public transportation optimization

Mentored By

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Talking Transit: Use of Information Technology (IT) in Modernizing City Bus Services

Presentation on

Use of IT in Data Collection and Optimization of Public Transport Operations

Samir Sharma, Vice President
Delhi Integrated Multi-Modal
Transit System Limited (DIMTS)



DIMTS - Specialized Company in Urban Transport Space

Delhi Integrated Multi-Modal Transit System Ltd. (DIMTS) is an ***urban transport*** and ***infrastructure development*** company set up in 2007 with a sharp focus **on improvement initiatives in urban transport infrastructure**

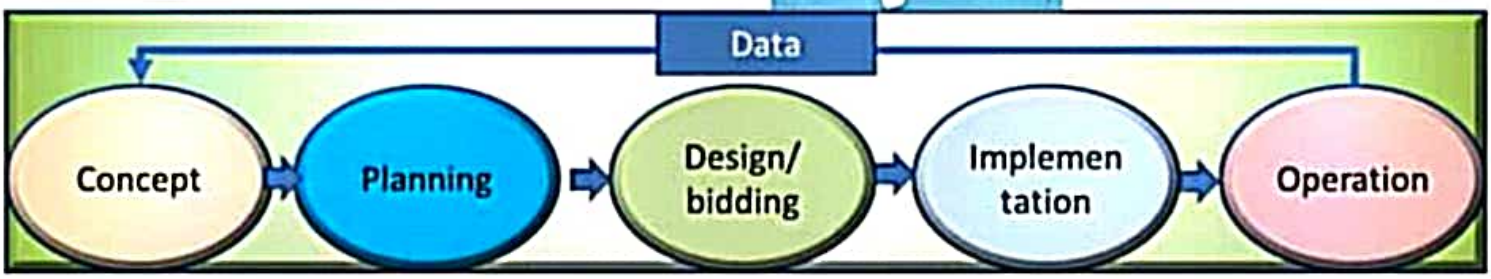
Transport Planning	Advisory Services	Engineering	Operations	Transport Technologies
• Comprehensive mobility planning • Urban Mass Transit Corridor Planning and Design • Traffic modelling and simulation • Public transit route planning, scheduling	• Feasibility Analysis • Project Structuring • PPP Advisory • Bid documentation • Bid process management	• Design • Project Management • Construction Supervision • Independent Engineering Services Railways • Alignment and Track design • Signaling	• Bus Concession Management • BRT Corridor Management • Operations Control Centre • Smart-card issuance management	• Automatic Vehicle Location • Electronic Ticketing • Passenger Information Systems • Mobile Applications • Intelligent Signaling and Traffic management systems

Equal equity partnership of

Government of National Capital Territory of Delhi (GNCTD)

IDFC Foundation (a not-for-profit initiative of IDFC Ltd.)

Projects and clients across 14 states in India and 5 countries



City Bus Service in India

Road Transport Corporation Act (1950)

Formations of STUs (54 no.s)

National Urban Transport policy (2006 / 2014)

JnNURM Scheme (2009/13)

AMRUT Scheme (2015)

Bus procurement guidelines and Bus Funding for Cities

Focus on improvement of PT to achieve mode shift

Old Traditional methods of bus operation & management

Inadequate Service / Fleet Capacity

Low maintenance /irregular maintenance

Unreliable Service & Irregular Frequency

Poor Route Network Coverage & Inadequate stoppages

Excessive Fares

Willingness to pay

No Profitability & Viability

Poor Quality of vehicles & Poor customer satisfaction

Status of City bus service in India:

