

Suggestions for the Improvement of the Quality of Public Transportation Service in Campos, Brazil

D. I. De Souza, G. P. Azevedo, P. Duarte

Abstract—In this paper the main objective is to analyze the quality of service of the bus companies operating in the city of Campos, located in the state of Rio de Janeiro, Brazil. This analysis, based on the opinion of the bus customers, will help to determine their degree of satisfaction with the service provided by the bus companies. The result of this assessment shows that the bus customers are displeased with the quality of service supplied by the bus companies. Therefore, it is necessary to identify alternative solutions to minimize the consequences of the main problems related to customers' dissatisfaction identified in our evaluation and to help the bus companies operating in Campos better fulfill their riders' needs.

Keywords—Public Transportation, Quality of Service, Riders' Opinion, Bus Companies

I. INTRODUCTION

THE urban transportation system of Brazilian cities depends deeply on buses. Therefore it is a major concern for local authorities to find ways to improve the efficiency of the bus service delivered to the population. In this paper the main objective is to analyze the quality of service of the bus companies operating in the city of Campos, located in the state of Rio de Janeiro, Brazil. Campos has about 400,000 people and the bus service is supplied by several public bus companies. 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 Campos' bus companies in terms of manpower, service cost, time schedule, etc. This work will also identify the profile of the bus companies' customers.

II. COLLECTIVE TRANSPORTATION SYSTEM CRISIS

The number of paying customers has been falling year after year. Due to the continuous decrease of the bus companies' profits, today, as a consequence, we have old buses; some of them with more than 10 years of use, with a decrease in safety

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and comfort provided to the customers as well as low salaries paid to the bus companies employees. More recently, according to the National Urban Transport Association [1], 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 Fig.1 below from the National Urban Transportation Association [1].

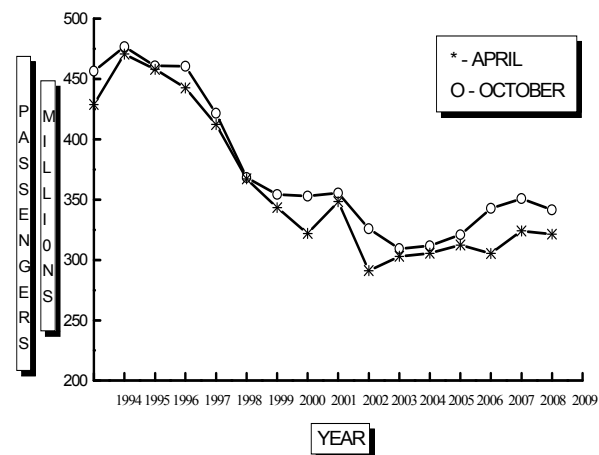


Fig. 1 Number of transported passengers during the months of April and October (1994 – 2009)

As major competitors to the bus companies, we have:

Personal car: The economic stabilization is keeping fuel prices accessible, stimulating some users of public transportation to acquire their own car. To them, the perceived cost is restricted only to fuel expense.

Informal transportation and alternative transportation: This type of transport has grown rapidly, mainly in 1997 and the beginning of 1998 and now represents 2% to 5% of the whole demand for urban transportation in a large number of cities. In some cases, this participation can go up to 10%.

Motorcycle-taxi: The fare charged is somewhere between the price of a taxi and of a bus. This form of transportation captured an impressive part of the market among users who don't have a personal car, but have an income high enough to use this type of service, which is faster than a bus.

Travel by foot and by bicycle: This type of travel is common mainly among families having a low income. The number of trips made on foot has been growing rapidly since 1992, according to [2] "In the last 10 years, the percentage of people that travels by foot has grown from 20% to 25% to levels up to 50%. With relation to travel by bicycle, it is estimated that there are around 45 million bicycles operating in the country."

Private Bus: Initially, these were utilized as school transportation, but today are also used in the transportation of people from residential areas to working places and back.

