

A Comparison of the Characteristics of Urban and Rural Bus Transport in Sri Lanka - A Case Study

Tissa U. Liyanage, Pradeepa R. Jayaratne and Amal S. Kumarage

Abstract: The public bus transport systems in most developing countries are not at a satisfactory level especially from the passenger point of view. Overloading at peak hours, waiting and travel time delay during the off peak, anti-social behaviour of bus crews, unacceptable noise levels, inadequate and unacceptable user comfort, lack of user rights, lack of night services and of non profitable routes are few of the major issues in the public bus transport system in Sri Lanka as well. There are a number of reasons for this situation. One of the main reasons is the lack of management of the demand and provision of adequate supply of public bus transport that satisfied both the user and operator simultaneously. Inability to understand the qualitative parameters of the transport supply demanded leads to poor response to this situation by both passengers and their communities as well as policy agencies. These parameters differ contextually. For example the requirements of typical urban passengers differ from those of rural passengers.

This paper analyses the results of a case study which compares the inherited problems in a bus transport system under typical urban and rural situations. The user response by interviews, bus loading and travel time surveys, from each of these locations has been analysed to understand and compare the problems in each situation. The analysis also shows a significant difference in supply and demand characteristics of the bus transport system between urban and rural areas in Sri Lanka. The research paper also discusses the need for passenger empowerment as one of the interventions needed to mitigate the present problems in Sri Lanka's public bus transport system.

Keywords: Urban and Rural Bus Transport, Demand and Supply Management, Passenger empowerment

1. Introduction

Provision of bus passenger transport is one of the largest industries in Sri Lanka. The total share of inland transportation provided by buses are high as it is more than half of the total passenger transportation demand at present. The market share among State-owned and private owned bus services varies by location and depends on the demand in the area. Apparently, private owners being profit oriented always select profitable routes while the State owned buses are often left to run non profitable routes as a service to the community. There is a significant difference in the fleet capacity and the share of the revenue among the two service providers in Sri Lanka.

According to previous studies, it has been shown that the available bus fleet is in excess of the present demand if it is managed well [5] using scientifically designed time tables [6]. Some of the other reasons for unsatisfactory service due to bad management can be observed as; time schedules not being monitored at terminals, no proper coordination

between time tables of private and State owned buses on a route, non availability of rotating time tables for changing the turns between peak and off peak demand, lack of ordinance to safeguard passengers against anti-social activities, and many more. This situation has led to loss of profit to the operators which in turn renders them unable to provide a satisfactory service to the passengers.

These shortcomings are reflected in terms of overloading, delay at start terminal, delay at intermediate stops, unsafe driving, frequent

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clashes between passengers and bus crew, lack of night services, poor service on non profitable routes, on-road competition between operators, poor standard of buses etc. It is very important to analyse these ill-effects in detail from the passenger point of view for a better understanding of the problem.

This study uses both quantitative and qualitative analysis to compare and discuss results of the analysis.

2. The Objectives

The following are the objectives of this research paper.

- The primary objective is to understand various problems faced by bus passengers in Sri Lanka.
- Secondly to compare the effects and significance of such problems between urban and rural passengers.

3. Bus Passenger Transport in Sri Lanka

The first bus in Sri Lanka (Then Ceylon) commenced operation around 1907. Since then, buses were operated by private companies till 1951 and then by public companies till the bus was nationalized in 1958. The Ceylon Transport Board (CTB) as a state-owned monopoly undertook the operation and continued until 1978, when it was decentralized into nine Regional Transport Boards (RTB). Since 1979, the private sector has been allowed to operate on selected routes. In 1985, Private Omnibus Associations (POA) were set up. Since then several reforms were introduced to ensure efficient public bus transport service by CTB as well as private operators, but has not been entirely successful so far [4].

