NEW TECHNOLOGICAL APPLICATIONS/INNOVATIONS IN JANMARG BRTS Ahmedabad & Surat BRTS

An initiative of:
AHMEDABAD MUNICIPAL CORPORATION

Operations:
AHMEDABAD JANMARG LTD.

Technical support : CEPT University, Ahmedabad
JANMARG- A METRO EXPERIENCE ON ROAD THROUGH TECHNOLOGY INNOVATIONS AT 1/20th THE COST

1. Bus Design
2. Bus Station Access
3. Access to Bus
4. Junction Management (Area Traffic Control System)
5. Integrated Transit Management System
   - Automatic Vehicle Location (AVL)
   - Passenger Information system
   - Automatic Fare Collection
6. New Integrated Transit Management System
Bus Design

- Limited capacity with the manufacturers - Available Models in 2008
  - Low Floor (380mm) – High cost of bus, High operating costs, Inefficient movement space inside the bus (Varying levels)
  - Semi Low Floor (650) – Moderate capital costs, Inefficient movement space inside the bus (Varying levels)
  - High Floor (1150mm) – Necessitates high station floor, longer ramps leading to high station costs & constraint on station location
- AMC with technical support from CEPT, after a series of discussions with manufacturers, operators and technical experts and due consultations with state government, MOUD, designed a new bus with 860-900 mm floor height, both side wide central door for Janmarg BRTS
- Bus Cost – Non-AC, Diesel- Rs. 21 lakh and AC-26 Lakh
- Bus is adopted as a standard bus and most cities are considering this as a sustainable option
Bus design: Flat floor

Low floor bus

Janmarg bus – Flat floor

Semi - Low floor bus
Bus Prototypes: Options

Janmarg Bus prototype - I
Janmarg Bus prototype - II
Janmarg Bus prototype – III
Janmarg Bus prototype – III & IV
AIM TO ENHANCE EFFICIENCY THROUGH ITMS IMPLEMENTATION!

Central Operations Centre & BI

Identify

Efficiency Improvement Opportunities

Stakeholder Consultation

Propagate New SOP’s

Efficiency Increase
Integrated Transit Management System

- Automated Fare Collection System (AFC)
  - facilitates purchase of pre-paid tickets and their subsequent use through electronic systems to permit access to/from the transit stations and buses
  - Paper ticket issued, Smart card and tokens to be ready by January 2011
- Automatic Vehicle Location System (AVL)
  - Allows central control room to monitor all vehicles, their performance related to on-time, speed as well as operator performance
  - Two way Information Broadcast service with bus and bus station operators
- Passenger Information System (PIS)
  - Advance information on arrivals, departures, next vehicle, next station display announcements
- Financial Management System (FMS)
- Vehicle Despatch & Scheduling System (VDSS), Depot Management System (DMS), Bus Terminal Management System (BTMS)
Bus Station Infrastructure

Central Contact Centre

Central Data Centre / DRC

Secured VPN Network Access

Network Mug, Station Server

Ticket Office Terminal (POS)

LED based PIS Display for ETA

Flap Barrier with Smart Card / Coin Validator
Bus Station Access

- Bus stations are accessed through ZEBRA crossings
  - Signalised & Synchronized with junction signal cycle (ATC)
- Closed Bus Stations & Off board ticketing
  - Provide safe and secure environment
  - Both side ticket windows
  - Access control through turnstiles/flap barriers
  - Off board ticketing to reduce dwell time, plug revenue leakage
Automatic doors: Components and operations

- Controlled by the driver
- Can be operated only when the bus aligns at designated location
- Built in design redundancy
- Safe user interface
Door Operations: Driver controls

Driver controls – Door operation

Driver controls – GPS device

RFID reader and sensors (non synchronized) at approach

RFID reader and sensors (synchronized) at hault
Junction Management

- Area Traffic Control System in place covering 93 junctions. Additional 55 junctions under implementation.
- Each individual intersection is provided with loop detectors, which are installed beneath pavement layers on each arm.
- If no vehicle plies within a gap time of 3 seconds only, signal turns red.
- Central control centre (Located at Victoria Garden) through Managed Lease Line (MLL) of BSNL play vital role for collection of data, signal coordination, connectivity with server.
- Max Cycle Time – 120 Seconds
- Buses to get priority (2 greens of 12 sec in one cycle)
- For more than 4 arm junctions, 2-phase signal system
Creating holding areas at the junction for right turning movements
Reduction of signal phase from 4 phase (regular) to 2 phase
Need to clear the vehicles at junction faster to increase the capacity
Access to the Bus