III. METHODOLOGY

The research method used in this work consists of a case study performed for the bus companies in the city of Campos, located in the state of Rio de Janeiro. From the population of riders in Campos, a random sample of 200 was selected from the seven bus companies operating in that city. Table 1 shows the bus companies' user riders and sample data.

TABLE I
BUS COMPANIES' USER POPULATION AND SAMPLE DATA

Population	Sample
Average of 2,942,684 passengers/month, corresponding to about 66,879 passengers/day (considering that all of them travel 22 days per month, twice a day, outbound and inbound).	200 passengers from the existing bus companies

A questionnaire or survey, with twelve questions and space for suggestions was used to collect information from the customers. The questionnaire is presented in the Appendix.

The research survey was divided into four parts:

1. Questions referring to the users' profile;
2. Questions referring to several conditions (attributes);
3. Questions referring to trip characteristics;
4. Suggestions.

These questions relating to several conditions had the objective of analyzing the users' satisfaction with the time elapsed inside the bus during the trip; the number of buses available in a particular bus line; the interval between buses; comfort; cleanliness; conservation; safety; noise and air pollution; fare; schedule and employees' courtesy. Finally, using a frequency distribution approach, the data collected was quantitatively analyzed.

IV. ANALYSIS OF THE RESULTS

A. Results Associated with Customer Satisfaction

The results of this survey 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 Tables 3 to 11 the profile of the bus companies' customer.

TABLE II
QUESTIONNAIRE RESULTS FOR THIS SURVEY

Conditions	Evaluation (200 customers per item)		
	Good	Average	Bad
Average Trip Time	26	109	65
Bus Itinerary	31	92	77
Interval Between Buses	19	72	109
Nº of Buses in the Line	15	78	107
Cleanness	32	82	86
Conservation	35	74	91
Comfort	25	89	86
Safety	35	93	72
Noise and Air Pollution	25	63	112
Fare	44	77	79
Schedule	50	75	75
Employees' Courtesy	36	99	65
Total	373	1,003	1,024

B Customer Profile of Campos' Bus Companies

TABLE III
AGE

Age (years)	Customers (total of 200)
15 or less	23
16 to 20	48
21 to 25	53
26 to 30	17
31 to 35	13
36 to 40	14
41 to 45	12
46 to 50	6
51 or more	14

TABLE IV
GENDER

Gender	Customers (total of 200)
Masculine	91
Feminine	109

TABLE V
EDUCATIONAL LEVEL

Educational Level	Customers (total of 200)
Incomplete First Grade	37
First Grade	11
Incomplete High School	42
High School	34
Incomplete College Degree	60
College Degree	16

TABLE VI
MANNER OF PAYING FARE

Manner of Paying Fare	Customers (total of 200)
Pre-paid Discount Card	39
Full Fare	48
Student	66
Free Pass	44
Didn't Know	3

TABLE VII
MONTHLY FAMILY INCOME OF PASSENGER (IN EUROS)
1 EURO = 2.28 REAIS

Income (Euros)	Customers (total of 200)
237 (minimum wage)	4
238 to 474	16
475 to 711	48
712 to 948	8
949 to 1,185	18
1,186 to 1,422	12
1,423 to 1,659	22
1,660 to 1,896	4
1,897 to 2,133	0
2,134 to 2,370	20
2,371 to 2,607	4
2,608 to 2,844	4
Didn't Know	40

TABLE VIII
REASONS TO TRAVEL

Reasons to Travel	Customers (total of 200)
Study	107
Work	74
Shopping	2
Multiple Reasons	17

TABLE IX
TRAVEL FREQUENCY

Travel Frequency	Customers (total of 200)
Daily	165
Once a Week	5
Twice or More a Week	16
As Necessary	14

TABLE X
WORST TIME TO TRAVEL IN THE OPINION OF THE CUSTOMER

Worst Time to Travel	Customers (total of 200)
During the Day	88
Night	79
Indifferent	33

