Improved public transport by data driven research

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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
Data sources

- GSM data; tracking travellers
- Vehicle data (AVL); tracking vehicles
- Passenger data (APC); tracking passengers

Combining data sources (APC and AVL)
- Service reliability from a passenger perspective

Many early trips

Holding regime
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
- **Tram Utrecht:** €200 Million social benefits
The challenge

- New methodologies
- Proven in practice
Applied examples

- Monitoring and predicting passenger numbers: Whatif
- Benefits of enhanced service reliability

- 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, Transportation research record

- Improved scheduling
Passenger data

Connecting to transport model:
• Evaluating history
• Predicting the future
• Elasticity approach (quick and low cost)

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

• Quick insights into
  • Expected cost coverage
  • Expected occupancy
Challenge the future
Challenge the future

fictitious data
Challenge the future
fictitious data
13
Challenge the future
fictitious data
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Origin Destination Matrix
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: changing the schedule
Whatif results: Flows increased frequencies
Decision making
Passengers in decision support systems?

Cost benefit analysis

Transport models

Calculated 0%
Expert judgment 13%
Qualitatively 27%
Not 60%
Case: Uithoflijn Utrecht

Transformation crowded bus line into tram line
Cost Benefit analysis required

CBA > 1,0

YES

+ NO

+  

[Image of tram]

[Image of bus]

Challenge the future 28
Three step approach

- **Vehicle performance**
  - Schedule adherence

- **Passenger impacts**
  - Additional travel time and variance

- **Travel time impacts**
  - Additional travel time and variance in travel time units

**Transport model**
Result

- Service reliability effects are about 60% of all benefits!
- Ministry supported project.
Summary

- Data: increased quality of public transport
- Data: enhanced decision making
- Valuable data available

- Evaluating and controlling -> predicting and optimizing
- Data-> Information -> Knowledge -> Improvements

- Two applied examples
  - Passenger data and whatif analysis
  - Cost benefit analysis
Questions / Contact

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Research papers: https://nielsvanoort.weblog.tudelft.nl/