אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev


TEL AVIV UNIVERSITY אוניברסיטת תל אביב

# Analysis of the Israeli Smartcard Data

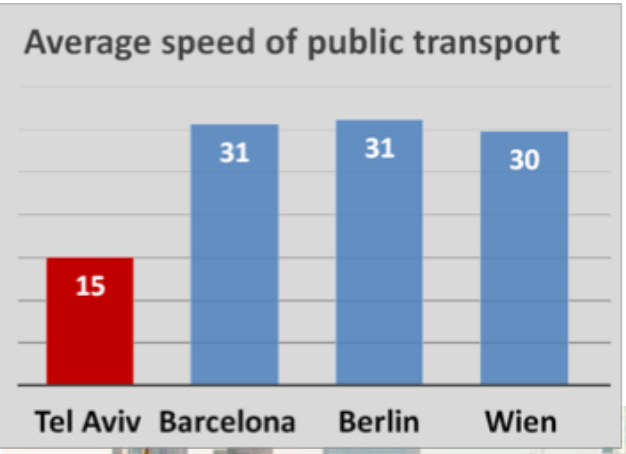
**Itzhak Benenson[1], Eran Ben Elia[2], Maria Marinov[1]**

[1]Department of Geography, Porter School of Environment and Geoscience, TAU
[2]Department of Geography and Environmental Development
Ben Gurion University of the Negev, Beer Sheba

Ministry of Transport and Road Safety

***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)**

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

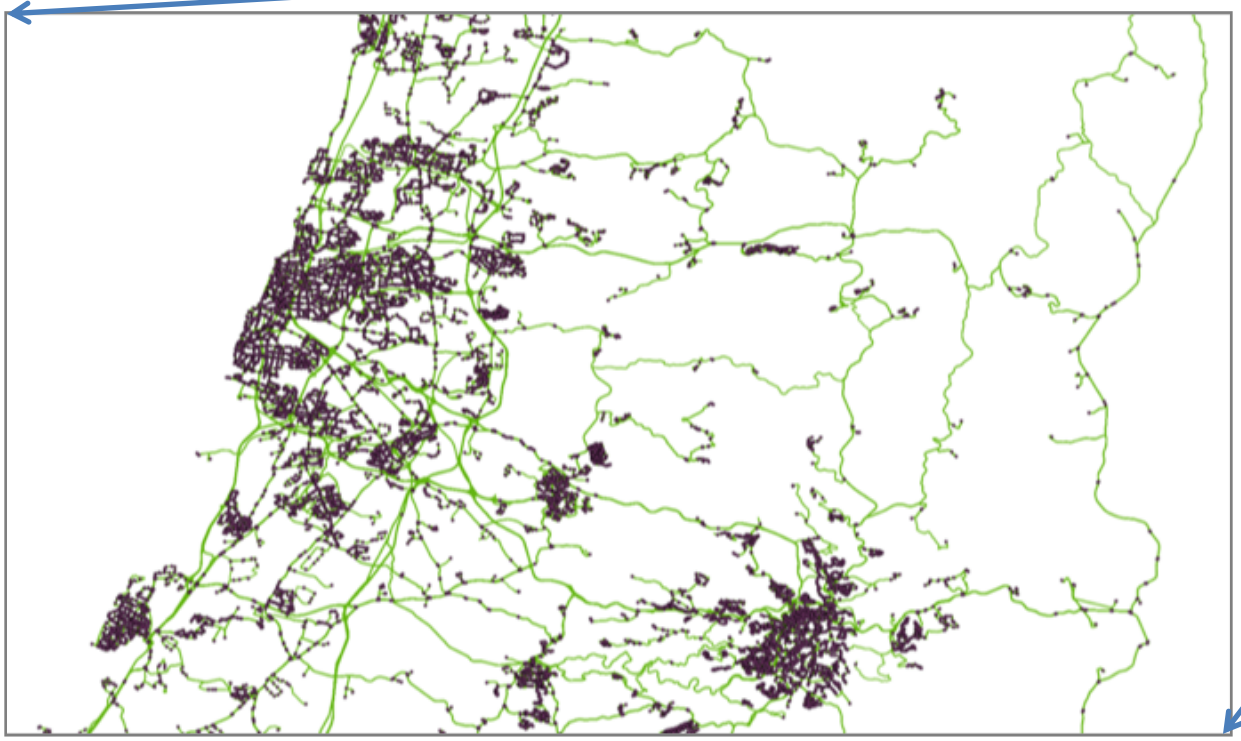
City of Two-Wheeled Vehicles

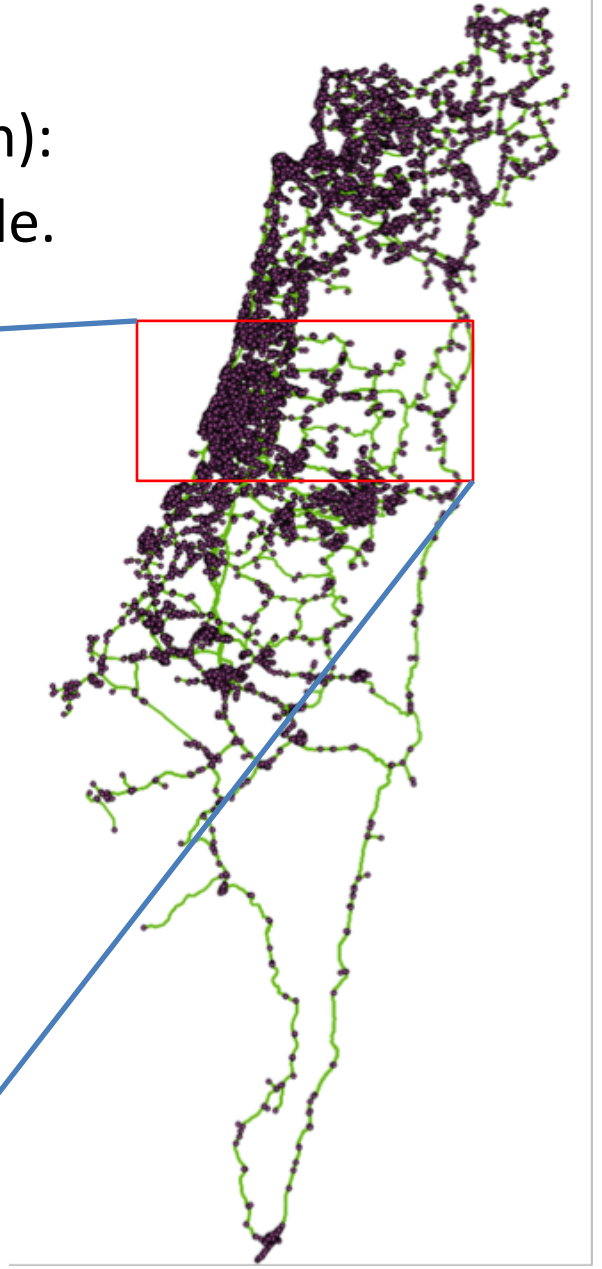
City of Autonomous Vehicles


Mobility as a Service (MaaS)

# **GTFS** (General Transit Feed Specification):

Data on stops, lines, bus trips and timetable.
Updated every day.



