Development of Bus Service Reliability Measures at the Stop Level

A.H.S. Sharic[1] and J.M.S.J. Bandara[2]

Abstract

Bus service reliability, one of the key performance measures, has become a major concern of both transit operators and users because it significantly affects user experience and service quality perceptions. Schedule adherence has been the most important existing reliability measure for infrequent services that operate with headways of more than 10 minutes. For routes characterized by high frequency service namely less than 10 minutes of headways, headway variability has been the most important existing reliability measure. But these measures do not differentiate between the cost of being early versus late. Different unreliability characteristics that cannot be captured by the existing measures calls for a supplementary measure. This research adopts two indices from (Saberi, et al., 2013) that overcome those issues such as Earliness Index (EI) and Width Index (WI). The Earliness Index is defined as the percentile rank of delay/headway deviation of zero. The percentile rank of a particular delay/headway deviation is the percentage of delay/headway deviations in its frequency distribution that are lower or equal to it. EI ranges between 0 and 1. For frequent services, an EI of 0 represents the "all behind schedule" condition and an EI of 1 represents the "all ahead of schedule" condition. For not frequent services, an EI of 0 represents the "all late" condition and an EI of 1 represents the "all early" condition. For infrequent services, the theoretical ideal distribution lays on the y-axis of the cumulative distribution function. Buses that are early can be treated as being one headway late, because passengers who are arriving near the scheduled departure time would have to wait for the next bus. Therefore, the "all late" condition is expected to be the achievable ideal distribution for non-frequent services to avoid early departures. Note that the above statement is true only when the theoretical ideal distribution (all "on-time" condition) is not achievable. The closer the EI is to 0, the more reliable is the service. For frequent services, one cannot argue similarly, since maintaining a fixed headway with a small deviation is more important than being ahead of or behind the schedule. Thus, another measure is required to capture the variation of headways.

To capture the width of the distribution of headway deviations in frequent services, the Width Index (WI) is defined as the 95th percentile of headway deviations minus the 5th percentile of headway deviations divided by the average scheduled headway.

Data needed for theses are as follows. Using the existing time keeper records at the bus stops, a number of measures can be simply calculated. The scheduled headway at a particular stop can be computed as the scheduled stop time for trip i at a stop minus the scheduled stop time for trip $_{i-1}$ at the same stop:

Note that the proposed reliability indices are not suggested as replacements for the existing measures; rather, they are complementary.

Keywords: Bus service, reliability, stop level

Author Details

1. PhD Candidate, Department of Civil Engineering, Faculty of Engineering, University of Moratuwa. ahmssharic@gmail.com
2. Senior Professor, Department of Civil Engineering, Faculty of Engineering, University of Moratuwa. bandara@uom.lk

References

1. Saberi, M., Zockaie, A., Feng, W. & El-Geneidy, A., 2013. Definition and Properties of Alternative Bus Service Reliability Measures at the Stop Level. *Journal of Public Transportation,* 16(01), pp. 97-122.