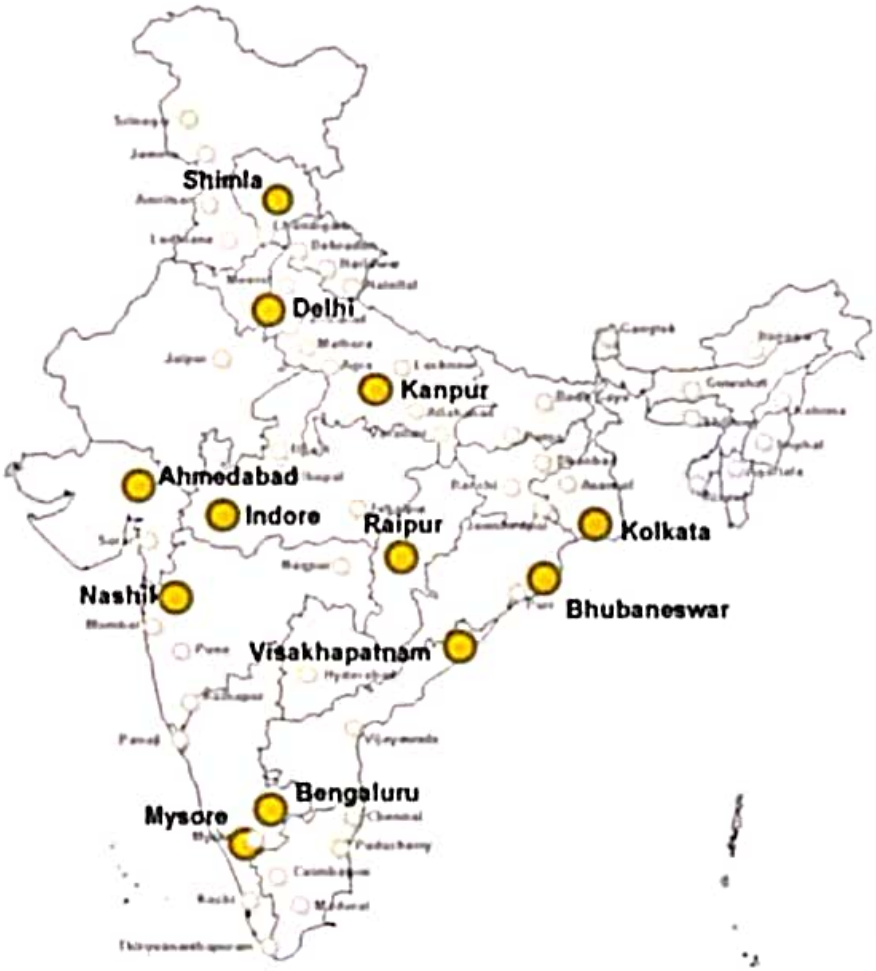
- Unable to meet the requirements of the majority of the public due to inefficient Bus transport in Cities in India.

Inefficient City Bus Transport in cities leading to:

- Imbalance in modal shift (Public preferring private mode - TWs & Cars).
- Environmental issues – Increase of energy requirements and Pollution.
- Higher costs – Improper Bus transport planning leads to higher operations costs & thereby losses.

Considering this situation, Shakti Sustainable Energy Foundation has taken up this initiative to identify policy road map for improvement of city bus system in various cities.

Policy Road Map for Urban Bus System in India



- Analysis of existing processes of Bus Companies In India
- Project being done with Support From Shakti Foundation

Use of Data in Public Transport Operations

Route Planning and Route Rationalisation

Concession Development & Award

Service Deployment and Optimisation

Service Monitoring

Service Delivery and Maintaining Level of Service

Vehicle & Crew

Users

Infrastructure

Use of Data in Public Transport Planning & Operations

Sl. No	Cities	Components						
		Population	No. of Buses	GPS availability*	ETM availability**	Route Planning***	Time Table preparation****	Schedule Optimization*****
1	Delhi	16787941	5834	Yes	Yes	software	GPS	Manual
2	Kolkata	14035959	632 (JnNURM)	No	No	Manual	Manual	Manual
3	Bengaluru	8520435	6603	Yes	Yes	Manual	GPS	Software
4	Ahemadabad	6361084	1209	Yes	Yes	Software	GPS	Manual
5	Kanpur	2920496	270	No	Yes	Manual	Manual	Manual
6	Mysore	920550	445	Yes	Yes	software	GPS	Software
7	Bhuwaneswwar	885363	185	No	Yes	Manual	Manual	Manual
8	Raipur	1122555	100	Yes	Yes	Manual	Manual	Manual
9	Vishakapatanam	1730320	654	Yes	Yes	Manual	Manual	Manual
10	Shimla	169578	169	Yes	Yes	Manual	Manual	Manual

* Yes, No ** Yes, No ***Judgment/Manual or Data-Based/Software **** GPS time/Software or Manual *****Use of ETM or Manual