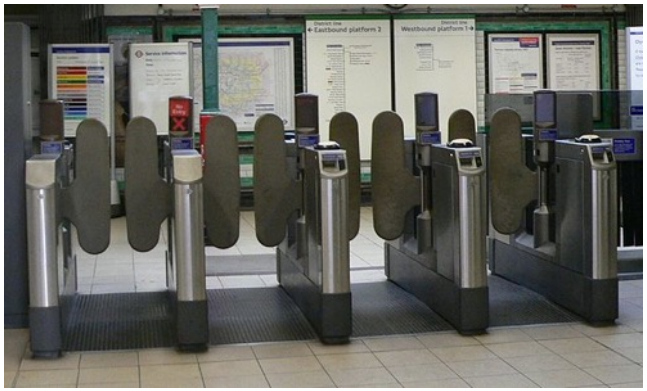


**Israel totals: Stops: ~27,500; Bus lines: ~3,500;**
**Bus trips: ~250K, Timetable: ~10M records**

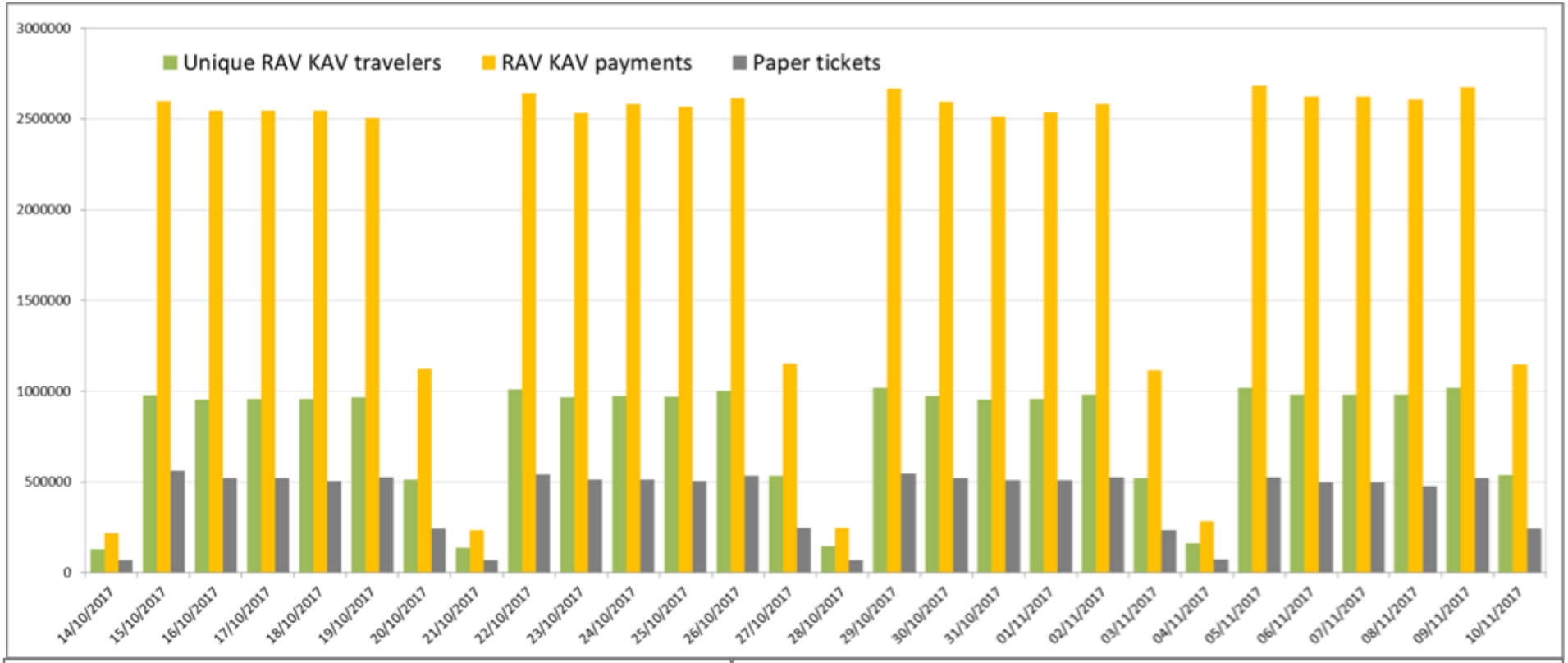
# Israeli Smartcard system is “TAP-ON” only

- 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**

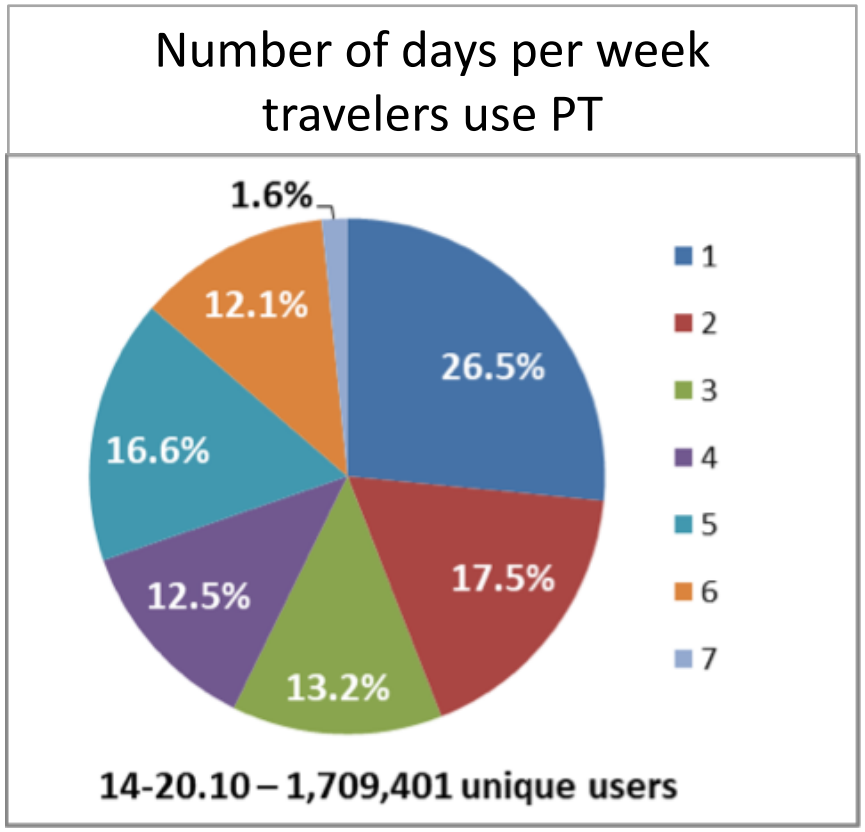
- 2.5-2.7M boardings per day
- ~ 1M unique Rav Kav users per day
- ~ 0.5M tickets sold per day
- Average boardings per traveler (workday) **2.7**

# Unexpected outcome #1: 27% of travelers board once a day

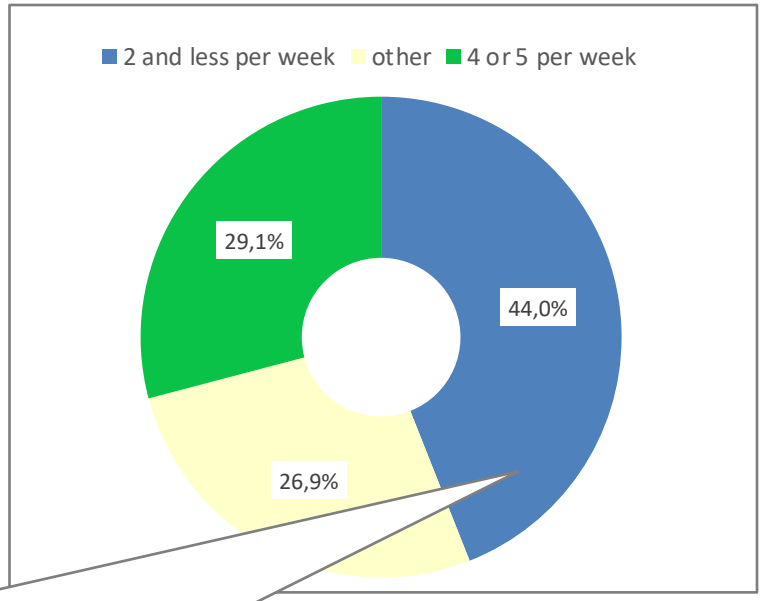
*More than 12 boardings per day (0.2% of smartcards, 1.2% of boardings) – excluded*

| Distribution of the number of boardings per day for smartcards with less than 12 boardings | |
|---|---|
| Number of boardings per day | Share |
| **1** | **27%** |
| 2 | 35% |
| 3 – 4 | 27% |
| 5 – 6 | 8% |
| 7 – 12 | 3% |

