle Tracks | 6.79 | 17.1 |
| 6 | Length of Obstructed Bicycle Tracks | 4.38 | 11.0 |
| 7 | Length of BRT Corridor with No Bicycle Tracks | 28.5 | 71.9 |

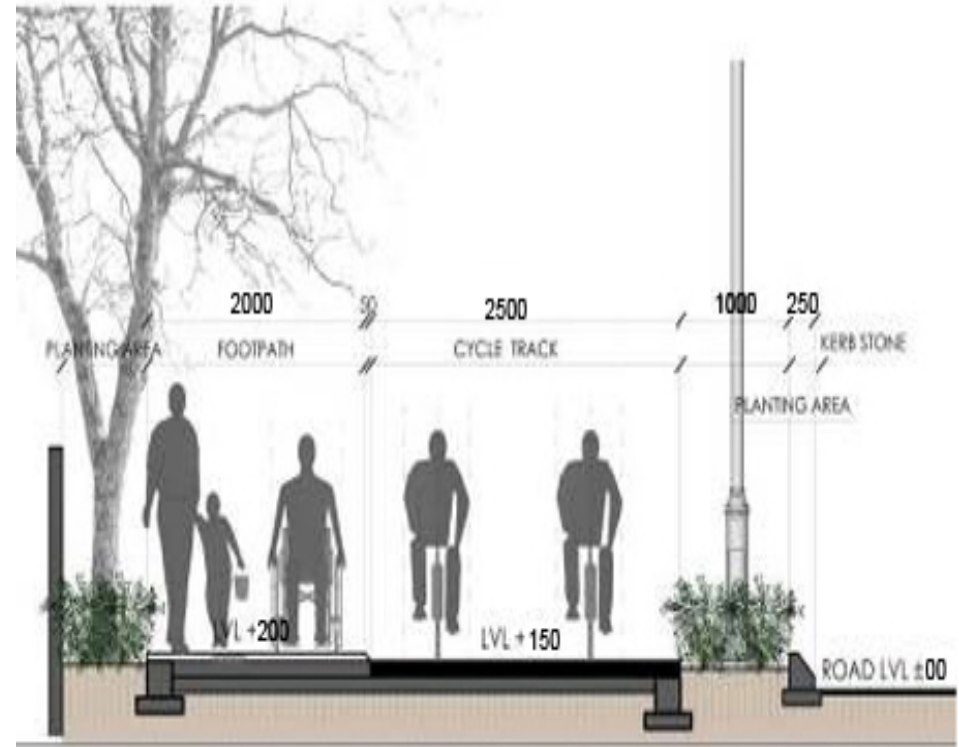
"A large proportion of the population either walks or use bicycle. Hence needs for improvements in related facilities are a necessity."

-Ahmedabad BRT DPR-1, pp 5-19

BICYCLE TRACK DESIGN



AHMEDABAD BRT



UTTPEC PEDESTRIAN GUIDELINES

- The effective width of Cycle track falls to 1750 mm, due to 250mm high curb making it unsafe for bicycle paddles.
- The Uttpec Pedestrian Guideline suggests minimum width of cycle track as 2500 mm, with no high curb.

BRTS cycle-track discarded over space, security concerns

TIMES NEWS NETWORK

Ahmedabad: If you had plans for a morning bicycle ride along the BRTS stretch from Shivranjani to SG Highway, you will be disappointed. AMC has decided to do away with the cycle track on this stretch which is supposed to run alongside the BRTS track.

The reasons cited were non-availability of land and security issues since it next to ISRO' Space Applications Centre. The bus stops here also have deliberately planned far away from the high security zones. Officials said that one bus stand will be somewhere near Jodhpur crossroads and the next at Ramdevnagar crossroads.

The official also said that AMC was not willing to take any chances. "Anyone can stand at a BRTS bus station and take photographs and hence we wanted to be sure. Those who would be riding bicycles would have to do it very close to the boundary wall. This was also a security threat to the establishment."

Another reason was simply the lack of space. This area has among the highest densities of cars and two



The revised road boundary being marked out adjacent to the ISRO wall on the Jodhpur Ramdevnagar stretch

wheelers passing by. He said that AMC had asked for some land from ISRO, but since it was a Government of India organization, there was a delay in getting the land and there was also no positive reply also from the Government. Officials thought it best to do away the bicycle track.

