Passenger arrival and waiting time distributions dependent on train service frequency and station characteristics: A smart card data analysis - DTU Orbit (19/08/2019)

**Passenger arrival and waiting time distributions dependent on train service frequency and station characteristics: A smart card data analysis**

Waiting time at public transport stops is perceived by passengers to be more onerous than in-vehicle time, hence it strongly influences the attractiveness and use of public transport. Transport models traditionally assume that average waiting times are half the service headway by assuming random passenger arrivals. However, research agree that two distinct passenger behaviour types exist: one group arrives randomly, whereas another group actively tries to minimise their waiting time by arriving in a timely manner at the scheduled departure time. This study proposes a general framework for estimating passenger waiting times which incorporates the arrival patterns of these two groups explicitly, namely by using a mixture distribution consisting of a uniform and a beta distribution. The framework is empirically validated using a large-scale automatic fare collection system from the Greater Copenhagen Area covering metro, suburban, and regional rail stations thereby giving a range of service headways from 2 to 60 min. It was shown that the proposed mixture distribution is superior to other distributions proposed in the literature. This can improve waiting time estimations in public transport models. The results show that even at 5-min headways 43% of passengers arrive in a timely manner to stations when timetables are available. The results bear important policy implications in terms of providing actual timetables, even at high service frequencies, in order for passengers to be able to minimise their waiting times.

**General information**
Publication status: Published
Organisations: Department of Management Engineering, Transport DTU, Transport Modelling, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Pontificia Universidad Catolica de Chile, Technical University of Denmark
Contributors: Ingvardson, J. B., Nielsen, O. A., Raveau, S., Nielsen, B. F.
Pages: 292-306
Publication date: 2018
Peer-reviewed: Yes

**Publication information**
Journal: Transportation Research. Part C: Emerging Technologies
Volume: 90
ISSN (Print): 0968-090X
Ratings:
BFI (2018): BFI-level 2
Scopus rating (2018): CiteScore 7.49 SJR 2.611 SNIP 2.973
Web of Science (2018): Impact factor 5.775
Web of Science (2018): Indexed yes
Original language: English
Keywords: Public policy, Smart cards, Subways, Automated fare collection, Waiting-time, Scheduling
DOIs: 10.1016/j.trc.2018.03.006
Source: FindIt
Source-ID: 2398202659
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review