Abstract

Decision-making by transit agencies in response to dynamic system and external conditions has significant impact on transit system performance. Automatic Data Collection (ADC) systems provide an opportunity to generate large quantities of precise, disaggregate transit operations data at low marginal cost. Analysis of this data has meaningful potential to improve transit agencies’ decision-making related to system planning and operations.

The objective of this research was twofold. First, a set of analytic models was defined to estimate changes in bus performance and passenger travel times, given user-specified stop layout changes to an existing transit trip pattern. The models drew upon archived Automatic Vehicle Location (AVL), Automatic Passenger Counter (APC), and schedule data, and were constructed to accommodate bus stop removal, stop addition, and introduction of limited-stop service. Second, a data analytics platform was created to present ten Key Performance Indicators (KPIs) which drew upon the analytic models. New models were created to estimate average boarding and alighting volumes; likelihood of vehicle dwell; and the number of passengers expected to prefer a hypothetical limited-stop service over an existing local service. Standard models were used to estimate average dwell time; passenger redistribution; acceleration and deceleration time losses/savings; access and egress time losses/savings; and changes to vehicle cycle time, headway, average speed, productive capacity, load factor, and passenger wait time estimation. KPIs produced included bus run time change; bus headway change; bus cycle time change; average bus run speed change; productive capacity change; maximum load section load factor change; passenger in-vehicle time change; passenger access/egress time change; passenger wait time change; and number of passengers expected to prefer limited-stop over local operation.

Software was created to integrate analytic modelling with a frontend graphical user interface for defining stop layout changes, and returning resulting KPIs. A case study was completed using data from the London (Ontario, Canada) Transit Commission (LTC), and intended typical use of the software was demonstrated. In the case of the LTC, vehicle run time change estimates due to stop removal or addition typically ranged from 14-17 seconds per deleted/added stop, with the bulk of per stop time changes (nine seconds) coming from reduced bus acceleration and
deceleration time. While the results were found to be reasonable and estimated changes to
vehicle run times appeared to be validated using a number of before-and-after comparisons from
the LTC database, vehicle run time changes were also found to be inflexible and predictable due
to limitations of the LTC’s data.