# Number of travel days per week



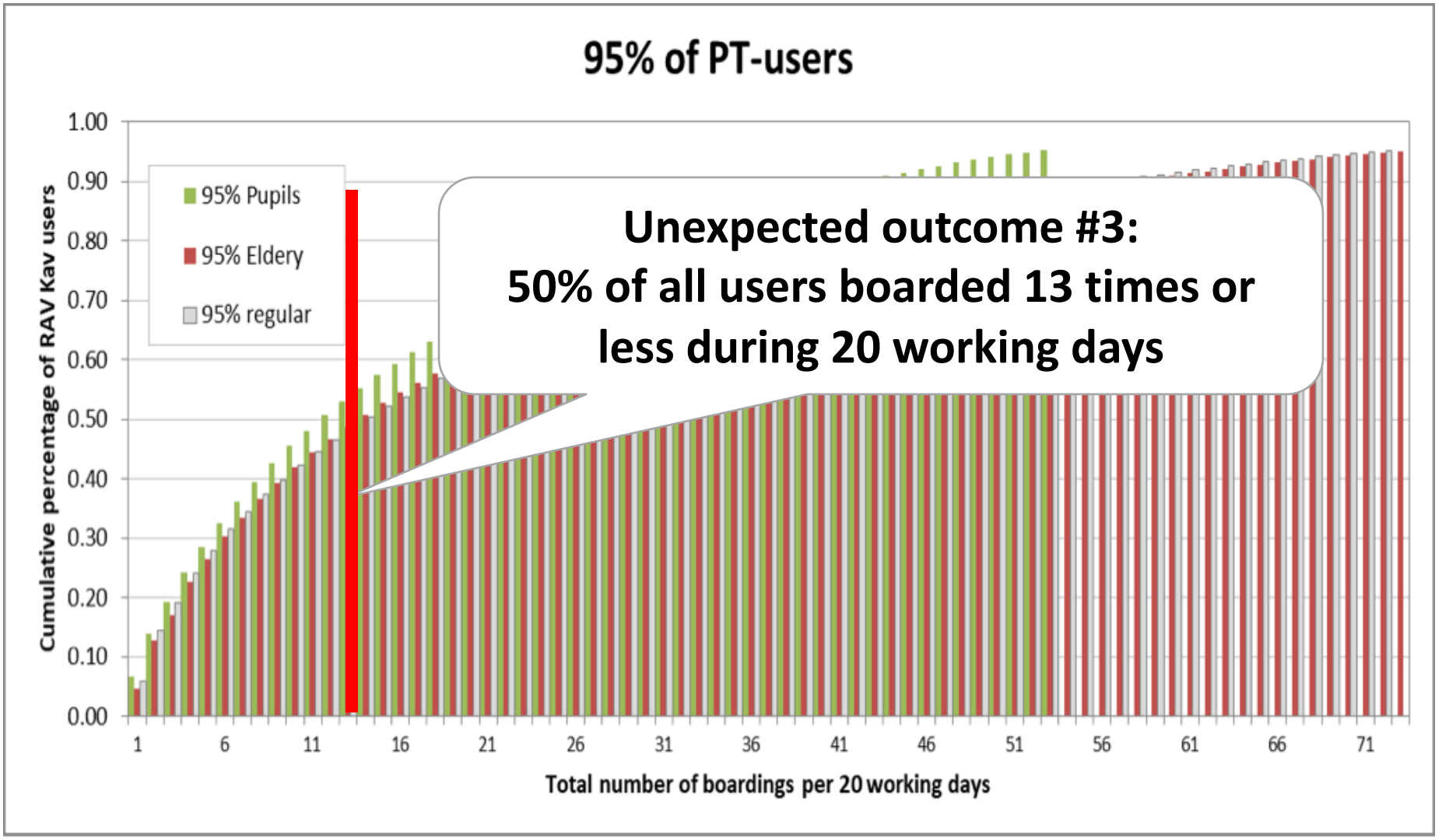

**Average PT use - 3 days per week**



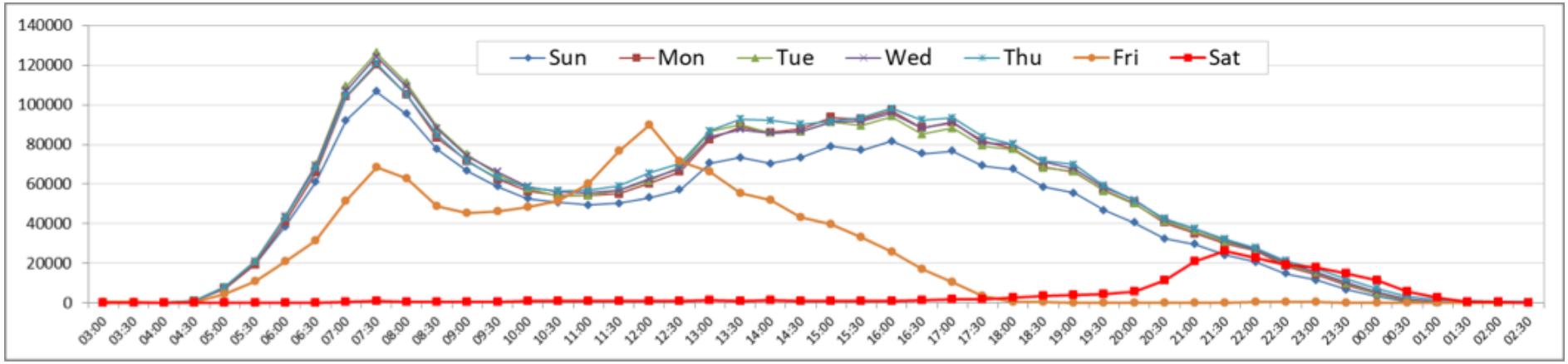

**Unexpected outcome #2*:***

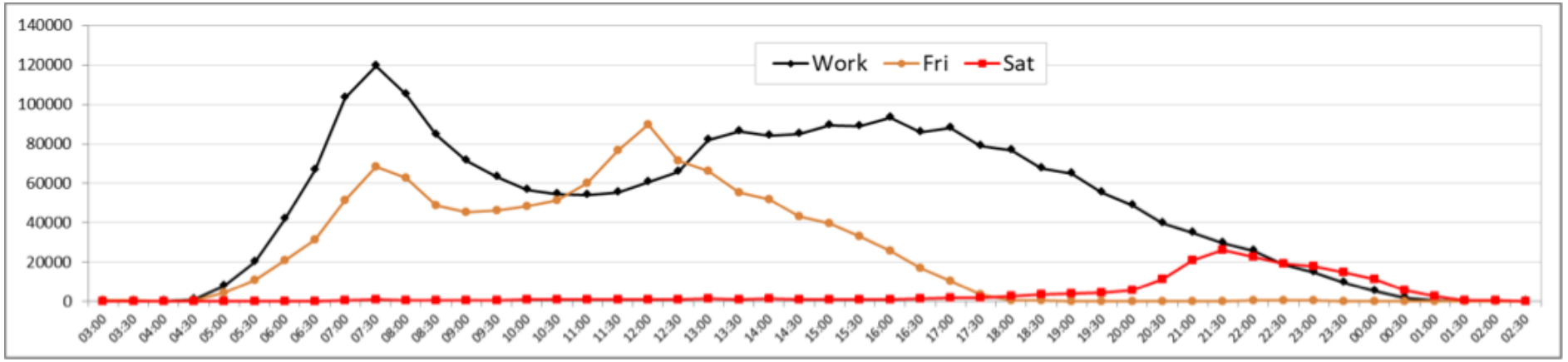
***44%* of travelers use PT one or two days per week**