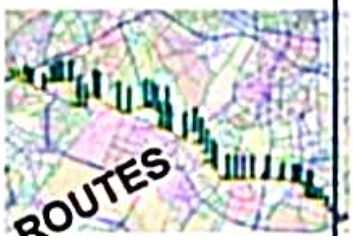
Use of Data in Public Transport Operations

Route Planning and Rationalization

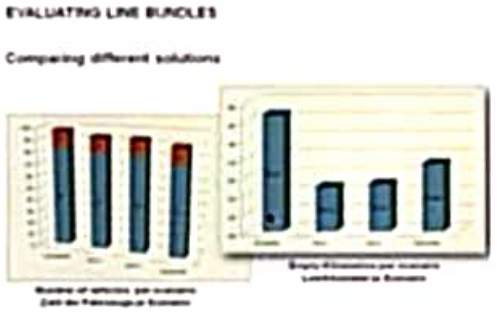
Understand Market & Users (O – D Data, Trip Characteristics and Demand Profile)

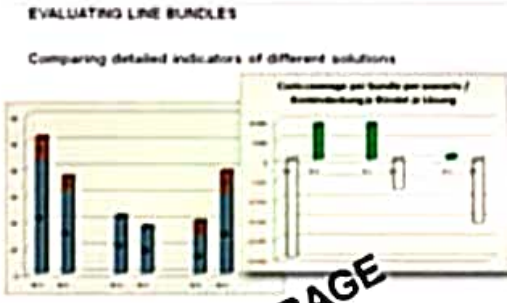
Network Structure & city generators (Route Mapping)

Route Performance



Concession Development & Awar



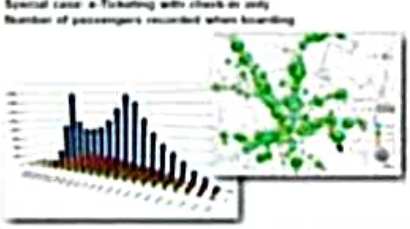


Use of Data in Public Transport Operations

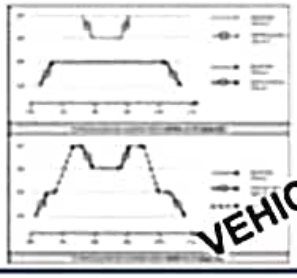
Service Deployment and Optimisation

Time Table Optimisation (GPS Run Time)

Frequency Optimisation (E ticket data)



Fleet Optimisation(Interlining)



VEHICLES

Service Monitoring & Payments

Monitoring KPI in concession Agreement from GPS data and making payment

CONCESSIONS

Service Delivery & LOS

- **Excess Wait Time**
- **Occupancy / Crowding**
- **Public Transport Accessibility**

USERS

Route Planning & Rationalization

Route Planning Practices – Various Cities

Delhi

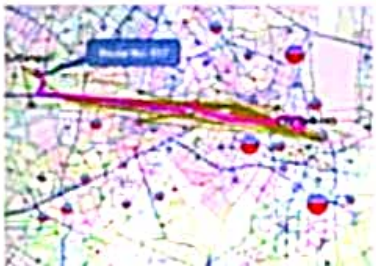
- Delhi Public Transport Model was frequently used for initiating new routes and for changing route alignment
- All Routes were mapped in GIS based transport planning software
- Origin Destination and User preference surveys done to determine
  - For New routes
  - Express routes
  - AC/ Premium Service
  - Feeder service
- Route Rationalisation : Route Modifications

Mysore

- Public Transport modelling for route rationalisation based on cube voyager. Route diversions based on desire-lines. Result of implementation was:
  - Performance of some routes improved.
  - Some routes were retained on original structure

Indore

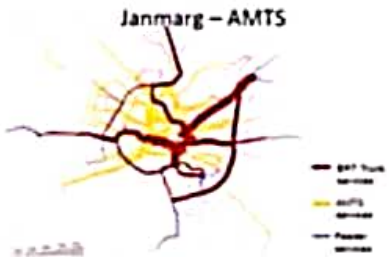
- Planning to carry out a detail review of all bus routes and route network to suggest improvements as well as new bus services, routes and route network for the city based on
  - Detail OD pattern & passenger surveys
  - Network Mapping



Route Planning Practices – Various Cities

Ahmedabad

- Ahmedabad also developed a trunk – feeder bus scheme but could not implement it entirely due to public opinion on direct routes
- Jan-Marg also developed " Feeder Route system based on passenger " Origin – Destination " data for BRT system as well planning for route extensions in non – BRT segments



