Possible ways to improve public bus transportation in Itaperuna, Rio de Janeiro, Brazil

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Abstract

In a previous paper by De Souza et al. we analyzed the transportation system by buses in the city of Rio Branco, located in the state of Acre, Brazil. In this work the main objective is to analyze the quality of service of the public bus company operating in the city of Itaperuna, in the state of Rio de Janeiro. Itaperuna has around 180,000 inhabitants and the bus service is supplied by only one public bus company. This analysis will be based on the opinion of the bus users with the objective of determining their degree of satisfaction with the service available. Then we will be able to determine the best way to improve the quality of the service provided by Itaperuna's bus company.
Keywords: public transportation, Itaperuna's bus company, quality of service, passenger opinion, service cost, time schedule, efficiency.

1 Introduction

The urban transportation system of Brazilian cities relies heavily on buses. Therefore it is a major concern for authorities to find ways to improve the efficiency of the bus service delivered to the population. Itaperuna, a city in the state of Rio de Janeiro, Brazil, is not an exception to this rule. It has around 180,000 inhabitants and the bus service is supplied by only one public bus company. Needless to say, the city's transportation system is highly dependent on this bus company.

In the last few years Itaperuna has shown a rapid population increase due to the economic development of Rio de Janeiro. Even with this fact in mind, it is


WIT Transactions on The Built Environment, Vol 116, © 2011 WIT Press
www.witpress.com, ISSN 1743-3509 (on-line)
doi:10.2495/UT110181

noticeable that the volume of paying passengers using the local bus service has been falling year after year. Several factors such as personal cars; travel by bicycles and motorcycles; private buses and passenger dissatisfaction with bus service can be contributing to this situation.

In this work the main objective is to analyze the quality of service of the public bus company operating in the city of Itaperuna. This analysis will be based on the opinion of the bus users with the objective of determining their degree of satisfaction with the service available. With the outcome of this evaluation we will be able to determine the best way to improve the quality of service provided by Itaperuna's bus company in terms of manpower, service cost, time schedule, etc. This work will also identify the profile of the bus company's customers.

2 Collective transportation system in Brazil

According to the National Urban Transport Association [2] "in Brazil, on average, the public transportation system is carrying 40% fewer passengers then they carried in 1995." This situation creates a vicious circle, shown in Figure 1.

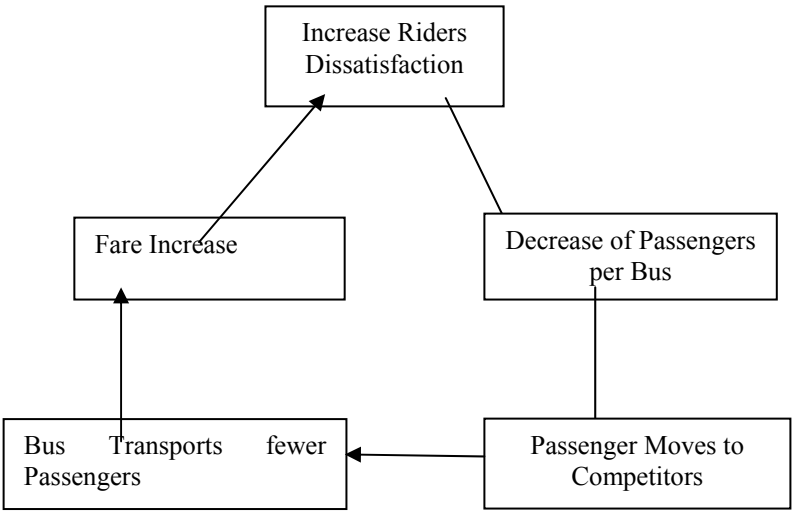
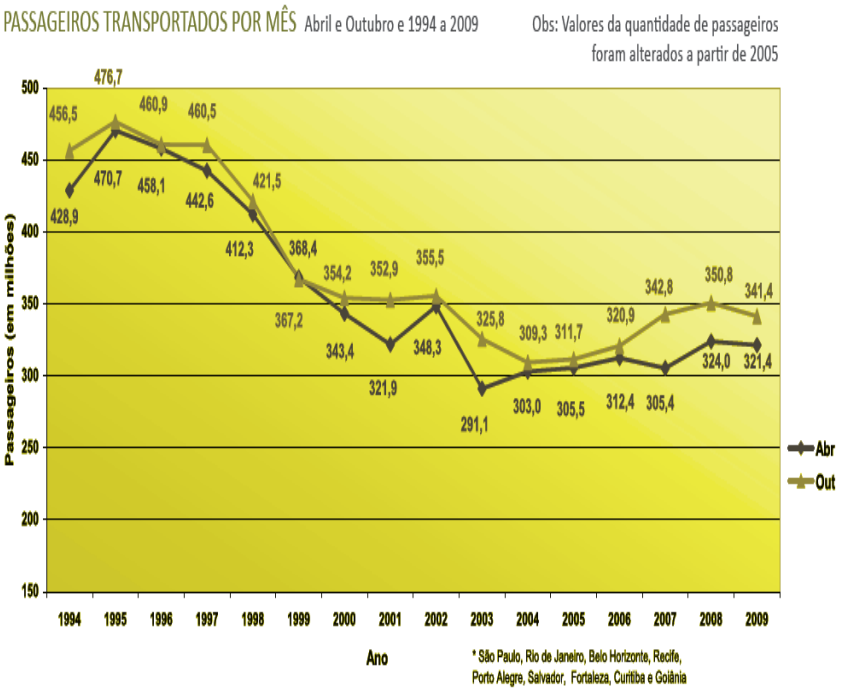


Figure 1: The vicious circle faced by public bus companies in Brazil.

