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D-BAUG Lighthouse Project: E-Bike City Subproject B

Multi-scale responsive public transport for bi-modal demand

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1 Introduction

This sub-project aims at creating a deeper understanding of the substantial demand variations resulting in unexpected loads and surplus capacity situations and provides tools to adjust the public transport system in advance. For example, driven by bad weather, many e-bike users might switch to public transport. Thus, we aim to provide an effective bi-modal system in which the modal split depends on exogenous uncontrollable factors [1].

2 Challenge

It is necessary to plan ahead of time to cope with those variations using minimal and easy-to-deploy actions by incorporating two or three operating modes (which depend on the current demand level) in planning line headways and resources [2]. The planning has to bridge multiple scales to understand the resources required ahead of time (say, one year ahead) and precisely (shortly before operations, say one week in advance, the day before, and one hour in advance).

3 Methods

New and robust planning algorithms (which need to include passenger choices, see Schmid and Schöbel 2015 [3]) for an uncertain level of demand seek to determine a few key parameters, between which the system can switch with few operational problems; and depending on reactively acquired information (for instance, weather; or unexpected loads in the morning to plan the afternoon).

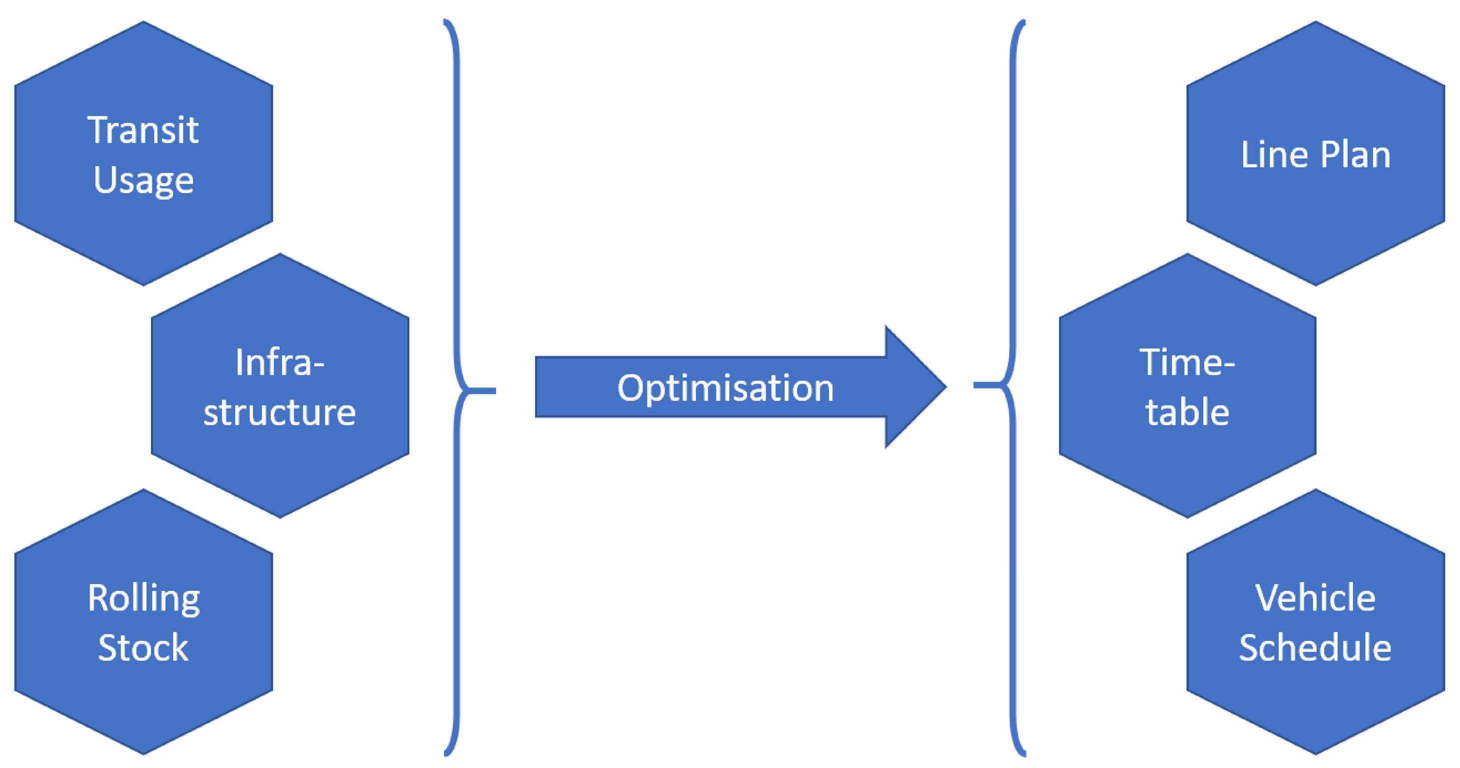

Fig 1: Schematic representation of the methodology

The change in demand requires the provision of a flexible offer, which should provide the required level of service with high efficiency. Hence, we aim to provide a system that can adapt by transitioning between states.