Bangalore

- Bangalore used passenger profiles and bus route network to develop Trunk – Feeder Bus Network named " BIG - 10" which is implemented

Raipur

- Raipur is also carrying out a route planning and service planning exercise for starting operation of BRT based on passenger profiles & related data

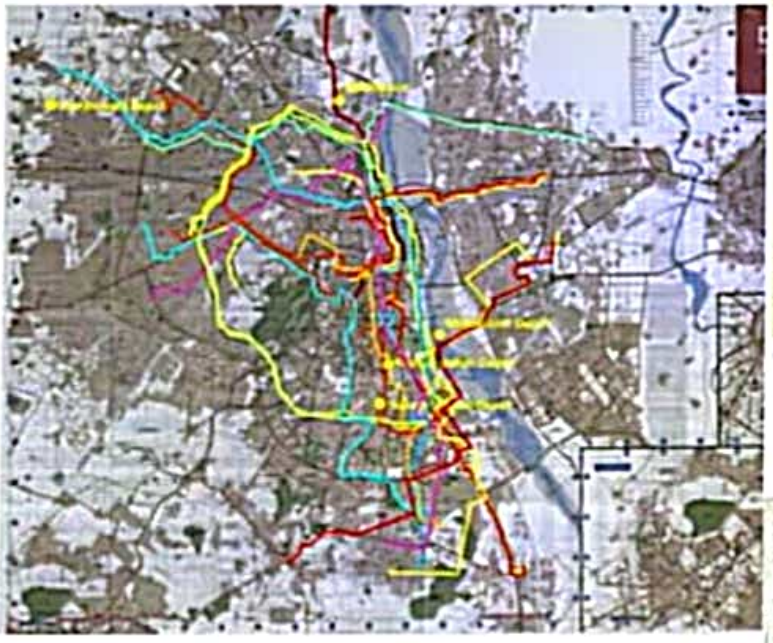
Route Planning Practices – Outcome & Experience

- Mysore Reported Benefits of Improvement in Route Performance using O/D Data and PT network Models. Almost 60 % routes modified got benefited after implementation.
- Delhi Cluster Routes Segment planning also reported improvement in route performance

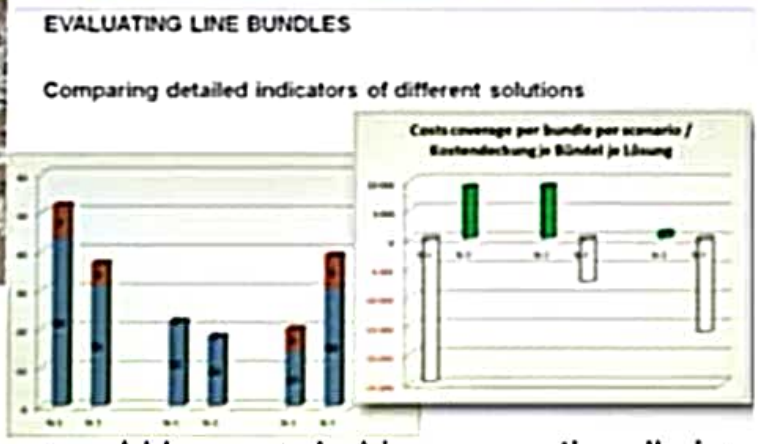
Concession Development/Route Clusters

Concession Development/Route Clusters – Various Cities

- Development of Route Clusters for Private concessions was done based on data and analysis in Delhi Cluster Scheme. Though it was done with limited database it helped to develop balanced cluster scheme



- **Most of Cities use judgement, local knowledge and limited data for route award to private concessions.**
- **Use of data provides information on likely profitability, number of buses, dead kilometres etc**

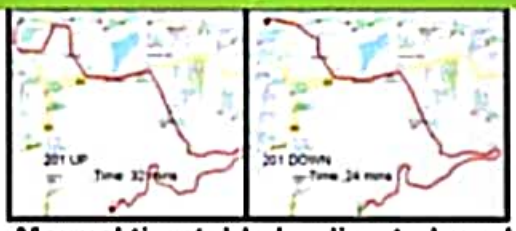


- By use of proper data, private concessions could be awarded in more rationally in our cities. **Delhi Cluster Scheme designed using Data & Network of city**