• Place for two buses on either side controlled through station door
• Level Boarding (900 mm)
• Floor projection by 250 mm for easy access
• Bus and bus station door controlled through Radio Frequency wireless switch operated by the driver
• Sequence: Bus door opens and then station door opens; reverse order. Complete operations takes 12-14 seconds
• Bus docking controlled through Radio Frequency Identification Device (RFID)
  • Door Alignment – Longitudinal - 400 mm +/-
  • Door Alignment – Transverse (Distance from projection) – 225 mm +/-
  • Acceptable Range – 2 inches (i.e 50mm); Warning – upto 4 inches; Absolute limit – 9 inches (225 mm)
• Applications under development: Warning signal at subways, Depot access
• Docking Control through RFID – First BRTS to Innovate in the world
• Now used by Guanghzou-China, Surat, Pimpri
Fewer lanes to cross to reach BRT station

Synchronized signals for safe pedestrian crossing

Median Station allows for easy transfers

More space for mixed traffic at intersection

Access to Bus stations: Signal synchronization
Access to Bus stations: Pedestrian Signals

Signal phase – 120 seconds
At-level Boarding and alighting and Automatic doors at bus stations
Automatic Fare collection System

• Off board fare collection
• Use of turnstiles
• Use of Smart card (under implementation)
Passenger Information Systems

- LED displays at Bus stations and buses
- Audio announcement systems in buses
- LED and audio announcements inside buses
- LED displays at Bus stations and buses
- Audio announcement systems in buses
Ahmedabad BRT Central Control Facility
Bus equipments Overview

- Mobile Network
- Control Centre
- Data Centre
- GPS Satellite
- GPRS
- Two Way Communication with Control Centre & Driver
- Bus Driver Console
- Control Unit
- Front Display
- In-Bus Display & Audio
- Rear Display
- Central Station
ITMS Integrated View

Bus Station Infrastructure
- Station Server
- Station Card Validator
- PIS Displays
- Station Ticket Terminal
- Communication Interface

Bus Infrastructure
- GPS based Bus Driver Console
- PIS Controller
- 3 PIS Displays
- Communication Interface

Central Control Centre
- AFCS
- AVLS
- PIS
- FMS
- VDSS
- Database Layer for Applications and Central Reporting
- DMS
- BTMS
- IMS

ITMS Integrated View

Secure Communication

Internet

Secure Communication

Near Site Disaster Recovery Center

Enterprise Application Servers with Load Balancing

LAN

DMZ

Firewall
Analysis through Data from Janmarg BRTS Control Room

• Tracking of Services
Analysis through Data from Janmarg BRTS Control Room

• Service Details
Analysis through Data from Janmarg BRTS Control Room

• PIS Monitoring
Analysis through Data from Janmarg BRTS Control Room

• Bunching of Buses
Analysis through Data from Janmarg BRTS Control Room

• Schedule Adherence
Analysis through Data from Janmarg BRTS Control Room

- Schedule Adherence
Analysis through Data from Janmarg BRTS Control Room

- Driver Assignment
Analysis through Data from Janmarg BRTS Control Room

• Fare Management
Analysis through Data from Janmarg BRTS Control Room

- Dynamic Scheduling
Analysis through Data from Janmarg BRTS Control Room

• Real Time Analysis at Control Centre
  – Avoid Bunching of Buses – Two Way Console provides
  – Real Time Scheduling – Demand based Dispatch of buses
  – Safety & Security
  – Monitoring of Service Levels
  – Monitoring Driving Behaviour
  – Monitoring of Speed
Analysis through Data from Janmarg BRTS Control Room

- Speed Analysis
Benefits

• **Improvement in travel speed:** Peak hour speed - 24kmph as opposed to 16-18 kmph of Ahmedabad Municipal Transport service.

• **Mixed Traffic Speeds are also matching with BRTS**

• **Dependable Service/Reliability:** Over 95% of departures & 85% arrivals are on time (+/- 300 sec time).

• **Safety:** Major reduction in accidents on the corridor has been observed.

• **Mode Shift:** Modal shift in favour of BRTS (shift of passengers from motor cycles, cars and 3-wheelers, which is about 50% of the total BRTS users)
• **User Satisfaction:** BRTS got average rating of 9.0 out of 10 in the eleventh month from its users

• **Ridership Increase:** Ridership has increased consistently through eleventh month by 305%. Ridership has gone up to 85-90,000/day.