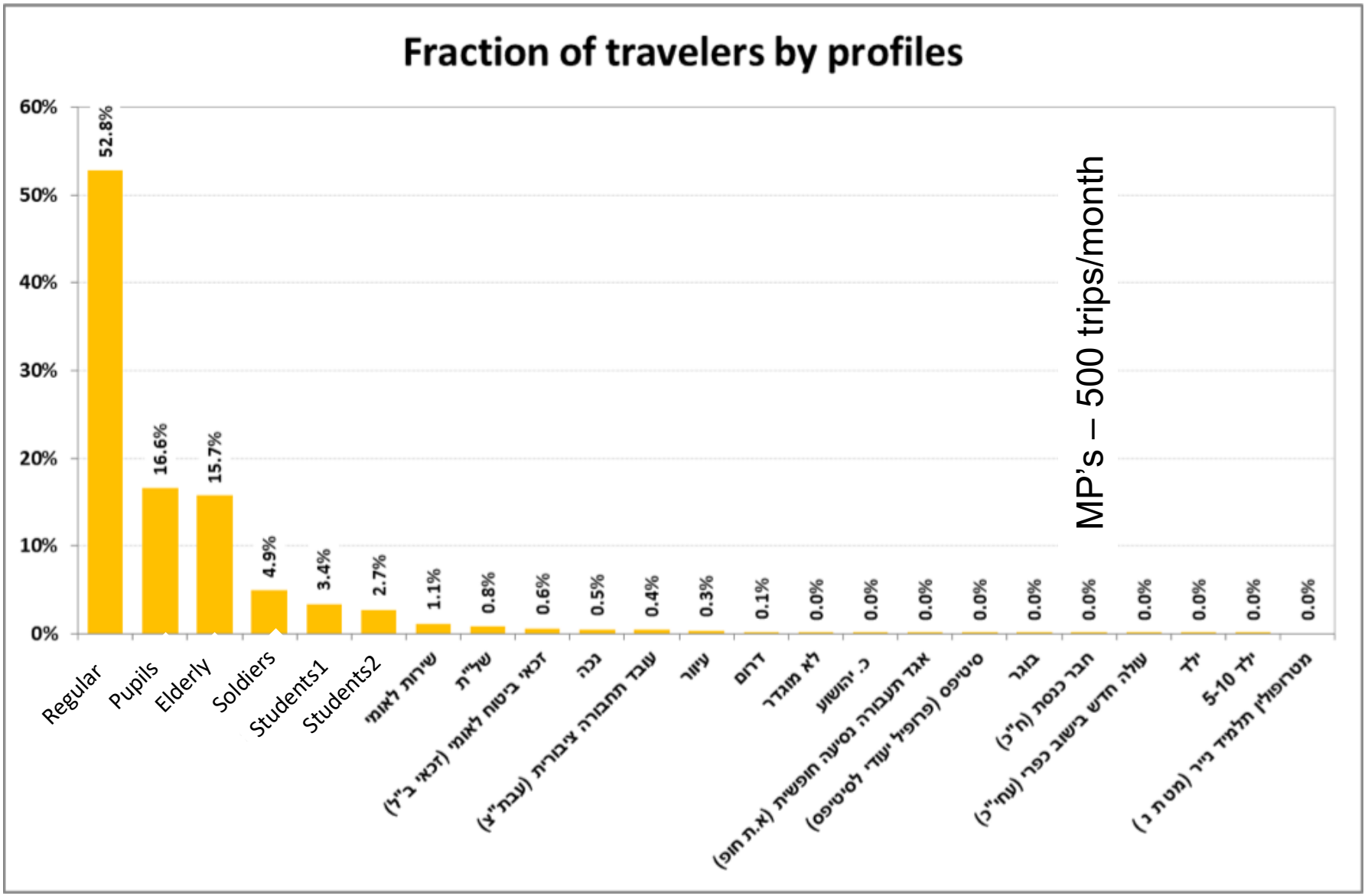
# Many travelers use PT only a few times a month