Service Deployment and Optimisation

Service Deployment and Optimisation

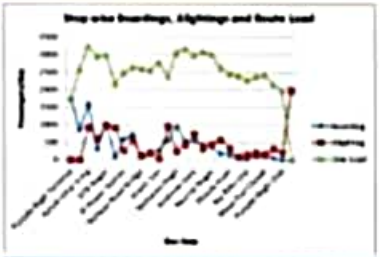
- Use of GPS Data for Realistic **Trip Time for Time Table** Preparation in peak and lean hours



- Manual timetable leading to bunching, unreliable operations and traffic jam

- Mysore, Delhi, Ahmedabad, Bangalore,
- (New Approach helped optimising schedule, Maintaining on ground schedule by crew, Reducing Stress to Crew)

- Use of ETM Data for **Frequency Adjustment**



- Mysore, Delhi, Ahmedabad,

- **Timetable deviation** on map can be viewed with yellow- late, red – early, Green – on time
- **Bunching** is Monitored from control centre
- Same day **Feedback** is given to Driver on his performance based on data

Driver wise analysis on speed, sudden acceleration

Mysore
Partly Delhi

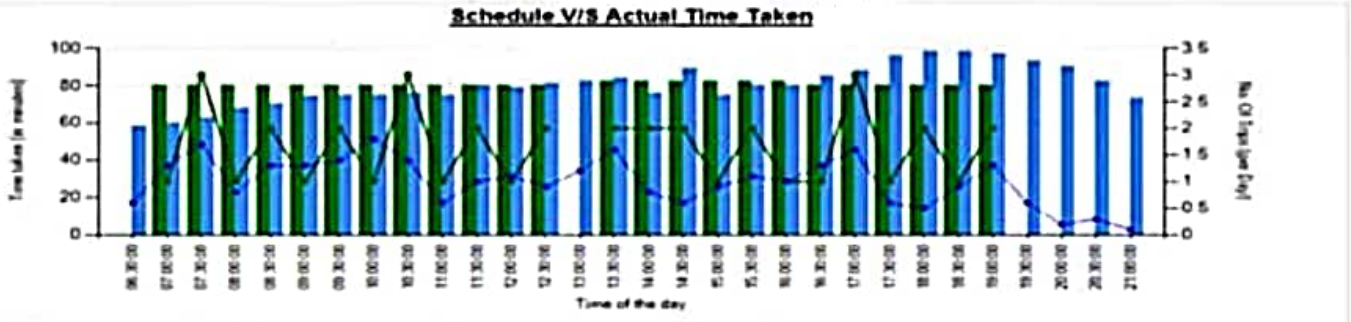
Benefits Experienced by Mysore in Schedule Optimization

Mysore Also used certain software's to carryout these Analysis/Time Table Preparation

Volvo	Schedule	Schedule Kms	Trips	crew	Duty Hours	Ot Hours
Before	8	1344	112	23	78:00:00	14:00:00
After	8	1344	112	23	72:00:00	8:00:00
	0	0	0	0	6:00:00	6:00:00
Ordinary	**Schedule**	**Schedule Kms**	**Trips**		**Duty Hours**	**Ot Hours**
Before	8	1799.6	146	29	93:05:00	11:25:00
After	5	1459.2	124	21	73:20:00	0:00:00
	-3	-340.4	-22	8	20:15:00	11:25:00