Table 1: Sri Lanka Modal Shares (2001)

Mode of Travel	Travel Kilometres (Mn)	
	Vehicle	Passenger
Bus	966 (08%)	45,407 (68%)
Private Vehicles	7,861 (64%)	15,831 (24%)
Railways	11 (00%)	3,600 (5%)
Three Wheelers	1,548 (13%)	1,161 (2%)
Truck/Land Vehicles	1,813 (15%)	907 (1%)
Water Transport	3 (00%)	
Total	12,202 (100%)	66,906 (100%)

A summary of the share by different modes of transport in Sri Lanka is given in Table 1. It can be seen that today, 68% of all motorized

passenger kilometres in Sri Lanka are made by bus. This indicates the success of the bus industry in Sri Lanka in terms of coping with the demand even though it continues to lose to the private vehicles since qualitative improvements have not kept pace.

4. Study Area

The two areas for the surveys were selected to cover typical urban and rural conditions. Mattegoda housing scheme of Kottawa in the Colombo District and Kudaligama village, off Matugama in the Kalutara District were chosen as urban and rural areas respectively. The two study areas are shown in the Location Map (Figure 1). The socio economic characteristics of the study areas- such as the number of households and population, the transportation characteristics such as number of bus routes severing the area, number of buses and trips per day, were considered in selecting the suitability of the area.

Mattegoda Housing Scheme

Mattegoda housing scheme is situated approximately 18km away from Colombo Fort and to the south east of the city. The housing scheme which is managed by the Homagama Divisional Secretariat is situated within the Homagama Pradeshiya Sabha. The scheme is located is 4.5km from the closest at Kottawa which is on the A4 highway, a main arterial road in Sri Lanka. The scheme is partly spread over four Gramaseva Divisions namely, Mattegoda Central A, Mattegoda Central B, Mattegoda East and Mattegoda West.

Kudaligama Rural Area

The village, Kudaligama belongs to Bulathsinhala Divisional Secretariat situated 14.2km away from Matugama town in , the Kalutara District and 72 kms from Colombo. The study was confined to three Gramaseva Niladari Divisions namely Ihala Kudaligama, Pahala Kudaligama and Girikola. The population is approximately 1850 and there are around 750 households in the area. There is a high school in the village. The students either walks to school or common by bus. There is hardly any large industry the area. Agricultural activities such as paddy farming are inherent to the area. Majority of the population is employed at urban centres and commute daily to these towns and some even to Colombo.

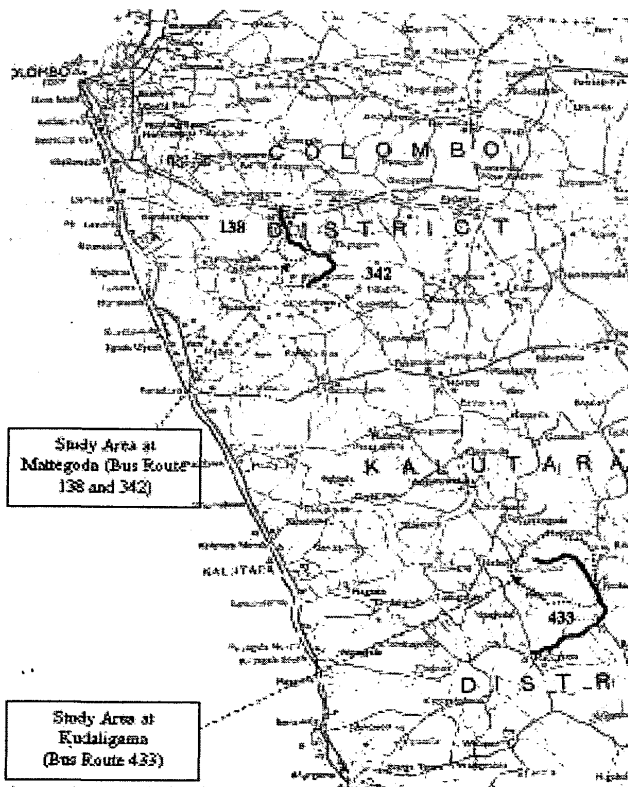


Figure 1: Location Map of the Study Area

5. Data Collection

Bus Travel Time Survey and Bus Loading Survey were carried out on two consecutive days for each study. 120 households from in the Mattegoda housing scheme were covered under the household survey which represented over 10% sample of the total population of the area. Randomly selected sample from Kudaligama rural area was 121 households (15%). Since there are several types (B, C & F type houses) of housing in Mattegoda scheme, equal sample rate was selected from the each type.

