

Development of Service Quality Index for Sustainable Bus Transport

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Abstract

Sustainable transport is essential for achieving most, if not all, of the proposed Sustainable Development Goals (SDGs). Improvement of public transport service quality is one of the best alternatives to achieve sustainable transport goals in any part of the world. Transportation agencies can better integrate the concepts of sustainability into their planning, programming, and project development activities through performance measures. The purpose of this paper is to propose a service quality index for sustainable bus transport (SQISBT) which would enable to see how a country or region is progressing towards sustainability in transport.

Reliability, convenience, comfort, safety, security and environmental standards have been identified as the main domains of service quality, in public transport. The relevant performance indicators found were waiting time, travel time, walking time, in-bus environment and station environment. Waiting time was used to reflect the domain of punctuality and reliability. Both waiting time and walking time were the indicators to reflect convenience. Comfort, safety, security and environmental standards were reflected by both in-bus environment and station environment.

Waiting time refers to the time spent at a bus stop/terminal to get on a bus. Average excess waiting time (AEWT) is proposed as an indicator. AEWT is estimated as the difference between the average of actual waiting time, and scheduled waiting time. Schedules of all the bus routes in operation are to be collected, and a weighted average of a scheduled headway for bus trips are to be calculated. The schedule adherence can be monitored either using Geographical Positioning System (GPS) or bus dispatchers' records. Average scheduled waiting time is taken as half of the average headway for frequent bus service routes which have one bus at least every twelve minutes. Decreasing score is always positive. Walking time refers to the time taken for the passengers to get access to a bus from their trip origins and the time taken to reach their trip destinations on foot, after taking the bus. This can be measured by the proportion of households within an acceptable (e.g. 500 meters) walking distance to bus stops/terminals from their trip origins. Buffer zones are to be drawn for all the bus stops/terminals and the proportion of population can be averaged for a certain district. Increasing score is always positive and the score would lie between 0 to 100 percent. The travel time means the time taken in bus travel. The average travel time per unit distance will be found out by the GPS or using published schedules, if no vehicle tracking is available for the certain locations. The weighted average travel time based on number of buses operated, is calculated, taking into consideration different routes and different times. Here, the decreasing score is always positive. In-bus environment refers to the level of comfort expected by the passengers inside bus. This can indirectly be measured by the age of the buses. Year of manufacture of buses and number of years in operation are to be collected from all the buses in an area. The weighted average value will

be used as an indicator. The decreasing score is always positive. Station environment refers to the needs and expectations of the passengers at the station or halt. This can be measured by the perception on the levels of which these needs are met. Theory of Maslow's Hierarchy of Needs was used to derive possible levels of passenger needs inside a bus while traveling. Availability of toilets, washroom, availability of seats and shelters, availability of television and entertainment, availability of categories of counters and availability of one room with all these facilities for a passenger to himself/herself are the identified indicators for measuring the perception on station environment that represent the elements of Maslow Hierarchy of Needs such as physiological, safety, love and belonging, esteem and self-actualization respectively. The score will be 1 to 5 for the respective needs. The perception should be collected from a sample of passengers representing various trip purpose, gender, level of income etc.

It is proposed to normalize the above scores using weightages for these service quality parameters obtained in a previous study (Sharic,2016) and the following equation, where Z is the normalized indicator value, Xmin is the 'worst' value of the indicator in actual units, whereas Xmax is the 'best' value. Xi, c are the values to be received for the identified indicators for a certain city.

$$Z_{i,c} = \frac{X_{i,c} - X_{\min,i}}{X_{\max,i} - X_{\min,i}} * 100$$

Likewise the normalized values for the indicators will be found notated by Zwalking time, Zwaiting time, Ztravel time, Zin=bus environment and Zstation environment respectively. Then the sustainable bus transport service quality index (SBTSQI) for the certain city/village would be found by the following equation.

$$SQISBT = 5Z_{\text{walking time}} * Z_{\text{waiting time}} * Z_{\text{travel time}} * Z_{\text{in bus environment}} * Z_{\text{station environment}}$$

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