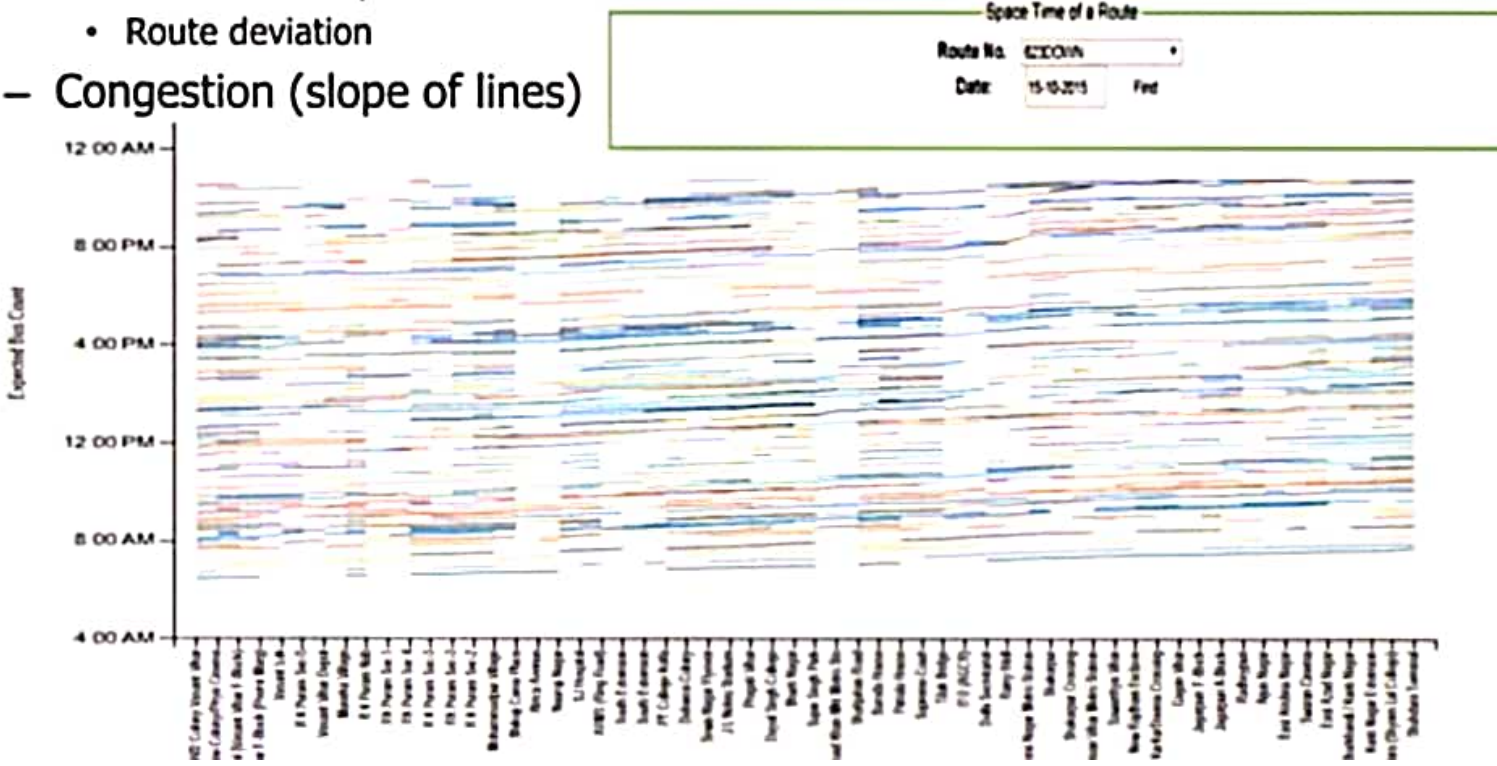
Trip Analysis: Cluster Bus Delhi

- Actual vs. Schedule time taken at various hours of the day by the buses plying on route
- Actual Trips Completed vs. Scheduled no. of Trips at various hours of the day
- Trip Completion analysis for different Duty along with Variance between Actual Start time of trips and Schedule