Travel Time Surveys and Bus Passenger Loading Surveys were carried out on the Number 138 route and Number 342 route as urban routes in Mattegoda, while the Number 433 bus route was a rural route (Figure 1) in Kudaligama. The selected lengths for above routes were 4.5km, 6.75km and 14.2km respectively.

6. Analysis

This analysis has been carried out based on three important contents: i.e; household interviews, passenger loading data and travel time data. Each item is discussed separately.

6.1 Analysis of Household Surveys

Table 1 has been derived based on the responses of the passengers on the quality of bus services available in the two study areas. Those who have indicated it as being excellent or very good have been given an average of 95 points (or marks) while those who indicated 'good' were given an average of 80 points, while those who indicated 'acceptable', were given an average of 55 points, with 'unacceptable scores fetching 20 points on average. This has been formulated on the basis of points given for general education which are well known among the public. In this case an average of around 40 points is generally known as a 'failure' while between 40 to around 70 may be considered as acceptable, and those higher than 70 would be considered as very good. The percentage responses in each category of service level are tabulated for both urban and rural areas.

According to Table 2 the quality of service with respect to overloading and non-issuing of tickets in urban areas can be termed as failing to satisfy the minimum requirement. On the other hand, the condition of the bus, the bus fare and the frequency of buses (waiting time) are considered as having met with required standard with the other attributes leaving much room for improvement. In rural areas, overloading, condition of buses and bus stops, waiting time attributes need improvements.

Table 2: Percentage Response on Bus Service (Urban and Rural Comparison)

Problems	Passenger Response											
	Urban						Rural					
	% Response					Average Score	% Response					Average Score
	Very Good (90-100)	Good (70-90)	Unsatisfied (40-70)	Poor (0-40)	Total		Very Good (90-100)	Good (70-90)	Unsatisfied (40-70)	Poor (0-40)	Total	
Travel Time	0	20	37	43	102	45	1	29	53	17	126	57
Overloading	1	1	27	71	101	31	1	2	60	38	126	42
Condition of Bus.	2	75	16	8	102	72	2	33	49	17	127	58
Bus Conductor Behavior	1	22	32	46	101	45	10	72	16	2	126	76
Bus Drivers Behavior	3	22	42	33	102	50	10	76	14	0	125	78
Ticket Issuing	2	8	30	60	101	37	29	35	25	12	126	71
Morning & Night Service	2	11	48	39	102	45	42	27	24	7	127	76
Condition of Bus Stops	1	23	42	34	102	49	0	12	62	26	113	49
High Bus Fare	40	17	34	8	99	73	25	1	60	15	121	60
Waiting Time	14	43	30	12	97	67	1	17	53	29	124	49

The individual score attained by each service attribute are compared between urban and rural context and discussed using ensuing bar charts given below.

Travel Time

The comparison of user response on travel time to complete the one way journey at urban and rural area services are shown in Figure 2. Bus passengers in both areas are unhappy with this attribute. Results show that more than 80% of urban users and more than 70% rural users are dissatisfied about the travel time of the journey. Average effect is shown by average score of the response as 45 in urban areas where as this is 57 in rural areas. This means that urgent attention is required to urban areas even though both situations require improvements.

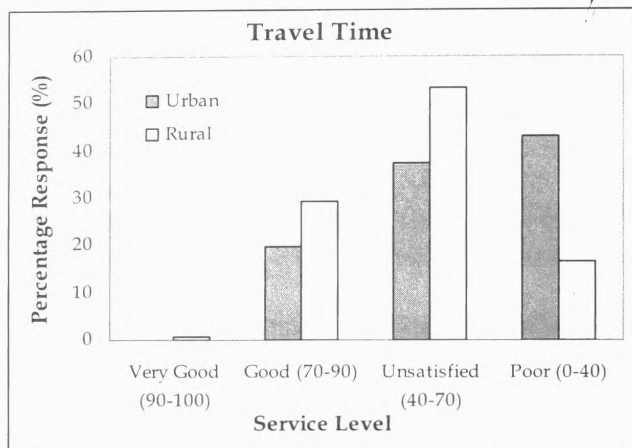


Figure 2: Passenger Response on Travel Time

Overloading

The response of the passengers on overloading is far worse than the effect of travel time delay. More than 98% of the passengers appeared to suffer from overloading of the buses (Figure 3).