UC Padia, deputy municipal commissioner said "We had demanded land from ISRO, but since ISRO is a Government of India establishment, there was a delay. Hence we decided to do away with the bicycle track and

have also taken a decision to narrow the pedestrian lane near the ISRO boundary to have more space for mixed traffic."

Another senior officer said other factors leading to the decision to do away with the track were a nearby school and temple, apart from parking by private luxury buses were major hindrances to traffic on the stretch. The school and the temple have visitors parking their vehicles right on the road, while the luxury buses also park on the main road at night.



BRT WITHOUT NMT?

"Better design of cycle tracks would have encouraged cyclists to utilise space better."

-Walter Hook, CEO ITDP

(Source: DNA Ahmedabad, 9th October 2011)

"The pedestrian space is pathetic. The space could have been better utilised as pedestrian space and for cycle tracks."

-Enrique Penalosa , Former Mayor, Bogota

(Source: DNA Ahmedabad, 15th November 2009)

*If you had plans for a morning bicycle ride along the BRTS stretch from Shivranjani to SG Highway, you will be disappointed. AMC has decided to **do away with the cycle track** on this stretch which is supposed to run alongside the BRTS track.*

- Times of India, Ahmedabad, 29th July 2011

BRT Ahmedabad: An example for BRT Implementation for other cities ?

AN OVERVIEW

BRT PROJECTS IN DELHI, PUNE & JAIPUR

BRT in other cities

DELHI



PUNE



AHMEDABAD



JAIPUR



ISSUES OBSERVED ON BUS CORRIDOR

DELHI

- Large Bus Pile up on the corridor, due to signal cycle favouring the mixed traffic!
- Signal time of just 10-15 seconds, for the buses to pass
- Level boarding is not always possible, due to bus pile-up longer than bus stop length.
- One corridor so far, others a planned. (Not possible to make conclusive statements on systems design)
- Exemplary design of the pedestrian and cycling infrastructure, inclusion of street vendors.

PUNE

- No level boarding, due to mismatch in bus stop heights and bus design, lack of drivers' training.
- No enforcement of the corridor.
- Corridor is discontinuous at many places.
- Fairly good cycling and walking infrastructure on the bus corridor.

NMT INFRASTRUCTURE

DELHI



PUNE



AHMEDABAD



JAIPUR



ISSUES OBSERVED IN NMT INFRASTRUCTURE

PUNE

- Obstructed due to Parking, Vending and Solid Waste Storage.
- Bicycle tracks, discontinuous at certain patches.
- No space for bicycle parking, Auto Rickshaw parking, vending along the corridor.

JAIPUR

- No dedicated Bicycle tracks
- Low Footpath widths of 1m. At many junctions.
- Sign boards obstructing footpaths

AHMEDABAD

- Obstructed, Discontinuous badly designed bicycle tracks with high curbs along.
- Discontinuous footpaths
- Water logging, haphazard parking and vending.
- Mostly unused

COMPARITIVE SUMMARY OF BRT SYSTEMS

| Sr.n o. | Component | Delhi | Pune | Ahmedabad | Jaipur |
|---------|--------------------------|--------------------------------------|--------------------------------------|---|-------------------------------------|
| 1. | Type of System | Open Corridor, side median bus stops | Open Corridor, side median bus stops | Exclusive Corridor central median bus stops | Open Corridor side median bus stops |
| 2. | System Run by | DIMTS | PMPNL | Ahmedabad Janmarg Ltd. | JCTSL |
| 3 | BRT Lane Maintenance | NDMC | PMC | Ahmedabad Janmarg Ltd. | JDA + JMC |
| 4 | Work Commenced in year | 2006 | 2006 | 2007 | 2006 |
| 5 | Work ended on | Ongoing | Ongoing | Ongoing | Ongoing |
| 6 | Total Cost (Rs. Lakhs.) | 15300 | 10313.5 | 100000 | 21920 |
| 7 | Kilometers (Planned) | 310 (In 3 phases) | 100.17 | 88.8 | 138 (39 Kms. Sanctioned) |
| 8 | Kilometers (Functioning) | 5.8 (Pilot-I) | 13.6 | 25.5 | 7.1 |