TABLE XI
WORST DAY TO TRAVEL IN THE OPINION OF THE CUSTOMER

Worst Day to Travel	Customers (total of 200)
Weekdays	67
Weekend	121
Indifferent	12

V. QUALITY LEVEL

Using the results obtained from Table 2 and applying the same calculation procedure presented in a previous paper by [3], we can determine the overall quality level of the service provided by Campos' bus companies. These results could be used in the future to evaluate whether the researched bus companies have improved their service and fulfilled their customer's needs. 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 (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 (2) could have, that is, the total number of items multiplied by the number of customers surveyed (in this work, 12 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 (2) will be equal to zero. This comparison is given by:

$$OQL \leq T_v = 2 \times 12 \times n \quad (3)$$

Here, n is the number of customers researched (200), T_v is the "optimal theoretical value" that (3) could have, 2 is the corresponding weight for the classification "good" and 12 is the number of items surveyed in this work. Then:

$$T_v = 2 \times 12 \times n \quad (4)$$

4. Now, to compare the obtained OQL value with the "maximum theoretical value" that (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 companies 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 companies.
- 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 companies 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 companies' concession.

VI THE OVERALL QUALITY LEVEL FOR THE BUS COMPANIES

Using the data from Table 2 and applying (2), with $S_g = 373$, $S_{ave} = 1,003$ and $S_b = 1,024$, we will have:

$$OQL = 2S_b + S_{re} + 0 \times S_b = 2 \times 373 + 1,003 = 1,749$$

Verifying if $OQL \leq T_v$:

$$T_v = 2 \times 12 \times n = 2 \times 12 \times 200 = 4,800$$

As a result, $OQL \leq T_v$, since $1,749 \leq 4,800$

Therefore, $OQL = 1,003$, which represents 36.4% of T_v .

This overall quality level (OQL) value of 36.4% 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 companies in order to raise their level of service.

VII. POSSIBLE SUGGESTIONS

The analysis of the survey answered by the bus companies' customers have shown that all conditions considered in the questionnaire need to be improved, especially the ones related to noise and air pollution, interval between buses and number of buses in the line.

The conditions that were given a "bad" evaluation greater than 40% were:

Noise and air pollution;
Interval between buses;
Number of buses in the line;
Conservation;
Cleanness;
Comfort.

The suggestions for improvement for these conditions are shown in Table 12. It can be also seen that in some cases the implantation of one suggestion could help in the solution of more than one problem.

TABLE XII
SUGGESTIONS FOR IMPROVEMENT OF THE MAIN PROBLEMS FOUND IN THIS SURVEY

Suggestion	Objective	Problem to be Solved	Time of Implantation	Cost
Utilize Alternative Fuels	To reduce the effects of noise and air pollution	Great generation of noise and air pollution	Medium to Long	Medium to High
Best Scheduling and Planning	To decrease intervals between buses	Long intervals between buses	Short to Medium	Low to Medium
Renew and Increase the Fleet	To increase the number of buses in the line	Long wait time and lengthy intervals between buses.	Medium to Long	Medium to High
Create a Consumer Service Center	To receive the suggestions of the users.	To know the needs of the users	Short to Medium	Low

VIII. CONCLUSION

The bus companies operating in Campos, state of Rio de Janeiro, need to go through a process of "change of attitude" in order to improve the quality of their offered services. This consumer neglect raises the level of disappointment in bus users; the bus companies don't realize that in order to get their own primary objective (profit) they must fulfill at least part of the expectations of their customers. The poor quality they offer can be confirmed by the great dissatisfaction reported by their users, since most of their users considered six of the twelve conditions analyzed "bad". Instead of fulfilling these needs, the bus companies treat their customers as "captive customers", thinking that their low incomes will exclude private transport and the people will, of necessity, use the bus. This is not the present reality in Brazil due to the economic stabilization Brazil is experiencing in the last ten years. The lack of interest by the bus companies 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 companies need 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. The bus companies 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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