Route Bunching Analysis- Cluster Bus Delhi

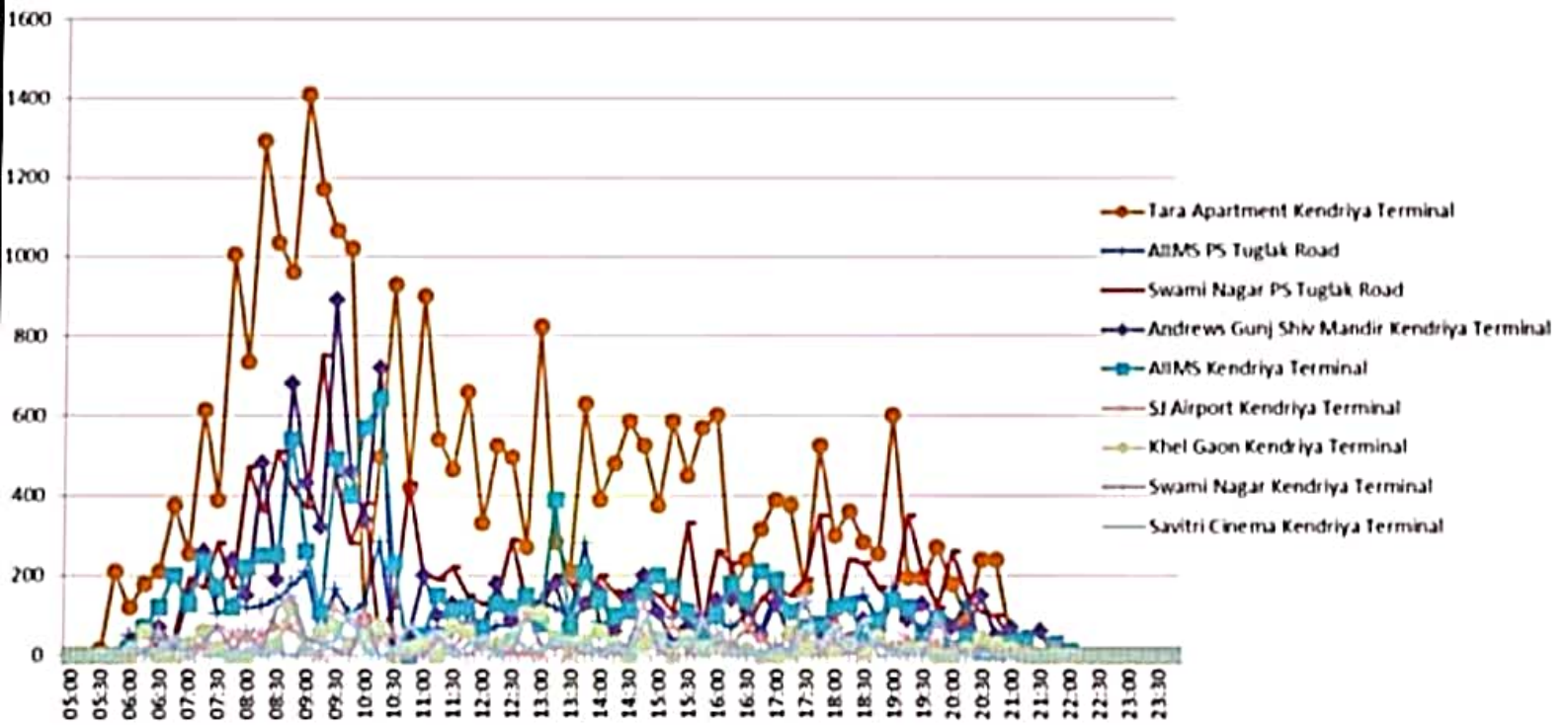
- A Graph between Route Geometry and Time of the day for all Buses of a particular Route
- Can be used for (real time)
  - Bunching Analysis
  - Gaps in graph
    - Missed bus stops
    - Route deviation
  - Congestion (slope of lines)



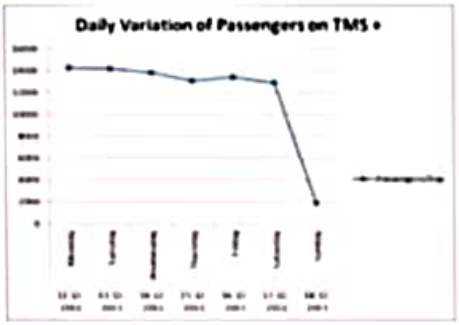
Analysis of ETM Data : Cluster Bus System

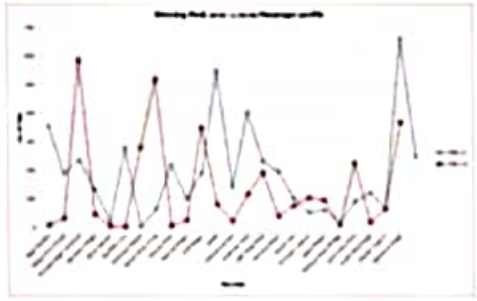
Detailed Analysis of Low Ridership Sectors

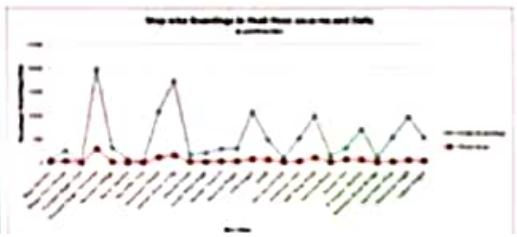
Revenue Generation Rate 540DN for O-D Pair Beyond SJ Airport to Central Secretariat segment