• **Information Availability:** Real Time passenger information is made available at the stations in the form of electronic signs that show next bus arrival. Announcements in English and Gujarati.
ITS system in Ahmedabad – Implementation Experiences
Technology and Operations Management

1. Technology Selection – Equipment’s, Application Stack, Network, Computing
2. Implementation Experiences & Challenges – Deployment localization, expectation management, skill deployment for operations, Domain Knowledge, SOP, MIS, Maintenance
3. Post-implementation Experiences & Challenges – Manpower quality management, change management, interoperability, Handover strategy
4. Contractual and labour issues
VISUALIZE ACTIVITIES WITH TIMELINES!

**Business / Operational Intelligence and Feedback Measurement**

Learning Process Implementation and Improvement Achievement

Base / Initial Deployment of ITMS

ITMS Creates learning and feedback System.

Short Term
Janmarg Implements ITS System & gets the necessary Traction

Medium Term

Long Term
Intelligence and feedback leads to efficient Processes.

2009 - 2010

2010 - 2012

2013 - Onwards

TIMELINE - ITMS Implementation
360° operational View and Analytics led to efficient decision making process and delivered financial and operational capability to Janmarg to continuously monitor sustainability initiatives.
Operational Efficiency Increased over a period of time due to high predictability and data intelligence input to operations management team.
Technology in Public Transport

• SMAC – Centre
  – SMAC for Intelligent Transport Management System

• Objectives
  – Make transport information easily accessible
  – Ensuring public safety during travel
  – To provide quick responses to incidents
  – Optimize transport operations for timeliness
  – To develop an efficient solid waste management system
  – To develop a rapid response system for fire and emergency services
First city in India to implement city wide common mobility management platform for urban local body and as well as private service operators. Common Incident management platform similar to 911 in The USA.
Technology in Public Transport
<table>
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<tr>
<th>Category</th>
<th>Quantity</th>
<th>Plan for</th>
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<tr>
<td>BRT</td>
<td>160</td>
<td>400</td>
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<td>City Buses</td>
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<td>300</td>
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<td>Control Centre &amp; DR</td>
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<td>Depots / Terminals</td>
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<td>School Bus</td>
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Integrated Fare Management

• Automatic Fare Collection
Integrated Fare Management

• Automatic Fare Collection - S-Connect Card Services

- Transport Service
  - BRT Service
  - City Bus Service
  - Pay & Park Facility

- Recreational Facilities
  - Science Center
  - Nature Park
  - Aquarium

- Membership based facilities
  - Sports Center
  - Swimming Pool
  - Library

- Other Services
  - Hospitals & Health Centers
  - Students
  - Anganwadi
  - EWS/LIG Houses
  - Reading Room
  - SAFAL Reg.
Surat Municipal Corporation

AFCS Contract
- Supply, Installation, Operation and Maintenance of Hardware and Software

Payment
(a) Upfront payment for Supply and Installation.
(b) Monthly O&M Payment
   1. Maintenance of Hardware and Software.
   2. Manpower for Control Operations

7 years Contract including O&M
Integration of Smart card is joint responsibility with SMC

AFCS Service Provider

Risk
- Supply and Installation
- Operation and Maintenance
- Integration with SBI and Card Service Provider is a Joint responsibility
- Sharing of API and Protocols are part of deliverables
- Compulsory Post Termination – Transition Management Support

Responsibility Includes
- Providing Bus Stations, Control Center space, rolling stocks
- Deploying Manpower for Fare Collection
- Facilitating Coordination among AFCS Service Provider, Bank and Card Service Management Provider
- Bearing Communication and Electricity Charges
- SLA – Performance Monitoring

Project Implementation and Foreign Exchange Risk
- Fare Collection and Vandalism Risk
- Deploying Manpower for Fare Collection
- Facilitating Coordination among AFCS Service Provider, Bank and Card Service Management Provider
- Bearing Communication and Electricity Charges
- SLA – Performance Monitoring
Technology in Public Transport

- List of Open Standard
  - Interoperability
  - Increased Competition
  - Future Expandability
  - Lower Costs
  - Increased Transportation System Integration

- City government shall publish a city API, which shall be made available to enable developers to design new and innovative solutions using common platform of GIS and Mobility Management leading to a new era of citizen oriented innovation and participation.
thank you