SUMMARY OF BRT SYSTEMS : FUNCTIONAL

| No. | Component | Delhi | Pune | Ahmedabad | Jaipur |
|-----|--------------------------|--|--|---|---|
| 1. | Level Boarding | Available, Partially functional | Available, Non functional | Available, fully functional | Available, fully functional |
| 2. | Ticketing | In Bus | In Bus | On Bus Stops | In Bus |
| 3 | Bicycle Tracks | Available at full length of operational corridor, fully functional | Available at full length of the corridor, partially functional | Available at some portion of the corridor, non functional | Non dedicated, road-marked space |
| 4 | Bicycle track Continuity | Continuous | Fairly Continuous | Discontinuous | - |
| 5 | Footpaths | Available at full length, operational | Available at full length, | Available at some portion of the corridor | Available at some portion of the corridor |
| 6 | Obstruction on NMT | No Obstruction | Obstructed by vendors, parking and SW storage | Obstructed by parking, vendors | - |
| 7 | Crossing Guard | Available | Not Available | Not Available | Not Available |

PLANNING ISSUES

- CMP has been prepared for Pune, Delhi and Jaipur, and not for Ahmedabad
- In Pune and Jaipur CMP has been made after the BRT.
- In Jaipur overlap of BRT Corridor with Metro Corridor because of the bias in favour of metro.
- CMPs are not in alignment with Master-plans.
- Planning processes are fragmented and no attempt to link land-use and transport plans. Example: Post BRT Discussion on increasing FSI in Ahmedabad.
- It is not necessary that FSI increase on BRT corridor under the idea of TOD (Transit Oriented Development) would bring in high BRT ridership - high FSI means high-end housing.

