Feed forward mechanism in public transport

Data driven optimisation

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Developments in industry

- Focus on cost efficiency
- Customer focus
- Enhanced quality

Main challenges:
Increasing cost efficiency
Increasing customer experience
Motivating new strategic investments

- Data enable achieving objectives
Operations and feedback

- Long term feedback loop
  - Strategic
  - Tactical
  - Operational

- Real-time feedback loop
  - Driver/Control room

- Long term feedback loop
  - APC
  - AVL
  - Customer surveys

Challenge the future
Data sources:
- GSM data; tracking travellers
- Vehicle data (AVL); tracking vehicles
- Passenger data (APC); tracking passengers
- WiFi, Bluetooth, video data

Combining data sources (APC and AVL)
- Evaluating and optimizing ridership and passengers flows
- Service reliability from a passenger perspective

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The potential benefits

Optimizing network and timetable design:

**The Netherlands:**
Potential cost savings: > €50 million

- **Utrecht:** € 400,000 less yearly operational costs
- **The Hague:** 5-15% increased ridership
- **Amsterdam:** ~10% increased cost coverage
- **Tram Maastricht:** > €4 Million /year social benefits
- **Light rail Utrecht:** : €200 Million social benefits
The challenge

- Data
- Information
- Knowledge

- Improvements

- Evaluation
- Forecasts

- New methodologies
- Proven in practice
Applied examples

- Monitoring and predicting passenger numbers: Whatif
- Vehicle performance and service reliability

Quantifying benefits of enhanced service reliability in public transport
Van Oort, N. (2012), Proceedings of the 12th International Conference on Advanced Systems for Public Transport (CASPT12), Santiago, Chile.

- Optimizing planning and real time control
Van Oort, N. and R. van Nes (2009), Control of public transport operations to improve reliability: theory and practice, Transportation research record, No. 2112, pp. 70-76.

- Optimizing synchronization multimodal transfers
Lee, A. N. van Oort, R. van Nes (2014), Service reliability in a network context: impacts of synchronizing schedules in long headway services, TRB

- Improved scheduling
Smartcard data (1/2)

The Netherlands
- OV Chipkaart
- Nationwide (since 2012)
- All modes: train, metro, tram, bus
- Tap in and tap out
- Bus and tram: devices are in the vehicle

Issues
- Privacy
- Data accessibility via operators

Data
- 19 million smartcards
- 42 million transactions every week
- Now starting to use the data
Smartcard data (2/2)

- Several applications of smartcard data  
  (Pelletier et. al (2011). Transportation Research Part C)

Our research focus:

**Connecting to transport model**
- Evaluating history
- Predicting the future

- Whatif scenario’s
  - Stops: removing or adding
  - Faster and higher frequencies
  - Route changes

- Quick insights into
  - Expected cost coverage
  - Expected occupancy
Origin Destination Matrix
OD-patterns

fictitious data
OD-patterns
Challenge the future - fictitious data
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Whatif scenarios

Adjusting
- Speed
- Fares
- Time of operations
- Number of stops
- Routes
- Frequency

Illustrating impacts on (indicators):
- Cost coverage
- Occupancy
- Ridership
- On time performance
- Revenues
Whatif results: Flows increased frequencies
Vehicle performance
The Dutch approach: GOVI

GOVI is a nationwide initiative to make transit data available to authorities and the public.

Focus on dynamic traveler information

Timetable and AVL data available from the majority of the transit vehicles.

-(source: GOVI)
GOVI insights

-Schedule adherence

Many early trips

Holding regime
GOVI insights

**Speed**

**Dwell time**
Predicting service reliability

- Improved predictions
- Predicting and assessing impacts of enhanced service reliability
Summary

- Much data available
- Data enables quality increase and enhanced efficiency
- Evaluating and controlling -> predicting and optimizing
- Data-> Information -> Knowledge -> Improvements

- Two applied examples
  - Passenger data and whatif analysis
  - Vehicle performance and service reliability
Questions / Contact

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Research papers:
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