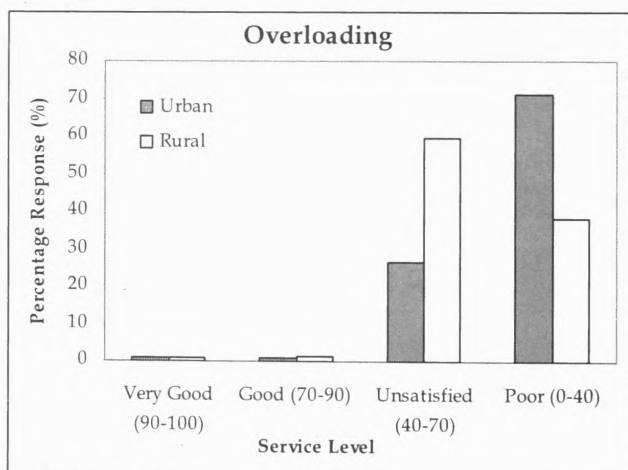


Figure 3: Passenger Response on Overloading

Here too, the worse situation is found in urban services. The average score calculated is 31. This is the worst average score in this analysis. The corresponding score is 42 for rural services which is also the lowest attribute score for rural services. This shows that overloading is the

most severe problem in today's bus transport service from the passenger's point of view.

Condition of Bus

More than 75% of responses from the urban bus passengers indicate that they are quite satisfied with the condition of the buses. But the buses in rural services are considered as unsatisfactory or poor by more than 65% of the responses. The high average score as 72 for urban buses confirms a favourable situation while the score of 58 for rural areas indicates the need for improvement. Generally, the condition of buses seems to be satisfactory in both contexts.

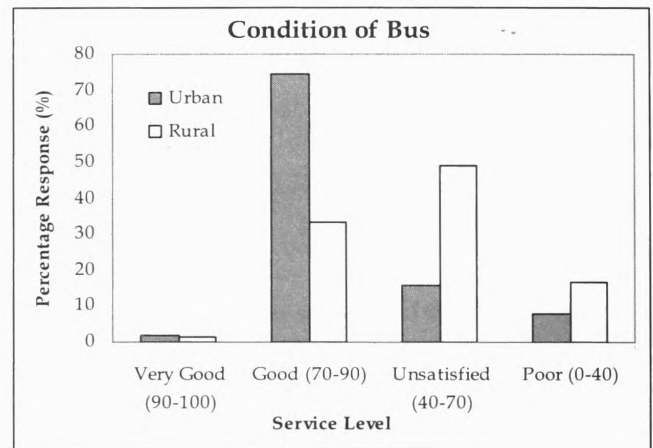


Figure 4: Passenger Response on Bus Condition

Bus Conductor's Behaviour

The analysis shows there is a significant difference in bus conductor's behaviour from urban to rural (Figure 5) context. Dissatisfaction among urban passengers is high at 77% while it is low at 18% among the rural passengers. The average score (45) appears to indicate that urban passengers are not satisfied, while an average score of 76 appears to satisfy most of the rural passengers. The apparent reason could be the close social relationship between conductors and the commuters who are generally known to each other in a rural context but it is not so in urban areas. Problems such as changing of conductors frequently, competition between buses, difference between supply and demand in urban areas seem to be the apparent reasons for the dissatisfaction over conductor's behaviour on urban routes. This difference is the reason for the conflicts that occur between bus crews and passengers in urban buses.

