Modelling on-board crowding

(Smart transfer nodes)

Soumela (Melina) Peftitsi (KTH)
Smart transfer nodes

- Many stations are operating over or near capacity and crowding at stations are connected to on-board crowding.

- Station performance is important for the efficiency and attractiveness of the public transport system.

- Develop methods to support station planning and operations with respect to
  - Passenger flows
  - Impact on crowding in vehicles

- The project supports the final stages of two PhD students.

*Project members*: Fredrik Johansson (Project leader, VTI), Erik Jenelius (KTH), Anders Peterson (LiU), Therese Lindberg (LiU/VTI), Oded Cats (KTH), Soumela (Melina) Peftitsi (KTH)
Crowding in Public Transport

- Overcrowding affects passengers’ travel experience.
- Service supply is underutilized due to variations in crowding across services, trips and compartments of the same vehicle.

Real-time crowding information (RTCI) provision can potentially reduce
- Crowding unevenness
- Denied boardings

Research objective:
Extend existing PT simulation models to provide passengers with predictive crowding information concerning individual train cars and assess the impact of RTCI provision.
Modelling on-board crowding distribution

Earlier extension

BusMezzo - Dynamic Transit Operations and Assignment Model

• Individual transit vehicles, i.e. trains, movements.

• Individual passenger car boarding choices.

• Captures on-board crowding distribution and evaluates user cost in a more realistic way.
• Measure the crowding level in each train car when train departs from a stop.
  – Crowding factor is a function of the car occupancy level.

<table>
<thead>
<tr>
<th>RTCI level</th>
<th>Car capacity utilization</th>
<th>Crowding factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;= 80% seated capacity</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>&gt;80% seated capacity &lt;= 100% seated capacity</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>&gt;100% seated capacity &lt;= 50% total capacity</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>&gt;50% total capacity</td>
<td>1.8</td>
</tr>
</tbody>
</table>

• Predict RTCI for each trip segment based on the measured car crowding level of the most recent train run.

• Each passenger utilizes the generated car-specific RTCI, as an in-vehicle time multiplier of a given trip segment, in the decision making process.
RTCI provision schemes

• The app-based scheme provides the RTCI for each stop along the passenger's path alternative.
• The platform-based scheme provides the RTCI on-board train trip at the passenger's boarding stop.
Stockholm metro network application
Effect of RTCI on passengers’ generalized travel cost

- Passengers' adjusted car boarding choices translate into improved on-board experience at the cost of increased walking times.
- Providing platform RTCI system only at busy stops results in time savings that are on-par with those attained when equipping all stops with information displays due to passengers larger motivation for adapting their choices at crowded stations.
On-going work

• Use simulation as a tool to investigate the effect of other control measures (e.g. fixed skip-stop operation) for reducing crowding and improving passengers’ travel experience, concerning station layout and passenger flow distribution.

• Potential effects on passengers:
  – Decreased in-vehicle time.
  – Increased travelling comfort.
  – Increased waiting time.
List of research articles

Thank you

soumela@kth.se