Planning and Scheduling Solutions for Public Transport Operations Optimization In the Indian context
LUMIPLAN GROUP

160
Permanent Employees

Lumiplan Group

Lumiplan India, Bangalore
20
Permanent employees

Mountain

Transport

City

Sport & Leisure

160 Permanent Employees

40 years experience in Public Transport and ITS project

6% of our turnover is reinvested every year in Research and Development

2 000 International / Government Customer
OUR PUBLIC TRANSPORT MISSION

• Improve commuters services, attract more passengers

• Enhance performance and profitability for transport authorities

• Deliver end-to-end its solution through cutting edge technologies

• Share our expertise & support, based on a long experience

The Right information for the Right people at the Right time with Right Accuracy to the Right Place
AGENDA

Introducing Indian Context
What is Planning and Scheduling?
Study cases
Benefit
1. PLANNING & SCHEDULING - INDIAN CONTEXT
HOW CAN WE IMPLEMENT AN EFFICIENT URBAN TRANSPORT SERVICE?
NETWORK ORGANISATION

Cities

Transport Network

Optimization of your Urban Transport Offer
How to plan the right **Vehicles Investments** – JnNURM scheme?

How to plan and optimize the **operations** - ITS context?

How to plan and evaluate the **service to commuters** - PPP Model?
HOW TO PLAN THE RIGHT VEHICLES INVESTMENTS?

INVESTMENT: Vehicles purchasing STU or fundings like JnNURM-2 scheme

- How to predict the right number of vehicles to purchase?
- The Decision Makers need a support for investment decision making
- Examples: opening of a new route, increasing frequencies on existing routes…
  How to calculate the needs of new vehicles?
- STUs and Central Government can use a Common Platform
- Estimate also the additional costs of running new vehicles
  - Staffing, Parking, Maintenance, Fuel…
SUPPORT FOR FUNDING DECISION MAKING - JNNURM

Central Government

New Vehicles

Purchase the right number of Vehicles

Anticipate operational costs

STU

Thanks to Fleet Planning Solution
Common Platform for central and local bodies
7. Optimize the planning

**Planning/Scheduling**

<table>
<thead>
<tr>
<th>Tn + 1</th>
<th>Tn + 2</th>
<th>Real-time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Re-optimization</strong></td>
<td><strong>Optimization</strong></td>
<td><strong>GPS/GPRS Fleet Tracking</strong></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Stop</th>
<th>ETA</th>
<th>ETD</th>
</tr>
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<tbody>
<tr>
<td>Stop 1</td>
<td>600</td>
<td>700</td>
</tr>
<tr>
<td>Stop 2</td>
<td>605</td>
<td>707</td>
</tr>
<tr>
<td>Stop 3</td>
<td>611</td>
<td>714</td>
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<tr>
<td>Stop 4</td>
<td>614</td>
<td>719</td>
</tr>
</tbody>
</table>
How to plan and evaluate the service to commuters?

Service Level Agreement
Timetables / Frequencies

Performance Evaluation for Schedule Adherence

Fees on kilometers

Resources Optimization to implement the timetables
2. WHAT IS PLANNING & SCHEDULING?
WHY PLANNING/SCHEDULING BEFORE FLEET MANAGEMENT SYSTEM?

The “I want a house” Diagram
Affectation of physical resources to the duties
Daily and real-time operations
Produce clear and optimized ROSTER Planning
Integrate vehicle maintenance / depot management

Integrate network (GIS enabled) and constraints like desired frequencies, bus occupancy, travel times...
Mathematical calculations based on statistical data
Produce reliable and optimized TIMETABLES

Integrate legal policies & working rules
Integrate financial parameters (extra hours...)
Produce optimized form IV
Reduce errors, buffers and additional costs

Integrate network (GIS enabled) and constraints like desired frequencies, bus occupancy, travel times...
Mathematical calculations based on statistical data
Produce reliable and optimized TIMETABLES

Integrate legal policies & working rules
Integrate financial parameters (extra hours...)
Produce optimized form IV
Reduce errors, buffers and additional costs
Travel Time Analysis at different time of day
TRIP PLANNING - TIMETABLES

Automatic Report
KM per day / Driving hours / Working hours / Frequency / No of bus required

Comparison report – Line nº 001A

<table>
<thead>
<tr>
<th>HASSAN 2011</th>
<th>HASSAN 2011</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday – Sunday</td>
<td>Monday – Sunday</td>
<td></td>
</tr>
<tr>
<td>with 3 buses 3min buffer</td>
<td>with 3 buses 5min buffer</td>
<td></td>
</tr>
</tbody>
</table>

| Usable kilometres            | 359.600                      | 285.200          | +74.400 |
| Deadrun kilometres           | 16.350                       | 13.500           | +2.850  |
| Total kilometres             | 375.950                      | 298.700          | +77.250 |

| Commercial time              | 29:00                        | 23:06            | +5:54   |
| Deadrun times                | 1:30                         | 1:15             | +0:15   |
| Driving time                 | 30:30                        | 24:21            | +6:09   |
| Buffer time                  | 9:41                         | 15:11            | -5:30   |
| Total work time              | 40:11                        | 39:32            | +0:39   |

| Buffer/Driving percentage    | 31.75 %                      | 62.35 %          | -30.61  |
| Buffer/Work time percentage  | 24.10 %                      | 38.41 %          | -14.31  |

| Commercial                  | = Duration of trips + Loading time |
| Deadrun                     | = Deadrun duration + Duration of deadrun trips + Turning short time |
| Buffer                      | = Buffer time                  |