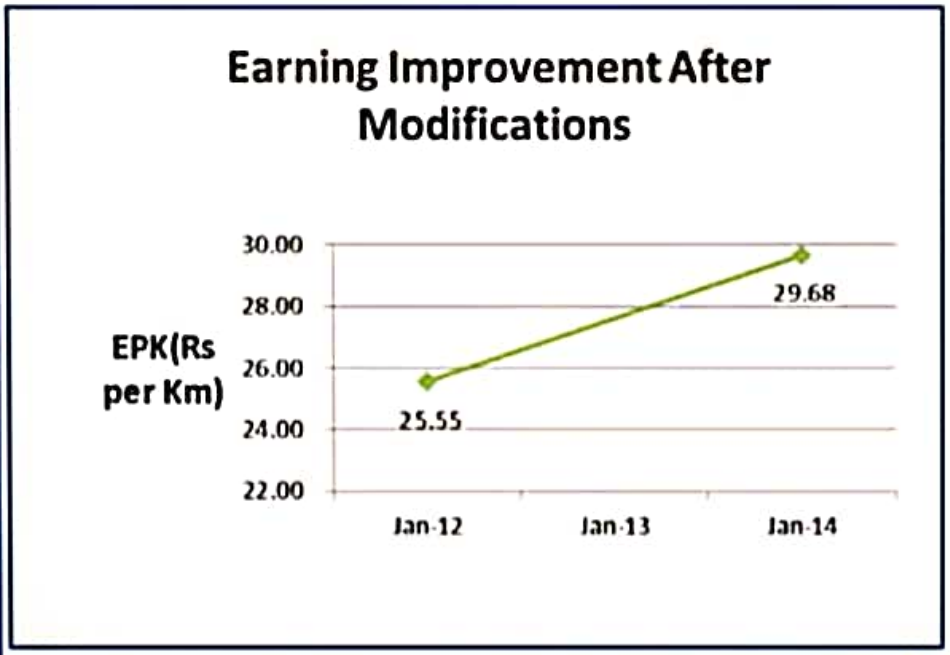


Service Optimisation Benefits - Delhi Cluster









Service Monitoring : KPI of Concessionaires

Service Monitoring : KPI of Concessionaires (Delhi)

GPS based Automatic Vehicle Location (AVL) System has been deployed on all the buses. System is being used to monitor operations of the fleet

Performance Incentive Regime

On-time benchmark	Payment for service exceeding minimum performance standards	+ ₹

Penalty Regime

Missed Trips	Deduction for service not operated due to factors within operator control	- ₹
Other Infractions	Deduction for proportion of service operated by vehicles meeting set standards	- %
Delayed Trips	Deduction for service failing to meet minimum performance standards	- %

Alerts Dashboard manages alerts and responds to deviation/violations

- Over-speeding reports
- Depot, vehicle and route wise reports
- Missed stops reports
- Route deviation reports
- Trip status reports (Cut/Short/Missed)
- Distance travelled

Performance of Cluster Buses

	Unit of Measurement	Cluster Buses
Km Efficiency	%	91.23
Fleet Utilization	%	93.48
Vehicle Utilization	Kms / Bus / Day	218
Gross Earning	INR / Bus/ Day	7528
Gross Cost	INR / km	40.8
Accident Rate	Number / Lakh Km	0.02

- **Use of Data Analytics Delhi Cluster Scheme is able to achieve :**
  - **Improving Efficiency**
  - **Improvement in Ridership & Revenues**
  - **Improvement in User Satisfaction**

Service Delivery and Maintaining Level of Service for Users

Service Delivery and Maintaining Level of Service for Users

• Information System Like Journey Planner, Mobile App	Most of the cities are in the process of developing Mobile App. Delhi is having App " Poochho" which gives data on " Seat Availability"
• Analysis of Excess Wait Time	None of the city is doing it. However, some cities are conducting user satisfaction surveys
• Occupancy and Crowding	None of the city is doing it. However, some cities are conducting user satisfaction surveys
• Transfers	None of the city is doing it.

Some International Experiences