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Quality mapping of public transport service: Case study for Brno, Czech Republic

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INTRODUCTION

Quality of public transport is a key element in mode selection process. Three types of performance indicators are: quality experienced by users, outcomes and cost efficiency. This study focuses on the first type to understand the experience of a random passenger using a public transport service.

STUDY AREA

The study area is the city of Brno in the Czech Republic, which has a well-developed public transport network and operates a tram, trolleybus, and bus network with 11 tram lines, 13 trolleybus lines, and 33 bus lines. The city accommodates more than 400,000 inhabitants.

AIM & GOALS

Aim and goals of this study:

- Develop a methodology for data collection
- Obtain descriptive statistics on key quality aspects of public transport in the study area
- Understand and evaluate random passenger experience

METHODOLOGY AND EXECUTION

A methodology of mystery shopping was used, the researcher acts as a regular passenger without prior communication of the intention to evaluate the quality of service to the operator, nor the staff. This methodology minimises potential bias and provides the study with real-world data. A showcase of collected data can be found in the next section.

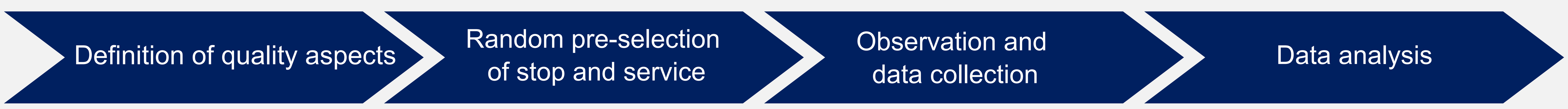

Fig. 1: Methodology workflow

DATA SHOWCASE

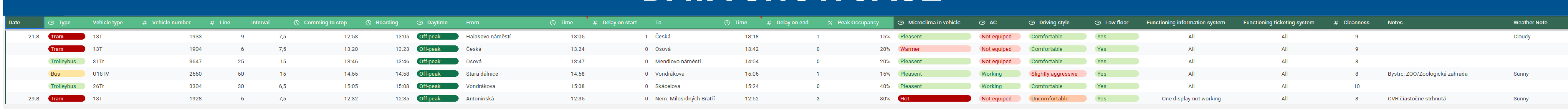

Fig. 2: Showcase of data collection spreadsheet

RESULTS

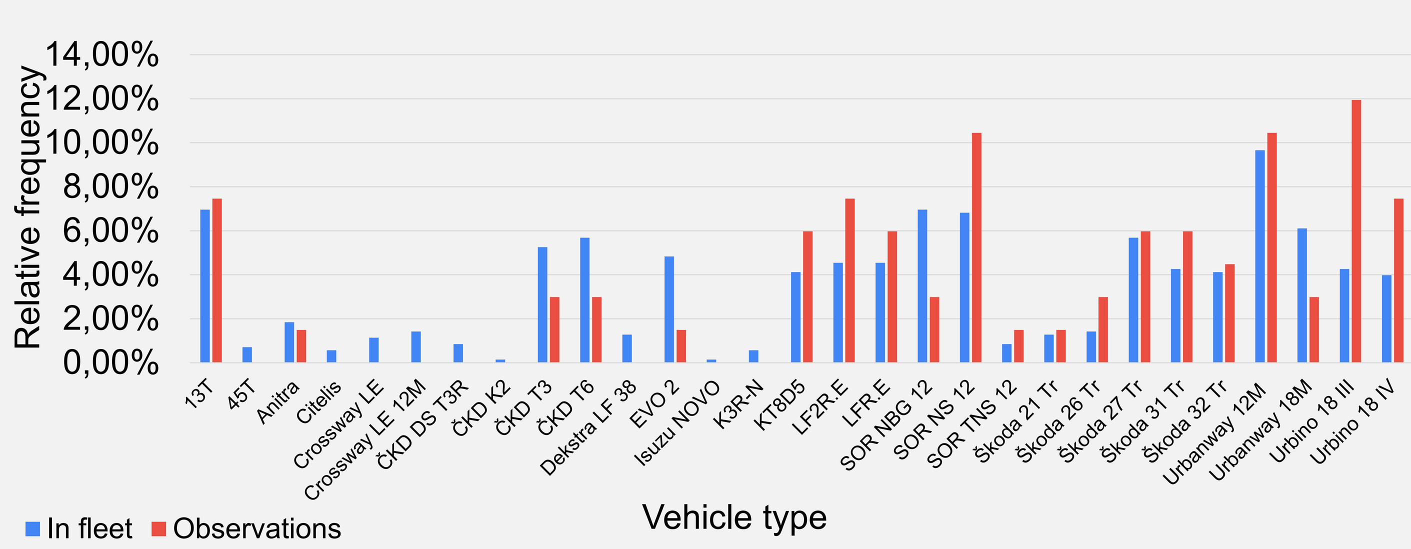

Fig. 3: Relative frequency of vehicles in fleet and in observations

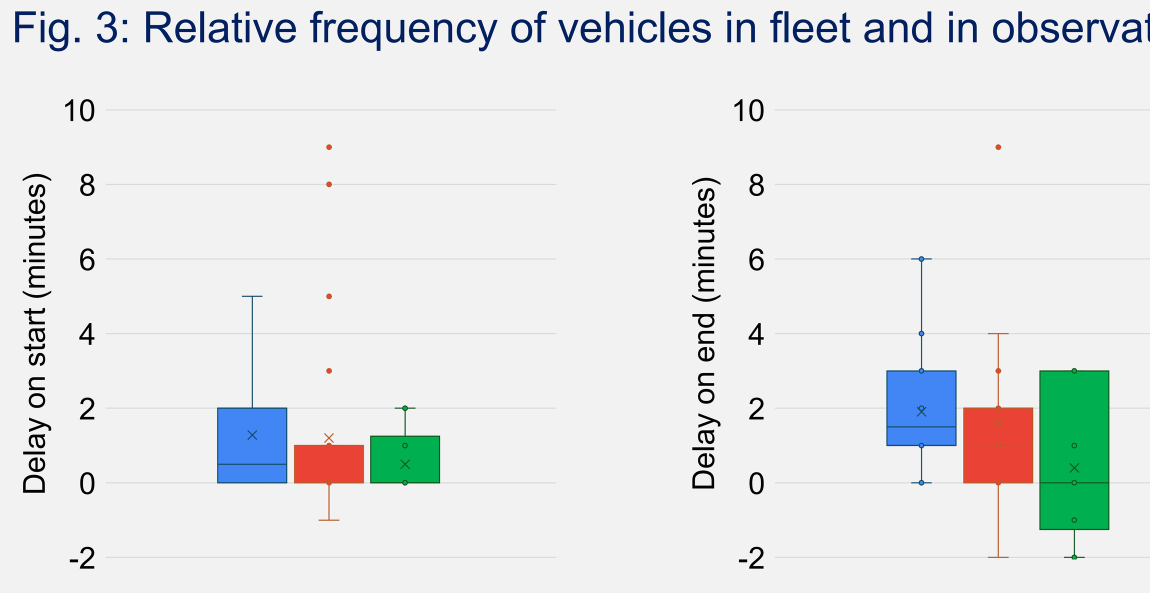

Fig. 5: Box plot of delay times

The delays on start of observations had a mean of 1.13 minutes, while on end it was 1.57 minutes. The delay times on end are higher in peak hours compared to off-peak by 16,23%

In total, there were 67 observations, out of which were 20 trams, 15 trolleybus, and 32 bus services. The peak hours held 32 observations, off-peak 25 and 10 were done at night. The average waiting wime (without night services) was 4.61 minutes. The waiting time relative portion of interval was 0.43. The expected value based on the theoretical approach is 0.5. The mean waiting time is higher in the off-peak hours than in peak hours due to more services. The occupation levels were higher in the peak hours than in off-peak hours as expected.