The NPK (Number of Passengers per Kilometer,) in 2003 was approximately 66% lower than in the beginning of the 90's, before the boom in the car industry and the creation of illegal (not authorized) bus or van transport. Another indicator of the decline in bus transport is the average number of passengers transported by day per bus, which at the beginning of the 90's was 600 and has declined to 400 in 2004. As the number of riders decline, the operational cost of the buses falls to the remaining passengers, who become unhappy and more willing to use other transportation options, which powers the vicious circle (National Urban Transportation Association-Yearly Report [3])

More recently, according to the National Urban Transport Association [4], in the state capitals the number of passengers transported per month in 2009 has shown some stabilization in relation to 2008, even though this number is quite inferior to the one registered at the beginning of the last decade. This can be seen in Figure 2 below from the National Urban Transportation Association [4].



Source: National Urban Transportation Association.

Figure 2: Number of transported passengers during the months of April and October (1994–2009).

3 Methodology

The research method used in this work was a questionnaire asking the customer's opinion about the service given by the bus company operating in the city of Itaperuna. From the population of riders in Itaperuna, a random sample of 200 was selected. This research was carried out during the month of October 2010, in the morning, noontime, and again, in the afternoon. Table 1 below shows the bus company's user population and sample data.

The questionnaire used in this work was composed of 27 questions, 16 related to customer satisfaction with the services provided by the bus company, and 11 questions concerning the passenger profiles. It also included a space for suggestions.

Table 1: Bus company's user population and sample data.

Population	Sample
An average of 320,000 passengers per month, or 7,272 passengers per day (traveling twice a day for 22 days per month).	200 passengers from the existing bus company ≈ 3 %

4 Results of this survey

The results of the questionnaire associated with customer satisfaction can be seen in Table 2. These results will allow us to determine the satisfaction level of all the customers in relation to each one of the items surveyed. Finally, we will present in Table 3 the profile of the bus company's customer.

4.1 Results associated with customer satisfaction

Table 2: Questionnaire results associated with customer satisfaction.

Conditions	Itaperuna's Bus Company		
	Evaluation (200 users per item)		
	Good	Average	Bad
Length of time of bus trip	32	99	69
Bus itinerary	28	88	84
Interval between buses	11	48	141
Number of buses in the users line	22	80	98
Cleanliness	78	101	21
Conservation	67	98	35
Comfort	30	108	62
Safety	31	94	75
Noise and air pollution	27	84	89
Fare	5	5	190
Scheduling	21	71	108
Employee courtesy	69	91	40
Information provided to passengers	16	99	85
Speed of the bus	101	30	69
Average trip time	42	126	32
Waiting time at the bus stop	9	36	155
Total	589	1,258	1,353

4.2 Customer profile of Itaperuna's bus company

Table 3: Age.

Age (years)	Number of customers (total of 200)
17 or less	26
18 to 25	63
26 to 33	46
34 to 41	30
42 to 49	20
50 to 57	4
58 to 65	6
66 or more	5

Table 4: Gender.

Gender	Number of customers (total of 200)
Masculine	74
Feminine	126

Table 5: Monthly family income of passenger (in Euros) 1 Euro = 2.28 Brazilian Reais.

Monthly family income of passenger (Euros)	Number of customers (total of 200)
Less than 195 (minimum wage)	8
195 (minimum wage)	35
196 to 390	49
391 to 585	50
586 to 780	14
780 to 975	13
976 to 1,170	7
1,170 to 1,365	3
Above 1,365	10
Didn't know	11

Table 6: Handicap special needs.

Handicap Passenger	Number of Customers (total of 200)
Yes	0
No	200

Table 7: Educational level.

Educational level	Number of Customers (total of 200)
Illiterate	1
Incomplete first grade	18
First grade	2
Incomplete high school	42
High school	58
Incomplete college degree	39
College degree	40

Table 8: Reasons to travel.

Reasons to travel	Number of Customers (total of 200)
Study	59
Work	99
Shopping	12
Sightseeing	6
Multiple reasons	24

Table 9: Travel frequency.

Travel frequency	Number of Customers (total of 200)
Daily	140
Once a week	1
Twice or more a week	6
As necessary	53

Table 10: Worst day to travel in the opinion of the customer.

Worst day to travel	Number of Customers (total of 200)
Weekdays	74
Weekend	123
Indifferent	3

Table 11: Number of times traveled per day.

Travel frequency	Number of Customers (total of 200)
Once	10
Twice	115
Three times	9
Four times	28
More than four times	4
Occasionally	34

Table 12: Worst time to travel in the opinion of the customer.