Average speed of blocks      | 9.36 km/h                     | 7.56 km/h        | +1.80 km/h |
| Line speed                  | 9.30 km/h                     | 7.45 km/h        | +1.85 km/h |
Fleet tracking solution

Display

Export

TRIP PLANNING - TIMETABLES

Edit timetables
Print
Internet
Publishing

Timetable for Commuter

Heures Presentation for India – LumiPlan – July 2012
### 2. CREW SCHEDULING - DUTY

**DRIVER Planning – Form IV (Customized to your format and local language)**

<table>
<thead>
<tr>
<th>Line</th>
<th>Start of duty</th>
<th>Block</th>
<th>Vehicle</th>
<th>DEPOT</th>
<th>Arrival</th>
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<tbody>
<tr>
<td>1</td>
<td>OBS1 06:27</td>
<td>NBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>DSK 06:41</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>KA1 07:14</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>DSK 07:43</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>KA1 08:14</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>DSK 08:45</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>KA1 09:21</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>DSK 10:02</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>KA1 10:46</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>DSK 11:18</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>KA1 11:59</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>DSK 12:29</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
<tr>
<td>1</td>
<td>KA1 13:04</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
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<tr>
<td>1</td>
<td>DSK 13:34</td>
<td>OBS1</td>
<td>OBS1</td>
<td>OBS1</td>
<td>NBS1</td>
</tr>
</tbody>
</table>

**Translation:**

Duty start at: 06:02
Duty ends at: 14:14
Working Hours: 06:12
Driving Hours: 06:21
Distance: 125.1
Extra hours: 00:12
Pause: 00:15

Comments:
- DSK DASARAKOPPLU
- OBS1 OLD BUS STAND
- KA1 KIADB
- NBS1 NEW BUS STAND
3. RESOURCE MANAGEMENT - ROSTER

Roster Groups
Specific parameters for each resource and each type of day
Funds management
Extraction of driver planning’s

Daily operations - drivers
Leaves, absenteeism...
Permutations
Quality indicators

Daily operations - vehicles
Maintenance
Depots
STATISTICAL DECISION MAKING TOOLS

Permanent analysis & optimization

- Working hours extraction
- Financial analysis
- Extra hours policy...
- Customer service analysis
- Customized reports
- Link with ITS solution

- Extraction of indicators for Managers
- Integration of fleet tracking data
DECISION MAKING SUPPORT

Planning
Scheduling
Reporting

Continuous Optimization

Possible Integration with ITS, Ticketing, HR, SAP...

- Long Term Strategic Decisions
- Short Term Operational Decisions
- Detailed Real-Time Decisions
- Statistics
PLANNING & SCHEDULING BENEFITS

- **Commuters Satisfaction**
  - Reliable Timetables -> Adapted to passengers needs
  - Support for Passenger Information Systems

- **Process Efficiency**
  - Decision making tools for investments
  - Constant Operations optimization

- **Operational Costs**
  - Saving on fuel and crew utilization
  - A better service with less resources

- **ITS Integration**
  - Reliable data
  - Better statistics

Attract more Passengers
Rationalize Operations
Optimize Crew / Vehicle
Less fuel consumption
3. STUDY CASES
STUDY CASE: PENANG, MALAYSIA, 2011

44 routes
350 buses
500 Drivers

Situation before HEURES implementation

- Low adherence to schedules
- Duties allocated twice or not allocated
- Driver working time not homogeneous
- Drivers gets their planning only for next 2 days
- No relevant and detailed information to monitor the situation in real time
STUDY CASE: PENANG, MALAYSIA, 2011

- 1. Installation and Training on the Planning module (1 ½ week)
  - 3 people of Lumiplan trained 15 people of Rapid Penang
  ➔ Fill the Planning module (5 weeks)
    Rapid Penang people alone with the support of 1 Lumiplan

- 2. Training on the scheduling module (1 ½ week)
  - 2 people of Lumiplan trained 10 people of Rapid Penang
  ➔ Fill the Scheduling module (5 weeks)
    Rapid Penang people alone with the support of 1 Lumiplan

- 3. Training on the Daily management module (1 ½ week)
  - Rapid Penang people alone with the support of 1 Lumiplan
  ➔ Fill the Scheduling module (5 weeks)
    Rapid Penang people alone with the support of 1 Lumiplan