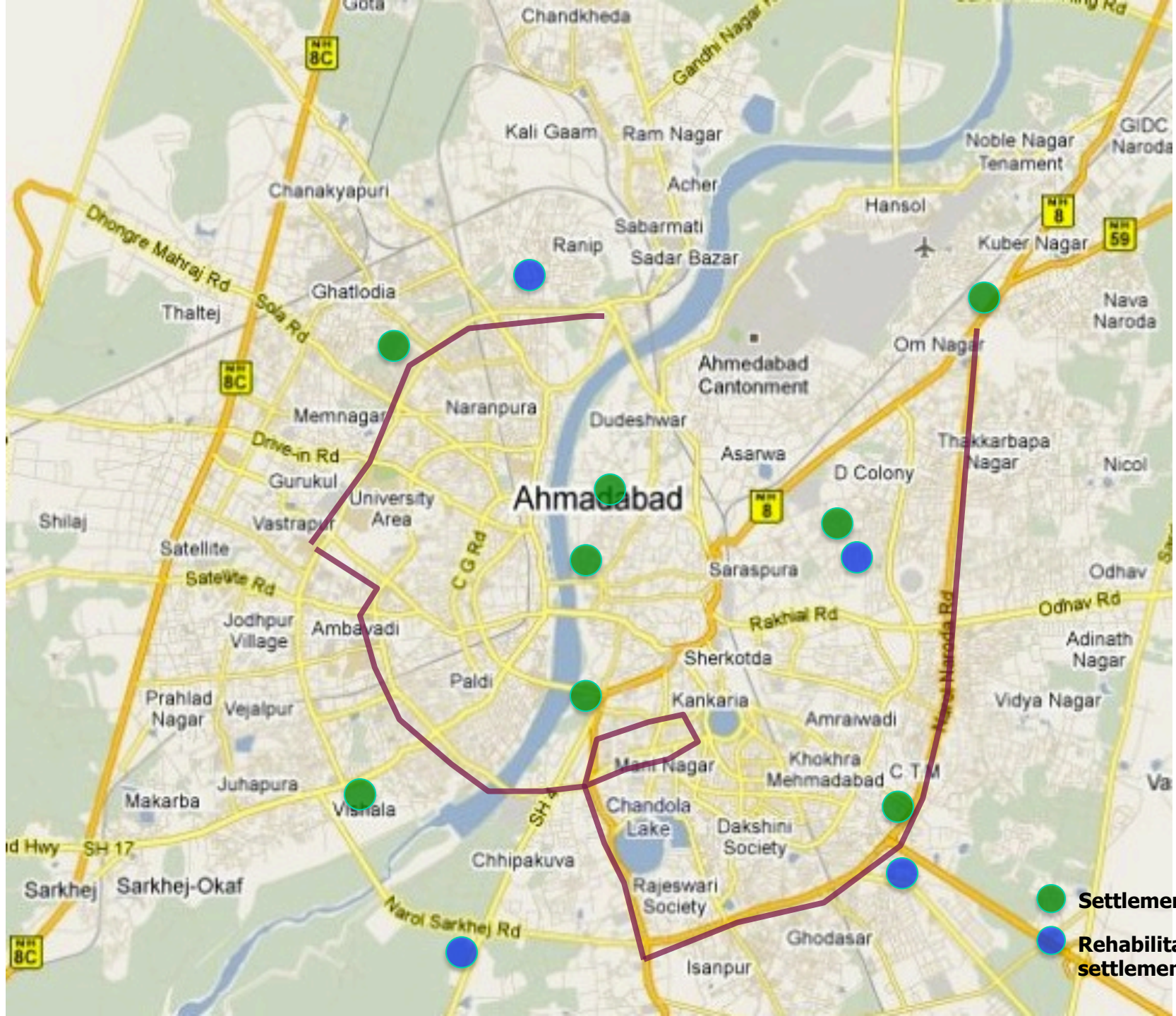
BOTTLENECKS

- Indian urban elites do not want to share urban resources with poor including road space. Hence it take long time for the cities to get convinced on systems like appropriate BRT Model. (e.g resistance to Delhi BRT and selection of the most convenient corridor in Ahmedabad as a pilot.)
- BRT Implementation difficult in dense and old settlements of city, where road widths are already too narrow.
- Enforcement issues, specifically in terms of Parking in the sides.
- Governance bottlenecks, in terms of institutional mechanisms for integrating different transport systems.
- Affordability- Very low Affordability and hence pricing to be more inclusive.

SUGGESTIONS

- BRT systems not to be treated as an exclusive system. Need to integrate existing systems with the new systems in terms of physical access, ticketing and governance mechanisms.
- Adapting BRT in different ways in Indian cities, rather than one defined prototype.
- BRT to be developed, with carefully designed NMT Infrastructure. Inclusion of NMT Infrastructure into BRT Corridor, “*Constructing roads from the sides, rather from the centre.*”
- Inclusion of Vending Activities, along with NMT Infrastructure, bus stops.
- The poor are the most dedicated and captive bus commuters in big cities. Is it possible for make the BRT more accessible to the poor by cutting down the ticket cost? The cost of BRT tickets can exclude people and discourage the use of it.
- Designing emphasis on pedestrian access to BRT stations.

Way forward
as part of this project



- Settlement
- Rehabilitation settlements

| # | Slum settlement Typology/ Direction | Ward | Zone | No fo Hh in settlements | Sample |
|-----------|---|-------------------------|-------------------|------------------------------------|---------------|
| 1 | Southern Core city | Baherampura | South | 750 | 64 |
| 2 | Eastern Core city | Rakhial | East | 997 | 98 |
| 3 | Industrial suburban South- Eastern Periphery | Bagefirdos | South | 320 | 29 |
| 4 | Western Core city | Naranpura | West | 975 | 59 |
| 5 | Western periphery | Vasana | West | 450 | 29 |
| 6 | Core city Rehabilitation | Rakhial | East | 704 | 29 |
| 7 | Western Rehabilitation | Near Akbar Nagar | West | 640 | 35 |
| 8 | Eastern Rehabilitation | Jasodanagar | south east | 672 | 54 |
| 10 | Rehabilitation/ Southern Periphery | Piplaj | South | 600 | 54 |
| 9 | Industrial suburban Northern Periphery | Naroda-muthiya | North | 1040 | 52 |
| 11 | Central core | Shahpur | Central | 350 | 29 |
| 12 | Central core | Khanpur | Central | 500 | 47 |
| | | | | Total | 566 |

Thank You