Extended abstract

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Insights into door-to-door dynamics of public transport riders by app, survey and AVL data; case of Amsterdam metropolitan area

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Introduction

Public transport enables fast and reliable station to station journeys. To assess passenger travel patterns and to infer actual quality of service, smartcard and AVL data offer great opportunities (see for instance European experiences by Van Oort et al. 2016 and Van Oort and Cats 2015). There is, however, an increasing interest in insights into access and egress dynamics of public transport riders as well. What is the size of a stop's catchment area, which modes are used, and how long and reliable are access and egress times? The answers to these and other questions enable optimization of the total mobility system, thereby also increasing public transport ridership and efficiency. Sufficient biking access of public transport stops (routes and parking), for instance, offer opportunities to increase public transport stopping distances, thereby increasing operational speed and reliability, without compromising accessibility of service areas. We developed a methodology to calculate and demonstrate these dynamics by using new and existing data technologies, namely AVL, survey and new promising app.

Three data sources

First, in the Netherlands, all public transport operators provide open AVL data (NDOV 2016). Data exchange interfaces are defined by a set of nationwide standards (Bison 2016). In the first place, NDOV was designed to facilitate data communication between vehicles and the land side information infrastructure to enable the provision of dynamic passenger information (i.e. real-time information). As an additional benefit, the actual and scheduled vehicle positions and times are logged into a database. Typically, for one public transport line in the Netherlands this involves 3.000 to 7.000 arrival times and departure times per day. Although, setting up this database was not the main objective of NDOV, it has become an excellent data source when monitoring and analysing public transport performance. The arrival and departure times of vehicles at stops are recorded with a precision of 1 second.

Besides this quantitative data source, a second qualitative data source focusses on perceived passenger experience. Passenger surveys enable understanding of how passengers perceive the actual service. Especially concerning multimodal journeys, surveys provide relevant insights into the combined (perceived) level of service.

Finally, the third and newest data source we use in our approach is an app. To gain insights into multimodal mobility, mobility apps are very useful. Apps provide knowledge beyond the stop to stop information of smartcards, such as access times, routes and waiting times. In our research, the app 'Sense.DAT' is used. It uses GPS, WiFi and the gyroscope in the mobile phone to detect where and when you travel, by what mode and which route. Each trip can be viewed, if necessary, corrected by the user, and finally approved. In this way highly accurate and complete travel diaries can be obtained with little effort. It includes self-learning algorithms to detect habitual patterns in behaviour. In this way the app will automatically detect frequently used routes and frequently visited places. Over time, these self-learning algorithms will lead to fewer user-made corrections and more efficient battery use during measurements. The app yields OD-patterns (including multimodal journeys), travel times (including variation) and waiting times.

Amsterdam case

Our methodology was applied in a case study in Amsterdam, the Dutch capital with almost 800.000 inhabitants and about 40% market share for biking and 30% for public transport. The authorities want to improve urban quality by stimulating cycling and public transport. A combination of both transport modes, however, competes more easily with car traffic than individual transport modes. Therefore the authorities have special interest in measuring multimodal bike-public transport journeys. The methodology finally results in presenting not only actual usage, actual and perceived quality of public transport, but also of the usage and quality of access and egress modes. A panel of over 300 people, commuting between selected areas, used the app for 2.5 months and jointly generated information about 27,000 journeys. The app successfully managed to measure their modes and travel patterns and yielded the required insights. In addition, AVL data were used to infer the quality of the public transport part of the total journey. A survey among 400 travellers was held to understand the perceived quality of service of the total, multimodal, journey.

Results showed that about 75% of the public transport users used the bike as an access mode, while this mode was used in 20% for egress. Obviously, one has to have a bike available at the destination stop. Bike sharing solutions might increase the usage of bikes at the egress site and therefore also increase total ridership due to better door-to-door services. The average access speed is 14 km/h vs. 9 km/h for egress. The lower egress speed is mainly due to a higher share of walking. Waiting, including parking the bike, is on average 7 minutes. Another finding is that the catchment area of BRT services (offering higher frequencies, speed and reliability) is about twice as large when compared to conventional buses. We found a discrepancy between actual and perceived level of service reliability: it was perceived substantially worse than the AVL data analysis illustrated. The total satisfaction number was substantially affected by the waiting experience at the first and transfer stops (45%), next to quality of access and egress modes (both 10%).

Conclusions

Our methodology has been successfully applied and thus yielded the required insights into total (multimodal) door-to-door journeys. The increased knowledge of access and egress modes also supports modelling to achieve better forecasts. These insights help authorities in policy making and project prioritisation. We expect this approach of combining data sources will be applied in other Dutch cities soon.

References

Van Oort, N., T. Brands, E. de Romph, M. Yap (2016), Ridership Evaluation and Prediction in Public Transport by Processing Smart Card Data:A Dutch Approach and Example, Chapter 11, *Public Transport Planning with Smart Card Data*, eds. Kurauchi F., Schmöcker, J.D., CRC Press.

Van Oort, N. and Cats, O. (2015). Improving public transport decision making, planning and operations by using big data: Cases from Sweden and the Netherlands. 18th IEEE international conference on intelligent transportation systems. Las Palmas, Spain.

NDOV (2016) https://ndovloket.nl/

Bison (2016) http://bison.connekt.nl/

Figure 1: Example of result: modal split of access and egress per area, including waiting times