Fig 2: Transitioning between states

To tackle this task, we will use and enhance the OpenBusToolBox [4], which provides us with all the required data structures. Using the toolbox, we can skip redundant steps and focus on implementing novel and scalable approaches.

4 Effect

Current approaches plan for an average scenario, but in our case, the system might oscillate between a few cases, which are notably skewed from each other (either little demand; or too much; but not a "nice to have" average performance). The information on which state is most likely to occur can only be communicated at a specific moment, and users will have to react to that [5]. predicting the total resources needed and how they will be operated will be the key output of this sub-project.

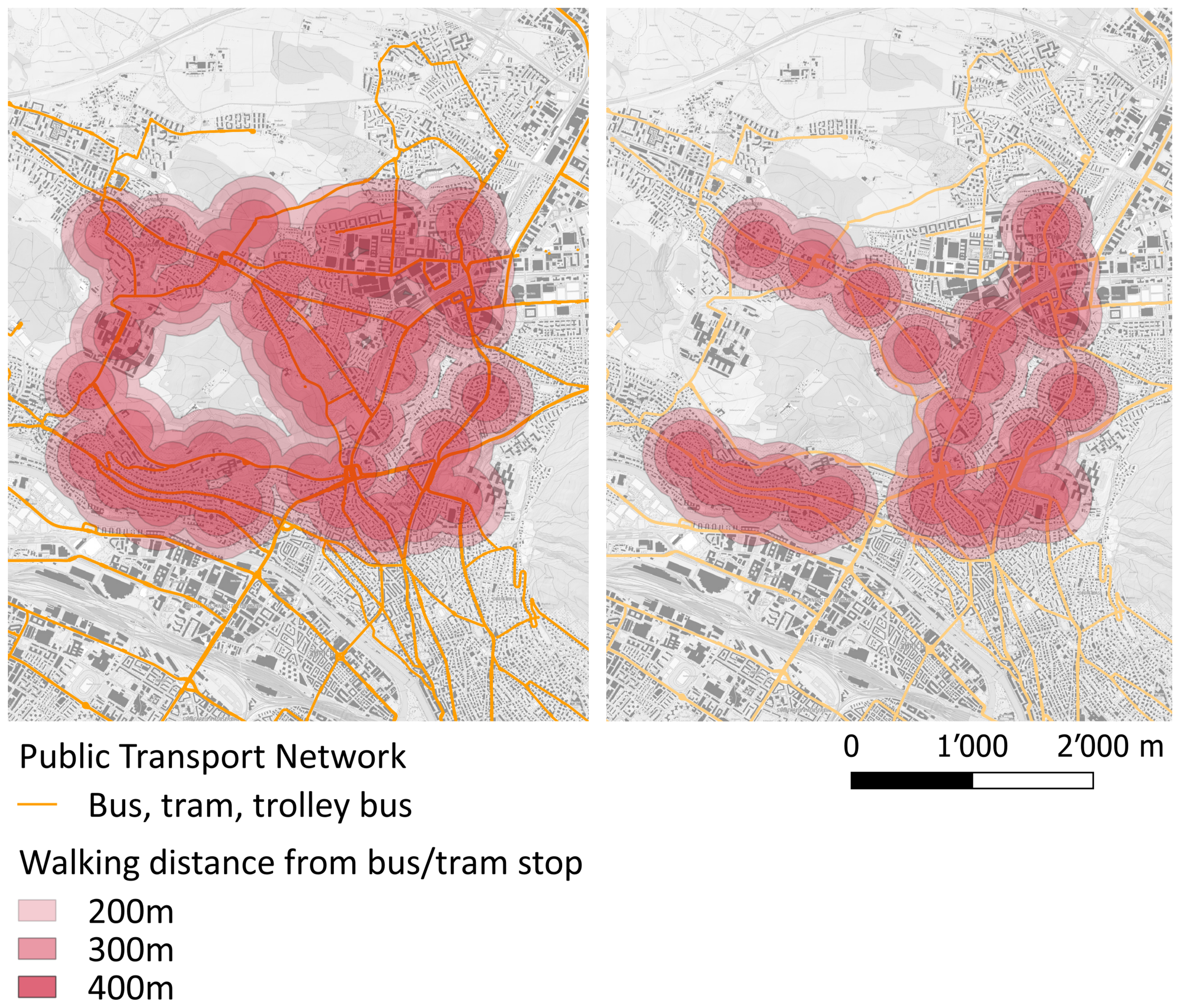

Fig 3: Varying accessibility as a result of an adaptive public transport system. The left case depicts a situation where the public transport system bears the main load (i.e. during bad weather), whereas the right one reflects a reduced level of service.

5 Future

As this sub-project essentially supports the other sub-projects as an "enabler", we aim to integrate and combine the insights here. Key aspects are the forecast models as well as the proposed infrastructure modifications. Using all these insights, we can investigate the effect on transit ridership and accessibility.

References

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