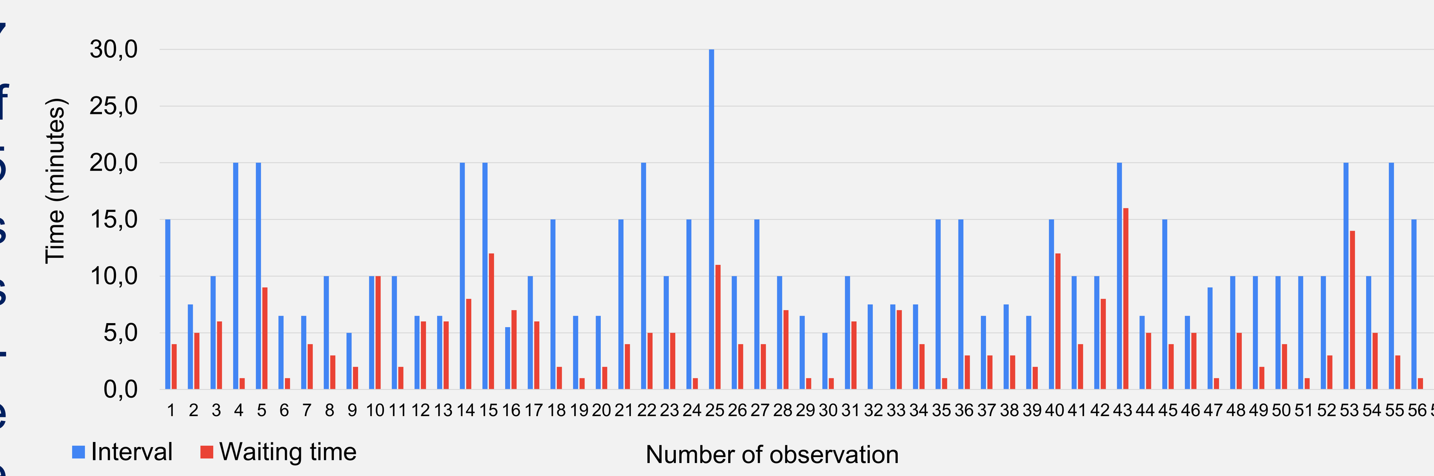

Fig. 4: Interval and waiting time in observations

Operational constraint	Mean	Median	Mode	Standard deviation	Sample variance
GLOBAL					
Waiting time (min)	4.61	4	1	3.51	12.35
Delay on start (min)	1.13	0	0	1.97	3.88
Delay on end (min)	1.57	1	0	2.15	4.61
Peak occupancy (-)	0.28	0.2	0.2	0.21	0.04
PEAK HOURS					
Waiting time (min)	4.56	4	1	3.15	9.93
Delay on start (min)	1.28	0.5	0	1.75	3.5
Delay on end (min)	1.91	1.5	1	1.71	2.93
Peak occupancy (-)	0.33	2.75	0.4	0.25	0.06
OFF-PEAK					
Waiting time (min)	4.68	4	1	4	15.98
Delay on start (min)	1.2	0	0	2.5	6.25
Delay on end (min)	1.6	1	0	2.58	6.67
Peak occupancy (-)	0.23	0.2	0.2	0.12	0.02
NIGHT					
Delay on start (min)	0.5	0	0	0.85	0.72
Delay on end (min)	0.4	0	3	2.1	4.4
Peak occupancy (-)	0.23	0.2	0.2	0.2	0.04

Tab. 1: Descriptive statistics of selected operational constraints

CONCLUSION & FUTURE RESEARCH

This study assesses the quality of public transport in the Czech city Brno. The study focuses mainly on time aspects of provided services. The findings suggest that services are affected by peak hour congestions and big numbers of exchanging passengers. However, most vehicles adhere to the schedule strongly. Waiting times were rather short, however there was a big sample variance. The same holds true for the delay times. This suggests possible improvements in the consistency of adherence to schedule. The occupancy levels were rarely higher than half of vehicle's capacity, however there were some observations of very high occupancy (up to 100%). There are short, but very intensive peaks. The accessibility levels are very good, only some tram connections are served by vehicles without a low floor access. The other collected data (not presented in this study) about qualitative aspects (microclimate, driving style, cleanness of vehicle..) can be used in the future for a more comprehensive analysis. More observations can be conducted to create a more representative sample. This work lays methodological framework and creates fundamentals to form and test hypotheses in the future research.

ACKNOWLEDGEMENTS

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