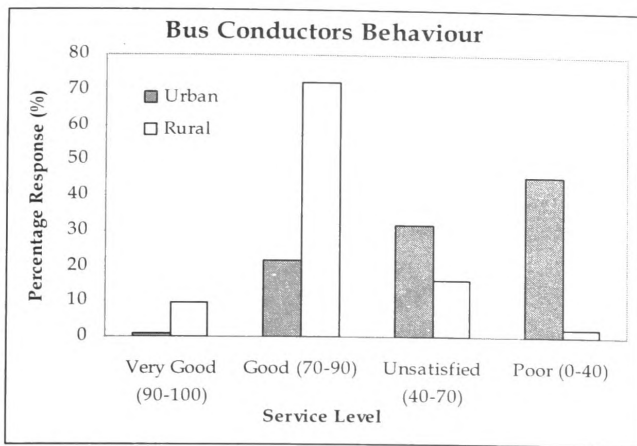


Figure 5: Passenger Response on Conductor's Behaviour

Bus Driver's Behaviour

The same trend as for bus conductor's behaviour is seen in driver's behaviour (Figure 6). But this is not as bad as conductor's behaviour. The rural passenger has accepted the driver's behaviour, while the urban passengers have rejected it. The same reasons as discussed previously for bus conductor's behaviour analysis can be attributed in this analysis as well.

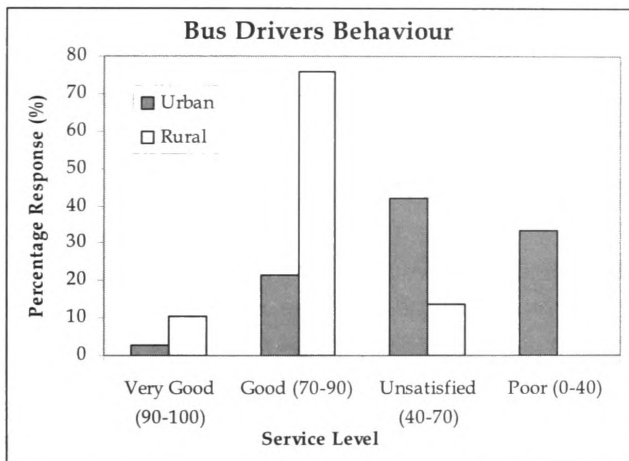


Figure 6: Passenger Response on Driver's Behaviour

Issuing Tickets

It is clearly shown in Figure 7 that this is a major issue in urban services compared to rural bus operations with more than 90% of passengers dissatisfied with the issuing (or in reality non-issue) of tickets. This is only 35% in rural areas. The average score on ticket issuing in urban areas is 37. This is the second lowest in any discussed attribute of this research. In the case of rural areas, this is 71 which shows a generally satisfactory level of service. One of the reasons for the difference in two situations could be the high market share of State owned buses in rural areas which generally issue tickets. Also the overloading in urban areas

encourages the conductors not to issue tickets. The user attitude in obtaining tickets where the rural passenger has a lower need for a ticket also may have led to the different responses from the passengers.

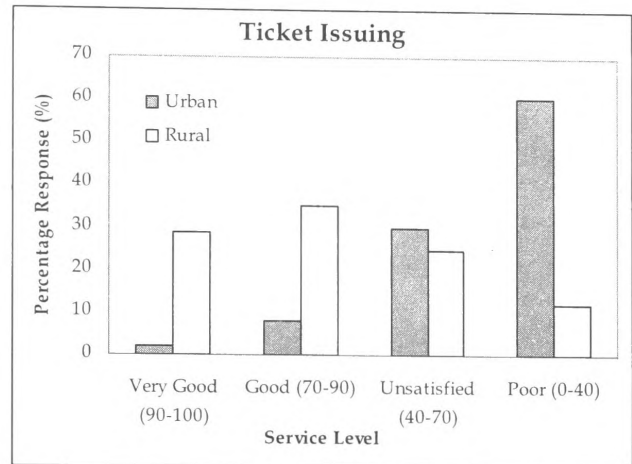


Figure 7: Passenger Response on Ticket Issuing

Morning and Night Service

Yet again Figure 8 shows a typical inverse relationship between urban and rural bus services. It shows more than 87% of responses indicate poor morning & night service in urban area whereas only 30% of rural passengers complain. The severity level of service is indicated by average score of 45 and 76 in urban and rural areas respectively. The reasons for this difference could be the early morning start of long distance buses originated from rural end and late hour's bus services provided from State owned buses. The need for early morning or late night services also may be higher in urban areas which have longer activity days. The analysis shows that there is a very high need for a satisfactory early morning and late night service in urban residential areas while in rural areas this is still at a satisfactory level.