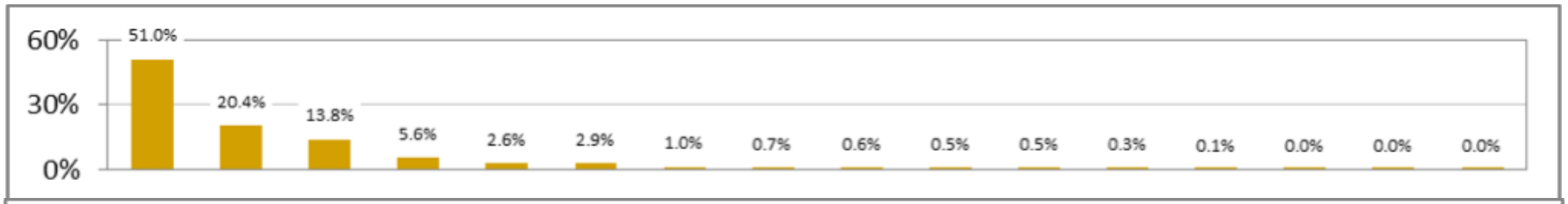


# Boarding by half-hours of the day, for the working days and the weekend

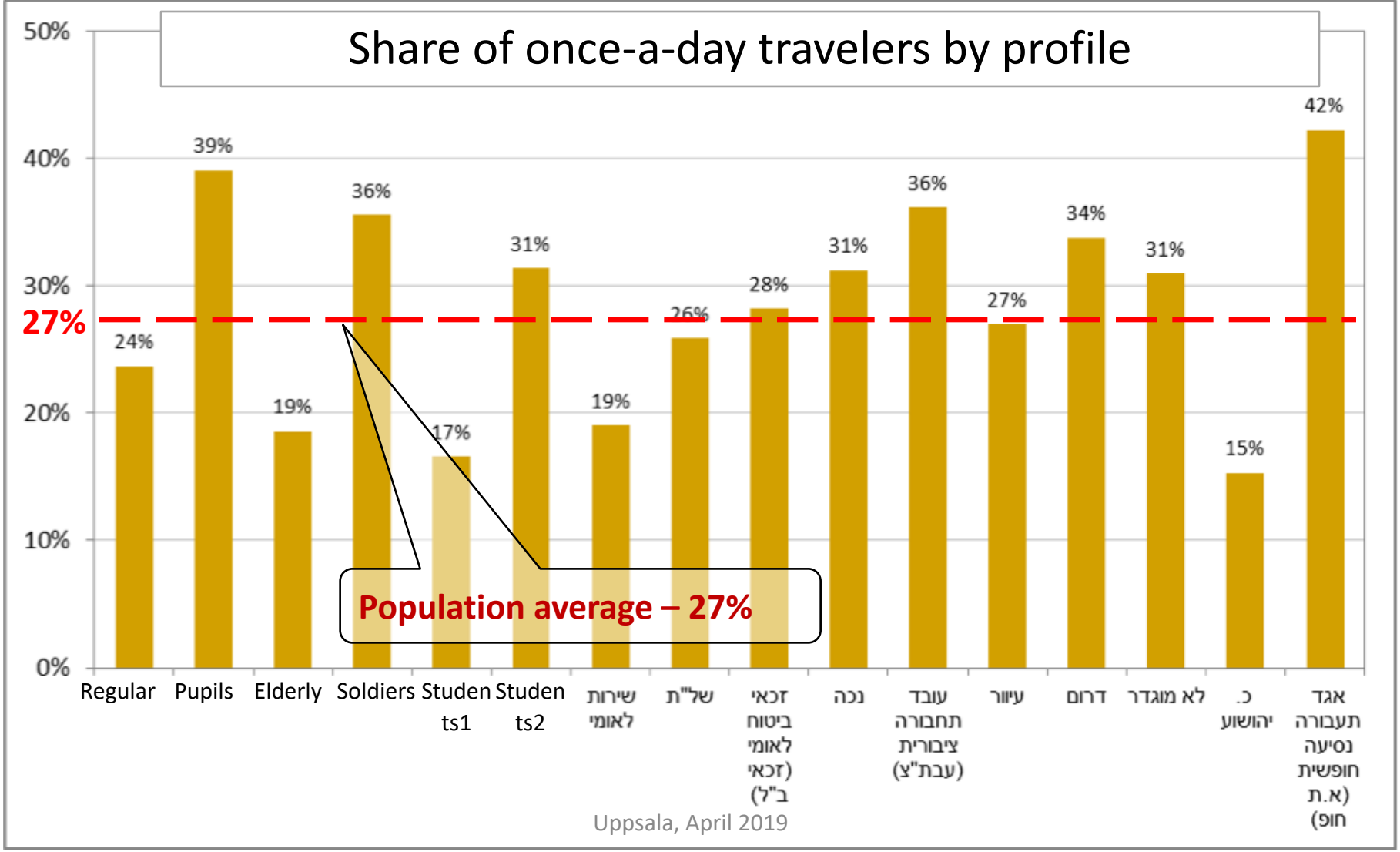


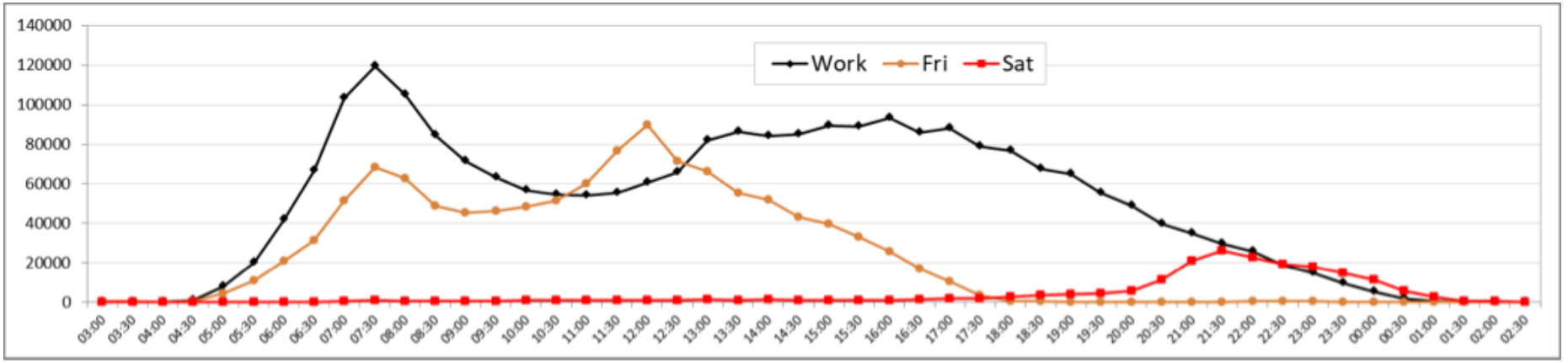

Fraction of travelers by profiles
60%
50%
40%
30%
20%
10%
0%
52.8%
16.6%
15.7%
4.9%
3.4%
2.7%
1.1%
0.8%
0.6%
0.5%
0.4%
0.3%
0.1%
0.0%
0.0%
0.0%
0.0%
0.0%
0.0%
0.0%
0.0%
0.0%
Regular
Pupils
Elderly
Soldiers
Students1
Students2
שירות לאומי
של"ת
זכאי ביטוח לאומי (זכאי ב"ל)
נכה
עובד תחבורה ציבורית (עבת"צ)
עיוור
דרום
לא מוגדר
כ. יהושוע
אגד תעבורה נסיעה חופשית (א.ת חופ)
סיטיפס (פרופיל יעודי לסיטיפס)
בוגר
חבר כנסת (ח"כ)
עולה חדש בישוב כפרי (עחי"כ)
ילד
ילד 5-10
מטרופולין תלמיד נייר (מט ת נ )
MP's – 500 trips/month

