FARE POLICIES FOR PUBLIC TRANSPORTATION IN THE STATE OF CEARÁ (BRAZIL)

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Abstract

Traditional methodologies used for the calculation of fares value of the public transportation in Brazil were based on the Manual of GEIPOT from 1996, which was focused in transportation around the city. This method has been very useful for the technicians in the country since then. However, in 2009, in the State of Ceará, the government had a contract with traditional transport companies with a new network and the Regulatory Agency of the State was the responsible for the fare revision of the transportation through cities in the State. This reality has brought a growing need to develop a new and more improved, updated and appropriate methodology to the specificities of rendered services by the concessionaires that operate in this modality, seeking a consensus in the definition of the procedures for the calculation of basic coefficients of consumer and operating parameters. However, facing the need of the upgrading and improvement of the traditional methodology and considering the lack of methods for the public transport through cities, the State of Ceará, by means of its Regulatory Agency, developed a method for this calculation. This paper shows the method that was developed for fare policies for public transportation through cities.

Points for Practitioners

This study is a contribution to the improvement of public transportation, because it has the potential to subsidize the discussion of public managers and civil society about the costs involved in providing public bus transportation service. Hence, this paper is applicable for the use by professionals of public administration and public policies who work with transportation service provision.

The results of this study might serve as a basis for a gradual shift of mobility as a whole, and they focus on the problems, solutions and investments in the provided transport services, and they consider the consequences in terms of costs and the price paid by its users.

Keywords: Fare policies, Public transportation, Regulation of public services, Transportation economy.

1. INTRODUCTION

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The public administration must always be attentive to the needs of the general public, that through its action, aims at the common good and the reduction of social inequality. However, as Morgan (2017) points out, the formulation of public policies is complex, and it involves a large number of actors at different levels and technical issues of difficult understanding.

In providing the public transport service, this context of complexity is not different. Social, economic and geographic factors should be considered in the foundation of public mobility policies. As stated by Ferraz and Torres (2004), providing adequate mobility for all social classes is fundamental to induce the economic and social development of cities. Thus, transportation becomes essential for general population as well as water supply, sewage collection, electricity supply, street lighting, etc.

Asquer (2017) reported a ratio of the cities that have greater availability of jobs and the increase of the demand of public services, such as transportation. Besides that, he stated that the economic regulation of services is fundamental for the development of public policies.

According to the data presented by the IPEA (2013), public transport fares in Brazil have shown a higher growth than that of the inflation, and that compromises the population's income and affects mainly lower income families.

In cities, such as Prague, Turin, Warsaw, Budapest, Madrid, Vilnius, Berlin, Valencia, Barcelona, Copenhagen, Helsinki, Amsterdam, Brussels, Montreal, Stockholm, Stuttgart, Seville, Hamburg, Cadiz, London, Lyon and Paris there are public transportation financing that covers between 40% and 50% of the costs involved in the system, the cost of public transportation in Brazil, in most cases, is covered in its entirety by fares paid by its users (IPEA, 2013).

Therefore, the study of tariff costs is of utmost importance for the operation and access of the population to the transportation service. As Saboia (2007) emphasizes, on the one hand we have the public service user who seeks to pay the minimum and on the other hand we have the transport companies that seek increasing gains. In this way, the public administration has the fundamental role of balancing the interests guaranteeing a fair fare for the user and the maintenance of the economic-financial balance of the contracts signed with the operating companies, and has to be based on technical competence, total transparency and the fulfillment of the specifications of the contracts to guarantee continued service provision.

Given this context, the Executive Group for the Integration of Transport Policy (GEIPOT)[3], created in 1965 in Brazil, developed a handbook with the methodology to assess the costs of services and estimate the value of urban bus fares. The studied method has been helping professionals who work with urban public transportation for more than twenty (20) years.

Over the years, the methodology has been through some updates. However, in addition to the need for more significant updates due to a new transportation service scenario in the country, the GEIPOT method does not incorporate the peculiarities that exist in the operation of public transportation through cities. Thus, along with the need to improve the highlighted methodology, in 2009, the Government of the State of Ceará[4] established a new model of road transport network through cities and signed a contract with transportation companies for the

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[3] In Portuguese, the acronym *GEIPOT* stands for Grupo Executivo de Integração da Política de Transportes.
[4] A state located in the northeast of Brazil.

operation of this new route arrangement, which made it even more necessary to develop studies in the fare area for the economic security of service operators.

Thus, in the contracts signed by the Government with the companies, new fare adjustment rules were incorporated, in which the fare adjustment and tariff revision instruments were adopted. The fare readjustment occurs every year and is defined according to economic indexes. The fare review takes place every 03 (three) year cycle and it is marked as a complete study of all the costs and revenues involved in the provision of the transportation service, and it is therefore an important moment to have an operational diagnosis and also a financial assessment of the transport companies.

The fare readjustment in the State of Ceará, carried out by the Public Services Regulatory Agency of Ceará (ARCE)[5], has a team of professionals to survey, monitor, analyze and calculate operating parameters and a team of professionals to survey, monitor, analyze and calculate economic parameters.

This work is founded on the methodology developed for the calculation of the operational parameters of the fare readjustment, which is based on the definitions found in the GEIPOT handbook and, more recently, in the study presented by the National Public Transport Association (ANTP)[6] in 2017, but was adapted to the current context and to the particularities on public bus transportation through cities. This improvement adaptation has been occurring since 2009, when the transport companies that currently operate in Ceará were hired, and the study was enhanced when fare readjustments occurred in 2013, 2016 and 2019, since, as previously mentioned, the readjustment occurs every 03 (three) years.