Worst time to travel	Number of Customers (total of 200)
Morning	66
Afternoon	58
Night	72
Indifferent	4

Table 13: Manner of paying fare.

Manner of paying fare	Number of Customers (total of 200)
Pre-paid discount card	41
Full fare	123
Students	29
Free pass	7

5 Quality level

Using the results obtained from Table 2 and applying the same calculation procedure presented in a previous paper by De Souza et al. [1], we can determine the overall quality level of the service provided by Itaperuna's bus company. These results could be used in the future to evaluate if Itaperuna's bus company has improved its service and fulfilled its customer's needs. In a future paper we will compare the overall quality level of the service provided by Itaperuna's bus company with the one previously taken of Rio Branco's bus company.

To determine the overall quality level the following steps should be followed:

1. Determine the total number of customers that:
   a. S_g; considered the items researched as good;
   b. S_{ave}; considered the items researched as average;
   c. S_b; considered the items researched as bad.

   The following weights were used for each of the classifications:
   d. Good: $p_g = 2$;
   e. Average: $p_{ave} = 1$;
   f. Bad: $p_b = 0$.
2. Multiply the obtained values for each of the classifications by its corresponding weights. As a result we will have the overall quality level (OQL) given by eqn. (1):

$$OQL = S_g \times p_g + S_{ave} \times p_{ave} + S_b \times p_b \quad (1)$$

   Now, with $p_g = 2$, $p_{ave} = 1$ and $p_b = 0$, we will have:

$$OQL = 2S_g + S_{ave} \quad (2)$$

3. Compare the obtained OQL value with the "maximum theoretical value" that eqn. (2) could have, that is, the total number of items multiplied by the

number of customers surveyed (in this work, 16 items and 200 customers researched), multiplied by 2, the corresponding weight for the classification "good." Since in an "optimal theoretical case" all the customers surveyed will give the classification "good" to all the items researched, the value of S_{ave} in eqn. (2) will be equal to zero. This comparison is given by:

$$OQL \leq T_V = 2 \times 16 \times n \quad (3)$$

Here, *n* is the number of customers researched (200), T_V is the "optimal theoretical value" that eqn. (3) could have, 2 is the corresponding weight for the classification "good" and 16 is the number of items surveyed in this work. Then:

$$T_V = 2 \times 16 \times n \quad (4)$$

4. Now, to compare the obtained OQL value with the "maximum theoretical value" that eqn. (2) could have, we will use the following classification:
   a. If the OQL value is located between 90% and 100% of the T_V value: the service level is considered to be "good"; the customers' needs are being fulfilled. The bus company should keep up the good work.
   b. If the OQL value is located between 70% and 89% of the T_V value: the service level is considered to be "satisfactory". However, the service level should be improved in order to exceed the customers' expectation.
   c. If the OQL value is located between 40% and 69% of the T_V value: the service level is considered to be "reasonable", but there are complaints about some areas of service rendered by the bus company.
   d. If the OQL value is located between 10% and 39% of the T_V value: the service level is considered to be "bad", and urgent measures should be taken by the bus company in order to continue operating.
   e. If the OQL value is located below 10%: the service level is considered to be "very bad". The city authorities should immediately consider canceling the bus company's concession.

6 The overall quality level for the bus company

Using eqn. (2), with $S_g = 589$, $S_{ave} = 1{,}258$ and $S_b = 1{,}353$, we will have:
$S = 2S_b + S_{re} + 0 \times S_b = 2 \times 589 + 1{,}258 = 1{,}178 + 1{,}258$. Then: $S = 2{,}436$
Verifying if $S \leq T_V$:
$T_V = 2 \times 16 \times n = 2 \times 16 \times 200 = 6{,}400$. As a result, $S \leq T_V$, since $2{,}436 \leq 6{,}400$.
Therefore: S = 2,436, which represents 38.06% of T_V.
This overall quality level (OQL) value of 38.06% is located between 10% and 39% of the T_V value. The service level is considered to be "bad", and urgent measures should be taken by the bus company in order to continue operating.

7 Conclusions

The bus company located in Itaperuna needs to take measures in order to raise their service level. They should initially focus their efforts on the items that have presented the "worst" evaluation by their customers. Their service level is

considered to be "bad," and urgent measures should be taken by them in order to continue operating. The analysis of the survey answered by the Itaperuna's bus company customers has shown that some of the conditions considered in the questionnaire associated with customer satisfaction given by Table 2 need to be urgently improved, especially the ones related to fare, waiting time at the bus stop, interval between buses and scheduling, all these conditions showing a bad evaluation greater than 50%. The lack of interest by the bus company in customer satisfaction is the main reason for loss of passengers to informal and alternative forms of transportation, such as: personal car, motorcycle-taxi, private bus and travel by foot or by bicycle. The bus company needs to immediately begin the process of changing their attitude in order to improve the quality of their service. They should focus on customer satisfaction, or their future operations could be bleak.

Some of the problems found in this study will demand time and money to be solved or at least, eased. They should determine among the analyzed conditions, which ones they could improve in the nearby future by themselves, and which ones will need to have help from the city or state government to be improved.

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