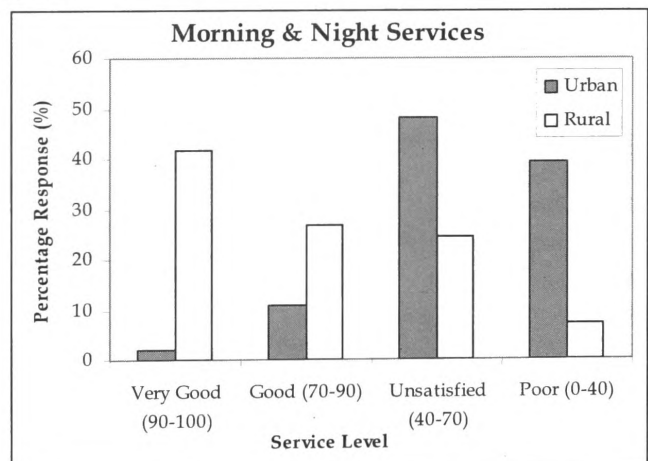


Figure 8: Passenger Response on Morning & Night Services

Condition of Bus Stops

Figure 9 shows an unsatisfactory level of the condition of bus stops in both environments. Passenger response confirms that their dissatisfaction levels are 77% and 88% in urban and rural situations respectively. They have the same average score (49) in both cases indicating that the dissatisfaction is equally severe in both areas.

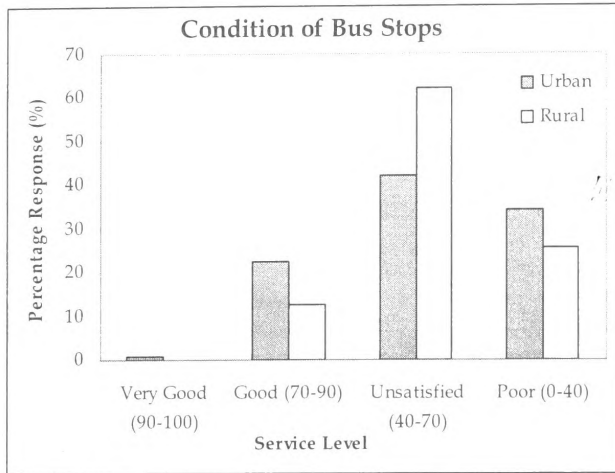


Figure 9: Passenger Response on Condition of Bus Stops

High Bus Fare

According to Figure 10 shown below, the affordability of bus fares has been a major concern to rural passengers where as urban passengers complain less. Seventy five percent (75%) of rural passengers say it is too high but only 42% of urban responses say so. However, the average score of 73 and 60 from urban and rural responses indicate that this is not as severe as other problems of bus passengers. The average difference of poverty levels of bus passengers in two contexts seems to be the main reason for the two dissatisfaction levels.

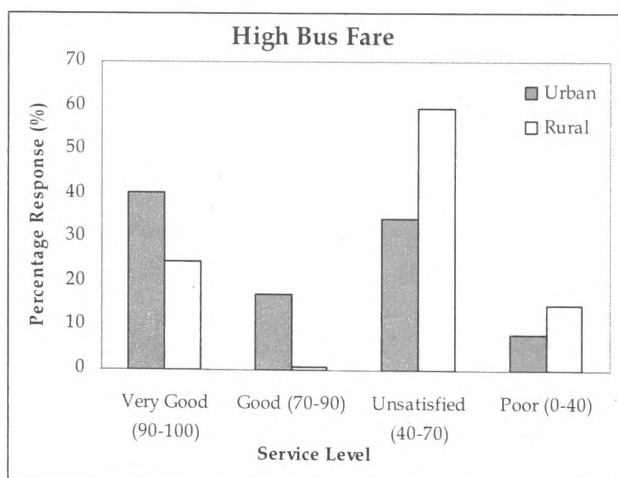


Figure 10: Passenger Response on Bus Fare

Waiting Time

The analysis of waiting time for buses is given in the Figure 11. It shows that this problem is much severe for rural passengers (82% responses against) than urban users (42%). The main reason seems to be the difference in despatching rate under different demand levels in the two environments. In the rural context due to less competition, buses tend to wait longer to fill them with passengers, while in urban areas due to competing services, this less grave problem is.