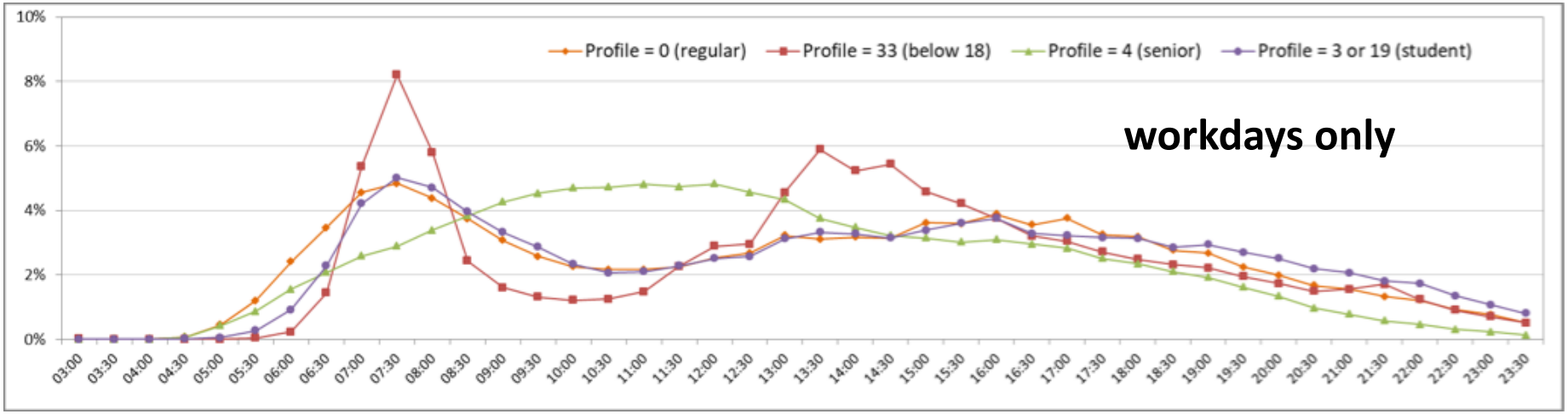



# Share of once-a-day travelers by profile



# Boarding time, average and by profiles



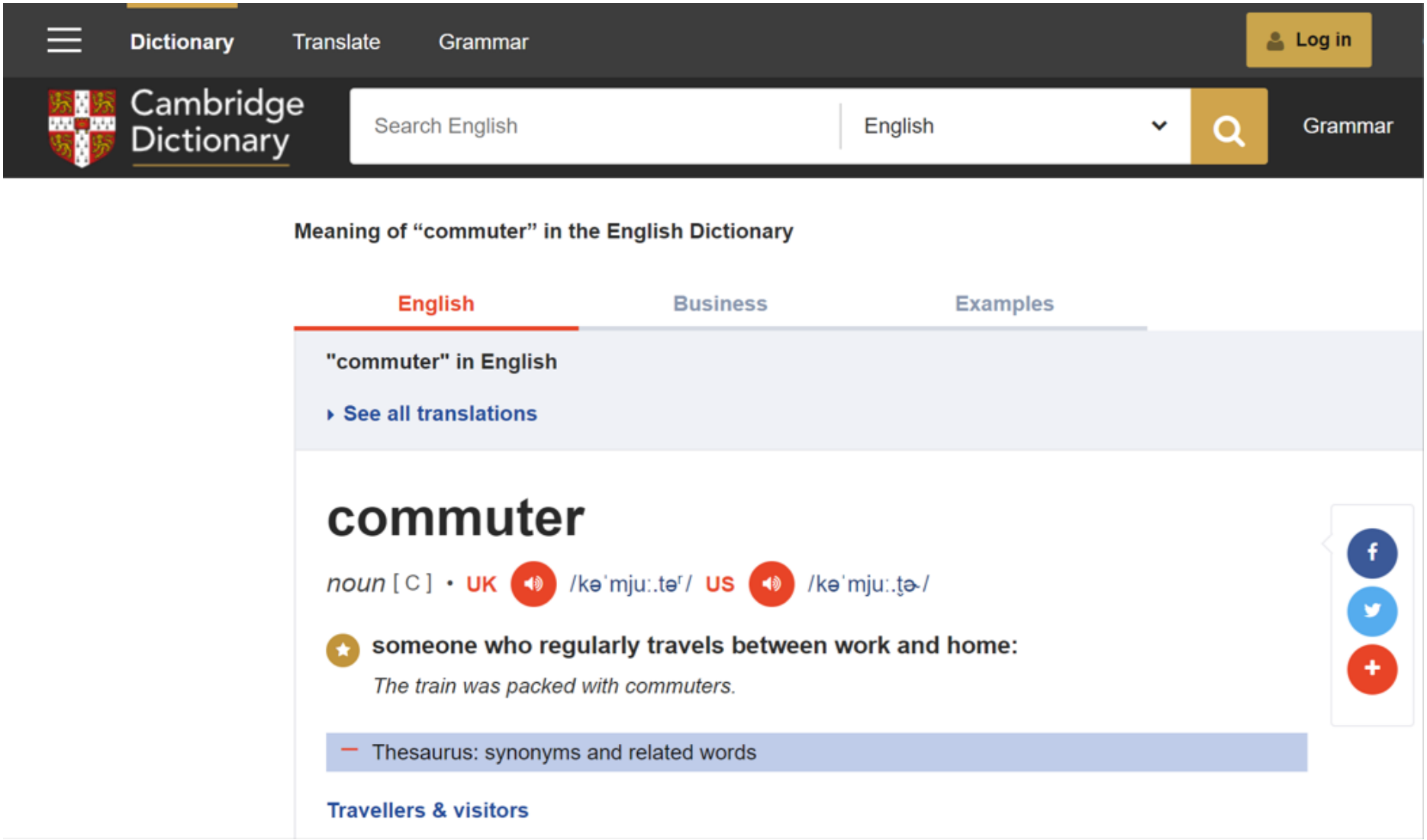



**Raux, Ma and Cornelis (2016)**

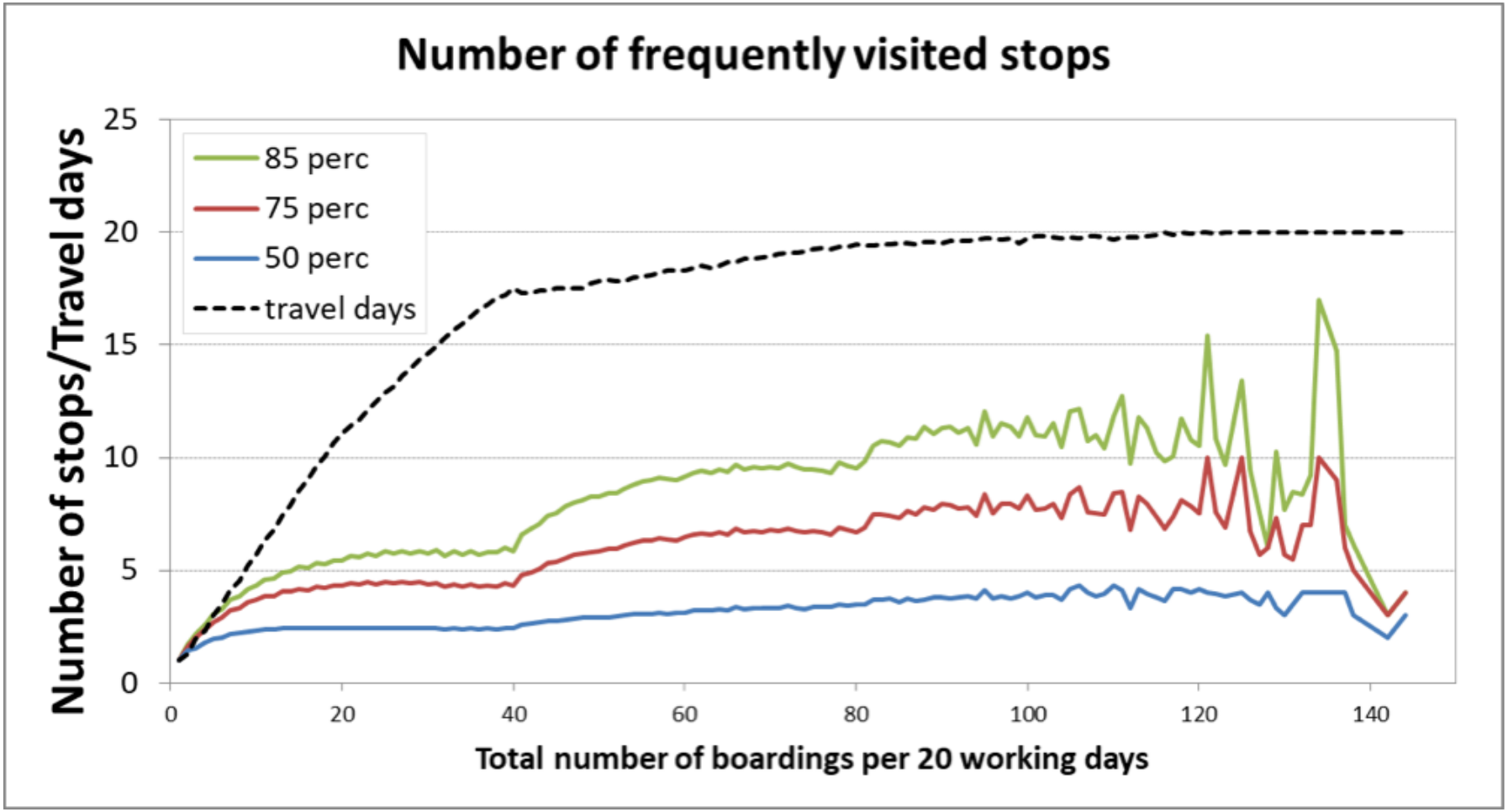
- A 7-day travel diary was collected for 707 individuals in the city of Ghent (Belgium) in 2008.
- Conclusion: “There is greater difference in the number of trips per day during the various days of week for a given individual than between individuals.”

