Mind the Gap – From a Simulation to a Field Experiment

Oded Cats
cats@kth.se
Centre for Traffic Research, KTH
Outline

• Analysis of the current conditions
• A simulation study
• Experiment preparations
• Preliminary results
Problem description

• Bus performance is the result of many interdependent sources of uncertainty
• High-frequency services are difficult to regulate
• Bus bunching phenomenon escalates along the line
• Low level-of-service and efficiency

Proposed solution

• Regulate the service based on real-time location
• Provide drivers with an indication on their relative position
• Maintain an even headway
Bus line 1, Stockholm inner-city

- Second busiest bus line in the city
- Subject to traffic congestion
- Headway of 4-7 minutes (7am-7pm)
- Schedule-based holding control, 3 time points
- 2 driver relief points
Research process

**Modeling** - transit performance in BusMezzo

**Validation** - Tel-Aviv case study

**Analysis** - AVL and APC Stockholm data analysis

**Simulation** - Real-time holding strategies for Stockholm case study

**Implementation** - Stockholm field trial
Analysis of current conditions
Analysis of current conditions (Cont.)
BusMezzo Simulation

- Based on detailed empirical data
- A multi-perspective analysis
- Comparison of various holding strategies

A holding strategy that aims at keeping even headways yielded the best results:
- Highest service regularity
- Shorter passenger waiting times
- More even passenger crowding
- Higher fleet operations efficiency
- Schedule adherence at relief points
## RETT2 project timeline

<table>
<thead>
<tr>
<th>Month</th>
<th>Events</th>
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| Feb    | • Simulation study results  
         | • SL-Keolis-KTH steering group |
| Mar-Jun| • Robustness analysis  
         | • Experiment design |
| Aug    | • Information preparation |
| Sep    | • Technical functionality tests  
         | • Information dissemination |
| Oct    | • Implementation of the new strategy |
| Nov-Jan| • Feedback meetings  
         | • Data analysis  
         | • Final report |
Information dissemination

- Seminars with dispatchers
- Brochures
- Personal laminated cards
- Newsletter
- Depot information desk
- BusPC remainder
System functionality

- Driver display
- Control room functionality test

- But still did not work when the experiment was suppose to kick off...
Implementation

- Oct 6 – Oct 31
- Regulate at all stops based on the new indicator
- Disregard the schedule-adherence indicator

- Dedicated control room dispatcher
- Traffic ambassadors at relief points
- On-going performance monitoring
Feedback meetings

• Drivers find it less stressful
• Want to continue with the new strategy
• Other drivers wanted to participate

• Positive reactions from the operator
• No need for control room interventions
• Did not encounter driver scheduling problems
• Indications of improvement in crowdedness
Preliminary results

- 10-15% reduction in the coefficient of variation of the headway
- 10-15% reduction in the share of bunched buses
- Punctuality remained at the same level
- Total time spent at stops remained unchanged

- An analysis of Automatic Passenger Counts data would allow to evaluate the impact on the crowding
Service regularity along the line

The 5 days prior to the experiment started vs. the last 5 days of the experiment
Future actions

• Assessing system performance and benefits
• Designing the next implementation step

• Headway-based dispatching
• Proposing a regularity performance measure

• Developing a Comprehensive fleet management and control strategy
• A decision support system for transit operations
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