  ➔ Validation of the solution

- 4. Support of Rapid Penang by Lumiplan during 1 year
Measured benefits after 2 months

- All relevant data **integrated** in HEURES (rules, constraints, travel time…) without error
- **Accurate** Timetables
- **Optimized** allocation of resources (drivers and vehicles)
  - Ex: on the main route, **26 buses instead of 30**
  - A new route is opened with the same number of buses
- **Better schedule adherence**
- Decision making process thanks to **simulations** (scenarios)
- **Homogeneous** and fair Drivers Planning
- **Better control** of the actual operational costs, anticipating future changes

**FAST RETURN OF INVESTMENT**
1 new Route, 8 Buses
- 6 Buses on full Route
- 2 Buses on busy Section

Before the pilot project:

Total number of km = 1500 Km/Day
Total revenue per day = 44 500 INR / Day
  - Revenue / KM = 29.50 INR
Total expenses per day = 45 270 INR / Day
  - Cost / KM = 30 INR
STUDY CASE: PILOT IN HASSAN, (KSRTC)

Thanks to the Heures solution

- We made Several Scenarios
- KSRTC Choose 1 Scenario to Implement

 KSRTC Report

[Table and image related to KSRTC operations]
STUDY CASE: PILOT IN HASSAN, (KSRTC)

For 6 Buses (Long Routes)

<table>
<thead>
<tr>
<th></th>
<th>Existing form 4 (7 to 9 June)</th>
<th>Lumiplan form 4 (10 to 12 June)</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total KM</strong></td>
<td>3486 KM</td>
<td>3177 KM</td>
<td>- 3%</td>
</tr>
<tr>
<td><strong>Total Revenue</strong></td>
<td>98717 INR</td>
<td>96905 INR</td>
<td>- 0.6%</td>
</tr>
<tr>
<td><strong>Total Passenger</strong></td>
<td>22 269</td>
<td>22 164</td>
<td>- 0.1%</td>
</tr>
<tr>
<td><strong>EPKM</strong></td>
<td>28.318 INR</td>
<td>30.502 INR</td>
<td>+ 7.7%</td>
</tr>
</tbody>
</table>

- 2000 INR on Fuel Expenditure

364 INR Per Bus Per Day

- Not enough buses and routes to highlight the benefits of an Automated Solution
- Good adaptation to local constraints (language, working rules…)
- Good adaptation to planning rules and ground staff (training remains a challenge)
- Difficult to evaluate the results as it was a new service (commuters not used to Public Transport)
STARTING A PROJECT IN MYSORE, KSRTC UNDER FASEP FUND BY FRENCH GOUVERNEMENT

MYSORE

- Around 500 buses
- Around 1 M inhabitants, 3 M+ tourists per year
- Mysore KSRTC operation Staff around 2000 people
- 250 000 passengers carried per day
- ITS - launched on 17th November 2012.

9 months for implementation and evaluation of the solution

- Indicators analysis (KPI)
- Data Collection and Integration in Heures, Training
- Creation of Scenarios for Operations Optimization
- On the field implementation
- Evaluation of the indicators after implementation
BENEFITS OF PLANNING & SCHEDULING

Improvement of commuters **services**
- More Passengers
- “More Revenue”

Improvement of internal **process**
- Resource Optimization
- “Less Cost”

Improvement of operational **efficiency**
- Less kilometers, fuel
- “Sustainable”
Thank You For Your Valuable Time

LUMIPLAN ITS INDIA Pvt. Ltd.

HERVE BEAUDET
CEO – ASIA

#93, 3rd Main Road, 1st Block,
R.T. Nagar, 560032
Bangalore, India
Tel: + 91 80 42 35 22 82

DAVID MOSZKOWICZ
MANAGING DIRECTOR - INDIA

#93, 3rd Main Road, 1st Block,
R.T. Nagar, 560032
Bangalore, India
Tel: + 91 80 42 35 22 82

www.lumiplan.com
RECENT LUMIPLAN P&S PROJECTS

Product: HEURES

50+ active customers in Europe

Malaysia
- 350 buses in Penang in 2011
- 1600 buses in Kuala Lumpur in 2012 – extendable to 3000+ Buses
- 160 buses in Johor Bahru in 2012 – extendable to 500 Buses
- 500 buses for 5 cities under deployment in Malaysia (Ipoh, Kuantan, …)
- 750 buses in Jakarta … SOON

India
- 1 pilot project in Hassan (Karnataka) with KSRTC
- Starting a project in Mysore for KSRTC (500 buses)
SOME CHALLENGES

Change Management
- From the ground staff / drivers to enhance schedule adherence
- From the Planners to use an advanced software (support must be provided by vendors)
- From the Management to improve KPI

Integration with other IT Systems
- Electronic ticketing
- Fleet Traking and PIS
- Depot, Vehicles and HR Management

Need to be user friendly