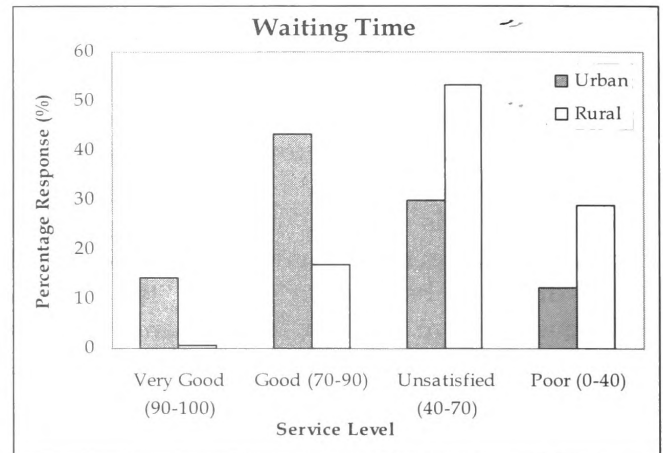


Figure 11: Passenger Response on Waiting Time

6.2 Summary of the Analysis of Household Surveys

According to the above analysis of the various aspects given in Table 2, we can conclude that the most severe problem in both urban and rural bus transport is the overloading. Ticket issuing is the second most severe issue. Travel time and condition of bus stops have equal severity, followed by lack of morning and night services. Bus conductor's behaviour and waiting time have equal public complaint against them.

When we consider the issues separately according to the above analysis, problems in the urban bus transport system are much severe than in rural services. Most critical issues in urban areas are overloading and non issue of tickets. The most critical in rural areas are overloading, condition of bus stops and waiting time.

6.3 Comparative Analysis of Bus Loading Data

The loading surveys were conducted on Route nos. 342 and 433 which serve Maththegoda

(urban) area and Kudaligama (rural) area respectively.

The collected data were analysed for both State owned buses and private operators. The number of passengers on board (loading data) have been considered as the demand at that time whereas the number of seats in the bus as the supply.

The analysis of urban routes shows that the peak demand is between 7 and 9 AM where as the morning and evening peaks are less prominent in the rural areas. The demand in rural areas is rather consistent throughout the day. It was observed that there was a deficiency of the supply throughout the day in both urban and rural areas (Figure 12). This deficiency is much higher in the urban areas. The response from the passengers on overloading of buses has confirmed the severity of the situation (Figure 3). The flat nature of the supply graph indicates that there are deficiencies in scheduling of the supply and the lack of a demand based timetable. This is evident in the dissatisfaction shown by passengers towards travel time and waiting time shown in Figure 2 and Figure 11.

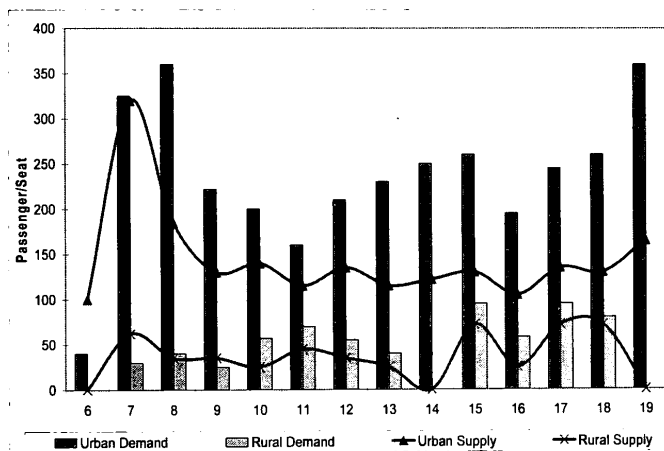


Figure 12: Demand and Supply Graph for Rural and Urban Bus Routes

As shown in Figure 12 it clearly shows the variation in the demand for the route as well as the deficiency in the supply which results in overloading.

6.4 Comparative Analysis of Bus Travel Time Data

The bus travel time surveys for the two bus routes in above rural and urban areas have been carried out separately.

