Analysis of the Israeli Smartcard Data

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MOT funded project:
From Big Data to Public Transport Demand
by fusing cellular and smartcard data
The state of the Israeli transportation system

69% of employed Israelis drive to work, only 21% use public transport

Bank of Israel Economic report (2017)

Average speed of public transport

<table>
<thead>
<tr>
<th>City</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel Aviv</td>
<td>15</td>
</tr>
<tr>
<td>Barcelona</td>
<td>31</td>
</tr>
<tr>
<td>Berlin</td>
<td>31</td>
</tr>
<tr>
<td>Wien</td>
<td>30</td>
</tr>
</tbody>
</table>

Dr. Nir Sharav, NS Associates, Autonomous Vehicle in Israel Day, October 2018
WHAT NEXT?

City of Two-Wheeled Vehicles

City of Autonomous Vehicles

Mobility as a Service (MaaS)
**GTFS** (General Transit Feed Specification):
Data on stops, lines, bus trips and timetable.
Updated every day.

Israel totals: Stops: ~27,500; Bus lines: ~3,500;
Bus trips: ~250K, Timetable: ~10M records
Israeli Smartcard system is “TAP-ON” only

- Like almost everywhere in the world, the Israeli bus Smartcard system is **TAP-ON**. Traveler is registered only when boarding.

- Israeli train Smartcard system is **TAP-ON/TAP-OFF**.
The smartcard data: trips and travelers

**WEEKLY STATISTICS**
- **16M** RAV-KAV + **3M** paper tickets
- **1.9M** unique RAV-KAV travelers

**ON WEEKDAYS**
- 2.5-2.7M boardings per day
- ~ 1M unique Rav Kav users per day
- ~ 0.5M tickets sold per day
- Average boardings per traveler (workday) **2.7**
Unexpected outcome #1: 27% of travelers board once a day

Distribution of the number of boardings per day for smartcards with less than 12 boardings

<table>
<thead>
<tr>
<th>Number of boardings per day</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27%</td>
</tr>
<tr>
<td>2</td>
<td>35%</td>
</tr>
<tr>
<td>3 – 4</td>
<td>27%</td>
</tr>
<tr>
<td>5 – 6</td>
<td>8%</td>
</tr>
<tr>
<td>7 – 12</td>
<td>3%</td>
</tr>
</tbody>
</table>

More than 12 boardings per day (0.2% of smartcards, 1.2% of boardings) – excluded
Number of travel days per week

Unexpected outcome #2:
44% of travelers use PT one or two days per week
Many travelers use PT only a few times a month

95% of PT-users

Unexpected outcome #3: 50% of all users boarded 13 times or less during 20 working days
Boarding by half-hours of the day, for the working days and the weekend.

Uppsala, April 2019
MP's – 500 trips/month

Fraction of travelers by profiles

- Regular: 52.8%
- Pupils: 16.6%
- Elderly: 15.7%
- Soldiers: 4.9%
- Students1: 3.4%
- Students2: 2.7%
- Others: 1.1%
- Employees: 0.8%
- Business: 0.6%
- Commuters: 0.5%
- Cyclists: 0.4%
- Pedestrians: 0.3%
- Drivers: 0.1%

Uppsala, April 2019
Share of once-a-day travelers by profile

Population average – 27%

Uppsala, April 2019
Boarding time, average and by profiles
Raux, Ma and Cornelis (2016)

- A 7-day travel diary was collected for 707 individuals in the city of Ghent (Belgium) in 2008.
- Conclusion: “There is greater difference in the number of trips per day during the various days of week for a given individual than between individuals.”

Individual travel behavior is flexible, it is neither completely habitual nor completely random.
Commuters

Meaning of “commuter” in the English Dictionary

<table>
<thead>
<tr>
<th>English</th>
<th>Business</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>“commuter” in English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➤ See all translations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**commuter**

*noun [C] • **UK** /kəˈmjuː.tər/ • **US** /kəˈmjuː.tər/

Someone who regularly travels between work and home:

*The train was packed with commuters.*

- Thesaurus: synonyms and related words

Travellers & visitors
Typical number of activity centers is 5 – 8, the rest 70% of stops are used for less than 25% boardings.
How can we recognize commuters?

Proxy of Ma et al, 2017:

*Commuters repeatedly start they daily travel activities not far from their home, and repeatedly board last daily trip near the same job.*

Broader than home-work-home travelers, e.g. students.

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The problem of destination: travelers’ destination and possible mode are estimated based on spatial proximity of bus lines and boarding stops.

Is there a stop on Line #2 that is close to the 1st boarding stop?

Is the 2nd boarding stop close to some stop of Line #1?
The problem of destination: travelers’ destination and possible mode are estimated based on spatial proximity of bus lines and boarding stops.

Identification of destination stop demands heavy spatial querying that accounts for the distances between 28K boarding stops, 7K lines and 28K possible alighting stops.

Due to mismatch between line coding in GTFS and SmartCard data, we are able to identify distances between the boarding stop and the nearest stop of the last return line for 10% of daily bus users only...

Is there a stop on Line #2 that is close to the 1st boarding stop?

Is the 2nd boarding stop close to some stop of Line #1?
25% Rules of thumb

- At least 25% of bus travelers combine between the PT and non-PT modes to reach their daily activities.
- At least 25% of travelers use PT very infrequently – not more than one day a week or not more than 6 trips per month.
- Only 25% of travelers constantly repeat the same morning trip to work and evening trip home.

The share of the “non-routine” trips is much higher than expected.

Travelers would accept, for these trips, any mode that provides better service, they are waiting for MaaS!
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QUESTIONS?

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