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

# Commuters


Dictionary
Translate
Grammar
Log in
Cambridge Dictionary
Search English
English
Grammar
Meaning of “commuter” in the English Dictionary
English
Business
Examples
"commuter" in English
See all translations
commuter
noun [ C ] • UK /kəˈmjuːtəʳ/ US /kəˈmjuːt̬ɚ/
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

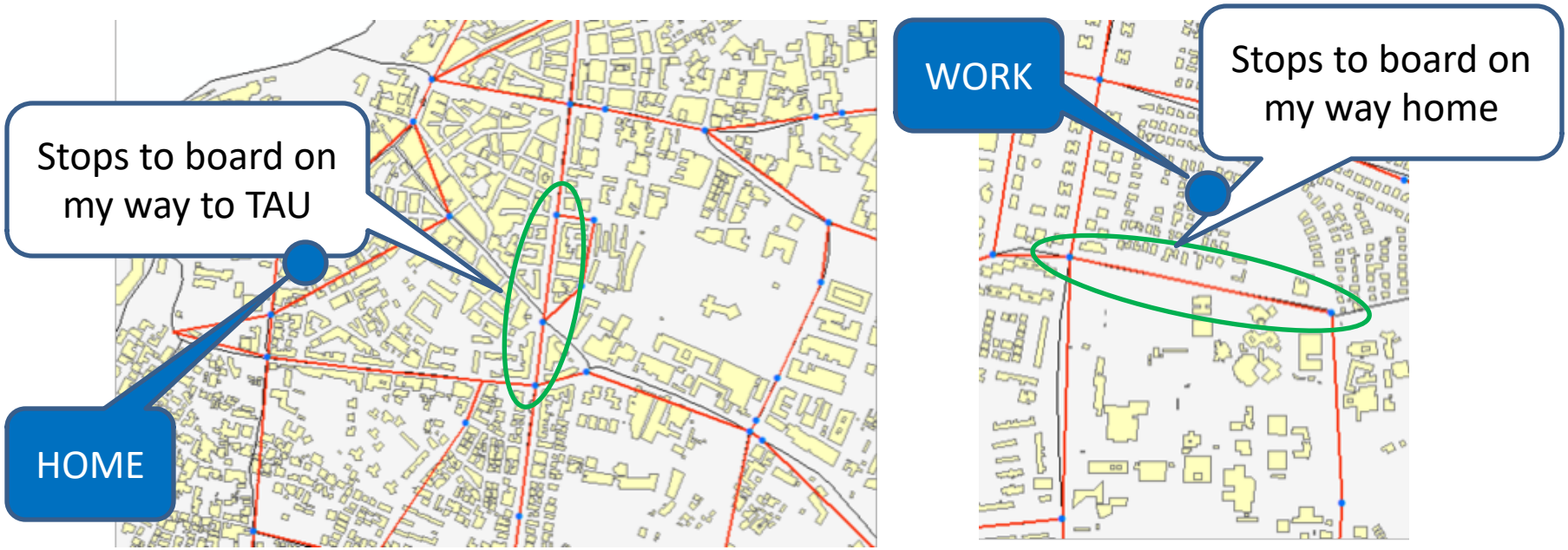


# How can we recognize commuters?

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

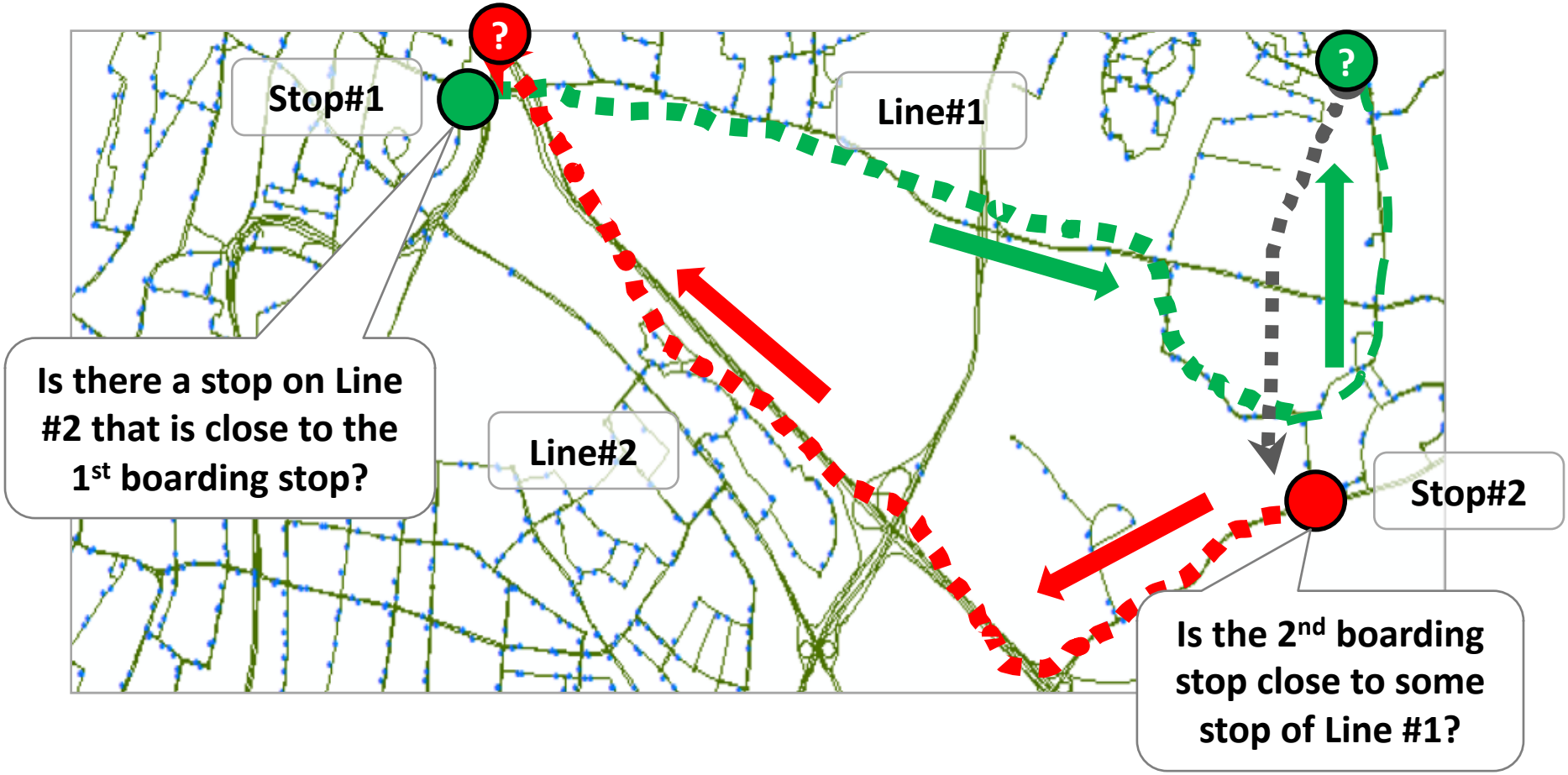



*Ma X, Liu C, Wen H, Wang Y, Wu Y-J. 2017, Understanding commuting patterns using transit smart card data. J Transp Geogr., 58:135–145.*