The total length (14.2km) of the rural road has been considered as two sections in which 7.6km belongs to a main road where there is competition from other buses travelling to different destinations. The other section which is 6.6km in length is purely serving the village. The travel time attributes of these two rural sections and the urban section are shown in Table 3.

Table 3: Travel Time, Delay and Speed Comparison

Details of Travel Attributes	Rural Road			Urban Road
	Road Section	Road Section	Total Length	
Number of Bus Trips in Data Sample	9	8	17	27
Length of Travel (km)	7.6	6.6	14.2	4.5
Delay				
Maximum Delay (min)	29	33	37	14
Minimum Delay (min)	4	2	2	3
Standard Deviation	10	10	11	4
Coefficient of Variance (CoV) %	74	114	71	69
Average Total Delay [min]	13	9	16	6
Travel Time				
Travel Time (With Delay) [min]	21	25	44	13
Travel Time (Without Delay) [min]	16	20	35	10
Travel Speed				
Travel Speed (With Delay) [km/hr]	22	17	20	22
Travel Speed (Without Delay) [km/hr]	30	20	25	30

Delay

The term delay referred to in this paper is the time duration where the bus remain at a bus halt over and above the time it takes for boarding and alighting of passengers. Average delays per kilometre are recorded as 75 seconds and 67 seconds per kilometre in urban and rural respectively. However, the initial delay at commencement of service in rural areas seems to be higher compared to the urban context. The high coefficient of variance (CoV) of delay at rural road section also indicates the highly irregular travel behaviour in the rural section.

Travel Speed

The travel speed without delay is the actual average moving speed of the bus in a given road section. This has been calculated by dividing the total travel length by the summation of all travel times between two stops. This is high as 30km/h in urban areas which is an acceptable speed (Table 3). However, this is around 25km/h in rural route. It can be seen that this speed in the main road section is as high as 30km/h whereas it is 20km/h in rural section. The higher speed on the main road section clearly indicates the competition by other buses which share the demand on the main road.

Summary

The first and second major issues of the public bus transport are overloading and travel time

delay are clearly supported by the on-site observed data as discussed in section 6.3 and 6.4. There is a good relationship between the user comments and the observed data from loading and travel time surveys.

7. Conclusion

There is considerable dissatisfaction over the quality of bus services that are provided to both urban and rural areas as disclosed in this paper. The nature of the dissatisfaction vary between locations. The suburban area referred in this analysis, demands more qualitative bus transport and passengers are prepared to even pay higher fares. On the other hand the needs of the rural area are more in terms of the deficiency in quantity of transport. These passengers are conscious of costs and correspondingly make lesser demands on quality. However, both communities note that delays and overloading are a source for great irritation.

Delays appear to be in the form of lingering at bus halts where there is a higher likelihood of passenger collecting. Typically, junctions and bus stands are prime locations. Delays appear to be higher in shorter routes and routes where there is only one bus route service. On main roads served by a number of routes, delays are less. On some routes the total travel speed appears acceptable. However there is high speeds in certain sections and lingering in others. This driving pattern is highly unsatisfactory as it can lead to accidents on the one hand and unnecessary stress and waste of time on the part of the passengers.

The loading pattern of both bus routes clearly indicates the absence of a controlling timetable. A simple rule appears to govern the dispatching of buses. That is the buses are dispatched when all the seats are taken. In the peak period this appears a consistent rule. In off-peaks when buses are dispatched without seats filling up, operators delay at junctions in order to ensure higher load factors. There appears to be no real enforcement of time tables or over-loading by any of the regulatory bodies. As such, the passengers are at the mercy of the operator's patterns. The industry bears all the signs of a supply driven, unregulated industry, wherein the passenger exists only in order to ensure that the operators can maintain a business.

Since we cannot see any favourable improvements controlling agencies to address this situation for a long period of time. It is important to test a procedure to minimise the negative impact of some of the quality issues with passenger participation. This can be made successful by implementing passenger empowerment policies to allow public transport passengers to participate in the event within a legal framework. The analysis of this research paper can be used to understand the present problems and their magnitude when such policies are formulated.

Acknowledgement

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