

Master's Thesis Topic

Modelling travel behaviour changes during public transport service disruptions

Background

Public transport (PT) is a key component of urban mobility systems, yet it is prone to recurrent variations in service patterns that result in temporary delays, disruptions, suspensions etc. This has major and negative consequences for PT users who need to make unexpected, en-route changes to their original trip itineraries. Travellers' responses may include shifts towards other PT connections or alternative travel modes, or sometimes even cancelling their trip altogether. This impact of sudden PT service disruptions upon decision-making in urban transport networks needs to be properly understood and described from analytical perspective.



sources: sueddeutsche.de; mvg.de



Thesis objective

The aim of this master thesis can be summarised by the following research question:

“What is the impact of unexpected public transport service disruptions upon travel behaviour changes in urban mobility networks?”

The master thesis student shall conduct a stated-preference survey among public transport (PT) users, and use its results to estimate discrete choice models of different travel decisions made in the event of PT service disruptions.

Methodology

Main points of the expected methodology are summarised below. Reasonable deviations from the project description and new ideas are welcome.

1. Design and conduct an online stated-preference passenger survey to investigate the above stated research problem. The questionnaire contents shall be verified in pilot surveys before the main data collection stage.
2. Analyse the survey data and estimate discrete choice models, describing the probability of travel behaviour shifts in response to PT service disruptions, accounting for different user categories (demand heterogeneity). Choice modelling shall be conducted with adequate analytical tools, e.g. BIOGEME, Apollo R (or analogous).

Expected results

Main outcome of this master thesis will be the evidence-based discrete choice models of travel behaviour shifts due to PT service disruptions. Estimated models will help understand the waiting time tolerance for the current (disrupted) PT service, as well as the popularity of alternative travel actions – i.e. taking another PT route, walking, cycling, shared modes, car or taxi etc. (or even cancelling the trip altogether). Conclusions from this thesis can provide important support for operations and management of complex urban mobility systems.

Key skills

- Completed the “Discrete Choice Modelling” course at TUM or similar. Experience in discrete choice modelling (BIOGEME, Apollo R or similar) is **necessary** for this master’s thesis project.
- Knowledge and experience of stated-preference survey design is **recommended**.
- Fluency in English and good scientific skills will be highly **appreciated**.

References and relevant work

- Auld, J., Ley, H., Verbas, O., Golshani, N., Bechara, J., & Fontes, A. (2020). *A stated-preference intercept survey of transit-rider response to service disruptions*. Public Transport, 12, 557-585.
- Bierlaire, M. (2023). *A short introduction to Biogeme*. Technical report TRANSP-OR 230620. Transport and Mobility Laboratory, ENAC, EPFL. Available at: <https://biogeme.epfl.ch/>
- Drabicki, A. A., Islam, M. F., & Szarata, A. (2021). *Investigating the impact of public transport service disruptions upon passenger travel behaviour—Results from Krakow city*. Energies, 14(16), 4889.

Lin, T., Shalaby, A., & Miller, E. (2016). *Transit user behaviour in response to service disruption: State of knowledge*. Available at: <https://ageconsearch.umn.edu/record/319263/files/agecon-trf-1381.pdf>

Nguyen-Phuoc, D. Q., Currie, G., De Gruyter, C., & Young, W. (2018). *How do public transport users adjust their travel behaviour if public transport ceases? A qualitative study*. *Transportation Research Part F: Traffic Psychology and Behaviour*, 54, 1-14.

Rahimi, E., Shamshiripour, A., Shabanpour, R., Mohammadian, A., & Auld, J. (2019). *Analysis of transit users' waiting tolerance in response to unplanned service disruptions*. *Transportation Research Part D: Transport and Environment*, 77, 639-653.

Zhu, S., & Levinson, D. M. (2011, August). *Disruptions to transportation networks: a review*. In *Network Reliability in Practice: Selected Papers from the Fourth International Symposium on Transportation Network Reliability* (pp. 5-20). New York, NY: Springer New York.

Starting date

As soon as possible from April 2024 onwards. The thesis will be registered at the Chair of Transportation Systems Engineering (Prof. Antoniou).

How to apply:

Interested applicants should contact Arkadiusz Drabicki (arkadiusz.drabicki@tum.de) by email. Please include (1) a short explanation (max. 100 words) of why you are interested in this project, (2) a recent transcript of records and (3) any work related to stated preference surveys or discrete choice modelling (e.g. report, paper).