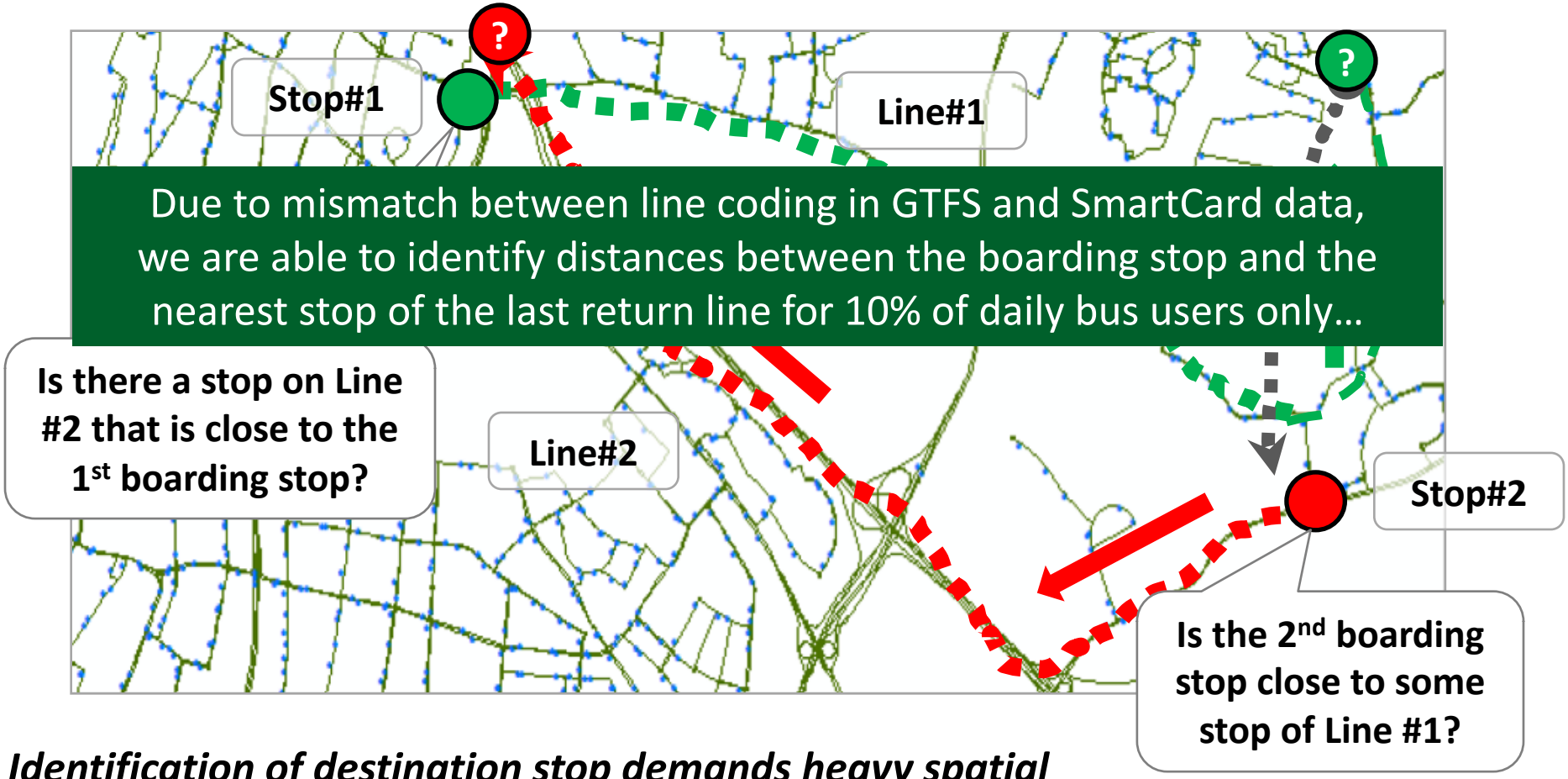
**The problem of destination:**

travelers' destination and possible mode are estimated based on

***spatial proximity of bus lines and boarding stops***

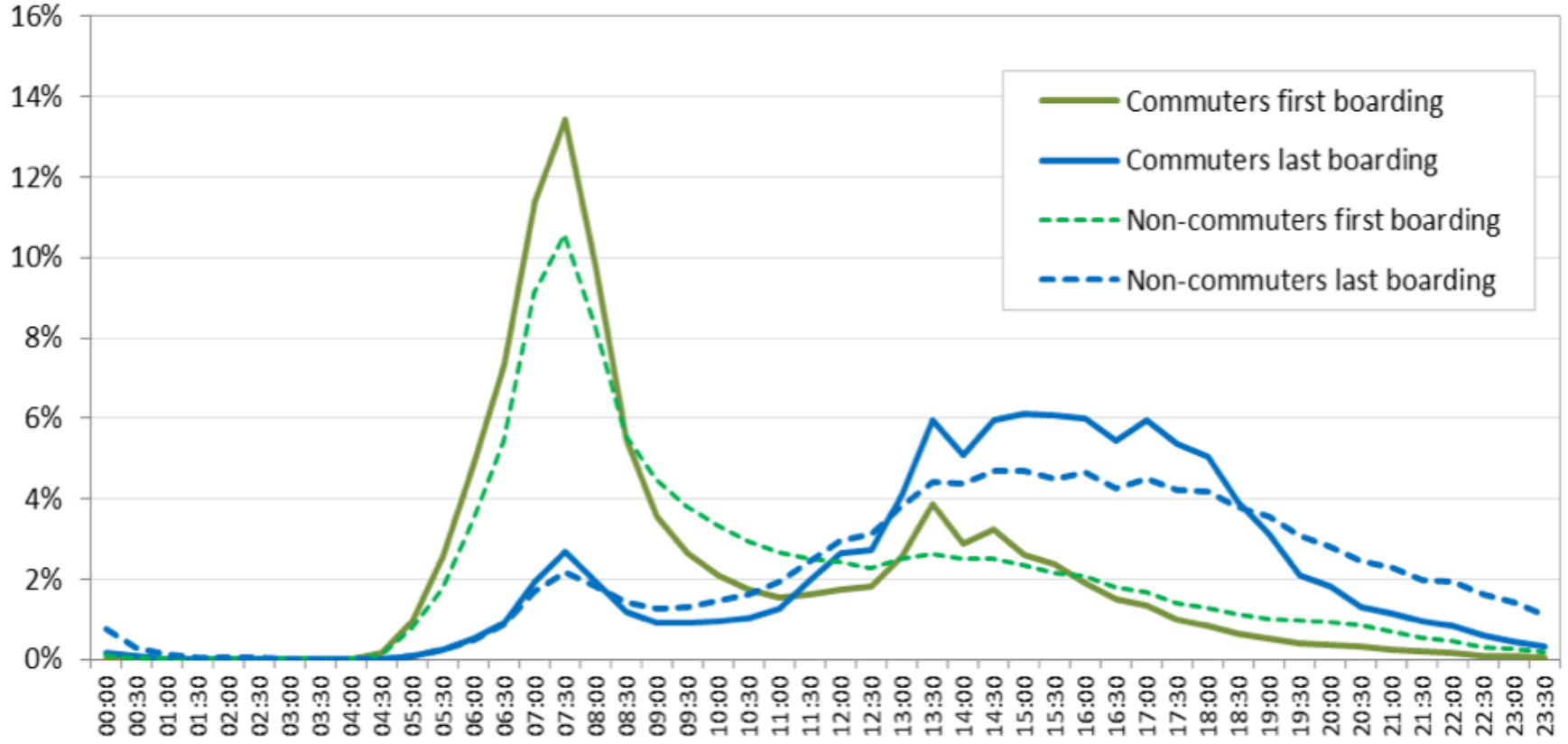


**The problem of destination:**
travelers' destination and possible mode are estimated based on
***spatial proximity of bus lines and boarding stops***




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

## Commuters vs the rest of travelers, time of the first and last trip



# 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!**

*Special thanks to*

***BGU: Bella Ackerman, Nadav Levy***

***TAU: Ariel Goldstein, Nir Fulman, Yulia Grinblat***

***PARTNER LTD: Barak Alon, Dvora Mauer***

***MOT: Aviva Shenitsky, Doron Narkis, Zeev Shadmi, Sarit Levy***

# QUESTIONS?

***Project:*** **From Big Data to Public Transport Demand by fusing cellular and smartcard data**

***Funded by the Israeli Ministry of Transport***