

DETERMINING THE LEVEL OF SERVICE OF BUS TRANSPORTATION IN SRI LANKAN CONTEXT

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ABSTRACT – Assessing the existing service quality of public bus transportation is a key requirement to identify potential improvements in buses. Level of service has been identified as an effective indicator to measure the service quality of buses. Even-though the definition of LOS says it should be measured based on user perception, existing LOS scale values have been derived through expert judgement. This research attempts to derive LOS threshold values for selected six service attributes (loading level, speed, service hours, waiting time, reliability, and frequency of service) which affect the level of service of public buses based on user perception using law of successive scaling technique. The derived LOS benchmarks are ranging from LOS A to LOS E which denotes the “best” to “worst” levels. The results of the study can be used to identify the existing service level of buses and thus to identify potential improvements for public buses in terms of identified service attributes.

Keywords: public transportation; level of service; users’ perception; service attributes

1. INTRODUCTION

Transportation sustains in a dominant place today whereas the demand for transportation has been increasing rapidly due to the growth in population and their needs. Even-though the public bus transportation in Sri Lanka is playing a key role in current transportation industry, the demand for public buses is decreasing drastically currently having 55% modal share for buses and predicted a modal share of 20% by 2031 under do nothing [1]. In order to grab the demand for public transportation, it should be well maintained and improved. Continuous monitoring of any activity will upgrade its existing performance to higher levels. The level of service of public transportation can be taken as an indicator to measure the service quality of the public transportation [2].

This study develops a methodology to measure the level of service of bus transportation in terms of service attributes as a case study based in Sri Lanka. In past years, researchers have developed different approaches to measure users’ perceptions of service quality of public transportation. Shreya Das and Debapratim Pandit [3] has developed LOS scale values for bus transit service attributes as a case study in Kolkata. They have used “Law of Successive Interval Scaling” to determine LOS scale values based on the users’ perception. Rengarasu et al. [4] has developed a level of service index for privately owned bus transportation in Sri Lanka where it measures the quality of service of buses. Further, Bachok et al. [5] has measured the service quality of public buses using existing LOS threshold values and has identified required improvements for current service.

This study explores a methodology to define LOS threshold values for identified quantitative factors affecting the LOS of bus transportation based on users’ perception and thus identifying improvement methods for existing bus transportation.

2. MATERIALS AND METHODS

A passenger survey was conducted along Colombo – Galle corridor and 219 responses were collected through random sampling technique. Passengers who use Colombo – Galle buses are the main respondents for the survey. The questionnaire survey was based on identifying the significant factors that affect the level of service of public buses. Measurements used for factor evaluations were five-

point Likert scale (1 – Most significant, 5 – Not significant & 1 – Very good, 5 – Very poor) which describes the significance level and the passenger satisfaction level of the particular factor.

2.1. Identifying attributes and the significance

Attributes that affect the level of service of public buses have been identified through a thorough literature review. Total of 15 attributes have been identified and Table 1 shows the identified attributes which were used in the questionnaire form.

Table 1. Identified Attributes that Affect the LOS of Buses

1. Bus fare	2. Waiting time	3. Loading level
4. Cleanliness	5. Safety	6. Reliability
7. Comfort	8. Frequency of service	9. Conductor attitude
10. Vehicle condition/Quality	11. Service hours	12. Physical design of bus stops
13. Travel time	14. No of bus stops	15. Facilities at the bus stops

The significance of the identified attributes has been analyzed through Exploratory Factor Analysis (EFA). EFA reduces the existing factors to a new set of factors based on the underlying latent principal [6].

2.2. Developing LOS thresholds

Law of successive interval scaling technique is used to derive threshold values for each significant factor where it converts ordered categorical data into an interval scale [7]. Passenger satisfaction ratings on perceived service levels for each factor were used to derive LOS thresholds for the given factors. By assuming a causal relationship between user perception of LOS rating and the actual physical measure, LOS scale boundaries were determined. Respondents were rated their satisfaction level on a five-point scale and thus, it leads to five different LOS categories from LOS A to LOS E.

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics

Total of 219 responses were collected through the passenger survey conducted during the peak hours at Pettah bus terminal. Table 2 shows the socioeconomic characteristics of the survey respondents.

Table 2. Descriptive Statistics

Factor	% share of users	Income (per month)	% share of users	Age	% share of users
Captive riders	48.40%	< Rs. 60,000	68.95%	16 – 25 years	43.84%
Choice riders	51.60%	Rs. 60,000 – Rs. 120,000	25.57%	26 – 35 years	23.29%
Male	53.88%	>Rs. 120,000	5.48%	36 – 55 years	32.88%
Female	46.12%				

3.2 Significance of the factors

Through Exploratory Factor Analysis (EFA), two main factors having eigen values of 6.418 and 2.162 were extracted. The extracted two factors cover 13 attributes out of 15, identifying those 13 attributes as the most significant factors which affect the level of service of public buses. Kaiser-Meyer-Olkin (KMO) test was performed to determine the suitability of data for factor analysis. KMO value was derived as 0.886 which indicates the sample size was adequate to conduct the factor analysis. Total variance explained by extracted factors is 61% which is at an acceptable level. Bus fare and conductor attitude were dropped out through the analysis indicating that those factors are not significantly affecting to the level of service of public buses.

3.3. Developed LOS Thresholds

LOS thresholds have been developed for six quantitative service attributes using law of successive interval scaling technique. The developed threshold values have been shown in table 3.

Table 3. Derived LOS Threshold Values

LOS Thresholds for Loading Level		LOS Thresholds for Speed		LOS Thresholds for Service Hours	
LOS Category	LOS Thresholds (Pax/Seat)	LOS Category	LOS Thresholds (kmph)	LOS Category	LOS Thresholds (Hours)
A	<= 0.30	A	> 55	A	> 20
B	0.31 – 0.50	B	40 - 55	B	12 - 20
C	0.51 – 0.80	C	30 - 40	C	7 - 12
D	0.80 – 1.70	D	16 - 30	D	4 - 7
E	>1.70	E	<= 16	E	<= 4

LOS Thresholds for Waiting Time		LOS Thresholds for Reliability		LOS Thresholds for Frequency of Service	
LOS Category	LOS Thresholds (Minutes)	LOS Category	LOS Thresholds (%)	LOS Category	LOS Thresholds (Minutes/Bus)
A	0	A	100	A	<= 13
B	0 - 12	B	75 - 99.9	B	13 - 18
C	12 - 18	C	62 - 74.9	C	18 - 22
D	18 - 38	D	31 - 61.9	D	22 - 32
E	> 38	E	< 31	E	> 32

4. CONCLUSION

The LOS selection framework can be applied to any bus system and the derived LOS scale values can be used to identify improvements in the current bus service and thus, can take steps to develop the public bus transportation in the country. However, the scope of this study is limited to only quantitative service attributes. The application of this methodology can be further applied to derive LOS scale values for qualitative service attributes.

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