1.1 The public interurban road transport service for passangers of the State of Ceará and some considerations on the fare calculation

Facing the need for the State Government to prioritize the provision of basic services and that demand great efforts such as health, education and security, and due to the interest of private sector in exploiting the public transport service, its operation in the State of Ceará is delegated to private entities with the use of regulatory mechanisms by ARCE to monitor the quality of the provided service.

Since 2009, for the operation of the public interurban road service in the State of Ceará by bus, the 184 counties that constitute the State have been divided into 8 (eight) operating areas, see Figure 1. It was considered the generation of travel through cities, access routes that interconnect counties, operational viability and the economic and financial balance of the service, the need to have a socially fair fare and to practice the principles of non-exclusivity, free user choice and competitiveness.

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[5] In Portuguese, the acronym *ARCE* stands for Agência Reguladora de Serviços Públicos do Ceará.
[6] In Portuguese, the acronym *ANTP* stands for Associação Nacional dos Transportes Públicos.

Figure 1 - Operating areas of the transport service in the State of Ceará

Each operating area is delegated to a transport company. However, it is possible for a transport company to operate up to 03 (three) regions, so, there are some companies operating in more than one area, with a total of five (5) transport companies providing service throughout the state. In 2017, a total of 68,808,428 km was covered, from 525,505 trips. As a result, 16,522,067 passengers were transported in 180 available lines, which generated a total revenue of R $ 278,936,455.

As it was already discussed, the provision of this service is fully funded by its user and the calculation of the fare paid is made by ARCE, and it is adjusted through the fare readjustment and tariff revision instruments. The review, object of study of this work, implies a depth study of all the costs and revenues of the transport companies in the provision of their service. Since 2009, the year that the contracts were firmed by the companies and the State Government, two (2) tariff reviews have been fully completed, in 2013 and 2016, and there is one ongoing in the current year.

One of the major challenges faced by ARCE in the occurrences of tariff reviews is the information disagreement between public authorities and companies, which consists of the phenomenon in which one of the economic agents involved holds more information than the others. Another issue is the definition of the methodology adopted for the use of these data in the tariff calculation. Therefore, regulatory agency professionals strive to increasingly approach data and methodologies that reflect the reality of the transport operation in the State.

The data that were needed to determine indexes and consumption parameters, efficiency indicators and benchmarking are obtained through information sent by transport companies, road vehicle data, data collected from the origins of travel and academic studies, and other regulatory agencies which help in understanding the

data. However, the public administration has a very large liability on the data emitted by the companies, which requires a lot of attention of the professionals so that this liability does not make the process vulnerable.

Regarding the methodology, as well as most of Brazil's institutions, in Ceará, the tariff calculation is based on the concepts defined in the GEIPOT handbook. However, over time, peculiarities in the service rendered in the State that were not contemplated in the methodology were identified.

The main issue identified was related to the type of service. In the GEIPOT handbook, the tariff calculation is based on the features of urban transport by bus. However, the need for application of the methodology by ARCE is in the interurban bus transportation. Urban transport and interurban transport have some very specific differences, such as the days and peak times of the operation of the service. The urban transport is more used during the week, and the interurban transport presents greater movement at the weekend though.

Another factor to be highlighted in the methodology of GEIPOT is that it considers the organization of the transport network by isolated lines. In the State of Ceará, as the transportation network is organized through its operating areas, the economic and financial viability considered is related to the grouping of lines contained in the areas.

Finally, another great difficulty found in the direct application of GEIPOT is the need to adapt to the new reality of operation of the transport service. As the developed method is already more than twenty (20) years old, some aspects that are now required by the regulations of the public administration are not incorporated in this procedure, such as the use of specific additives in the fuel to reduce air pollution.

Given the need to adapt the GEIPOT methodology according to the points raised, ARCE developed some mechanisms to approximate the calculation to the reality of the operation that impacted on all the groupings of variables considered in the process: Taxes, Information of used vehicles, Information on demand and mileage traveled, Variable costs and Fixed costs. Figure 2 shows the variables that constitute each highlighted group.

Figure 2 – Considered variables in the tariff calculation of interurban transport in Ceará

TAXES	
Regulation rate / ICMS / PIS / COFINS	
INFORMATIONS	
DEMAND AND MILEAGE TRAVELED	USED VEÍCULOS
Passenger payload quantity index (IPE)	Standart vehicle
Average annual route (PMA)	Value of the vehicle
COSTS	
VARIABLE	FIXED
Fuel consumption index	Depreciation
ARLA consumption index	Remuneration
Lubrificants	Labor (usage factor)
Tires	Management
Parts and accessories	Maintenance

Source: ARCE

From the variables that were considered, the ones that have suffred the most changes in the calculation were the operational ones, that are highlighted below:

    i.   Passenger payload quantity index (IPE)[7]: equals the number of effectively paying passengers carried;

    ii.   Average annual route (PMA)[8]: This is determined by the ratio between the traveled mileage and the operational fleet of each company, in this way, it obtains an indicator of vehicle productivity: the larger the PMA, the greater the use of the bus;

    iii.   Usage factor: it is a ratio of professionals allocated per vehicle in the operation of a given area;

    iv.   Standard vehicle: it refers to the most used vehicle models in a given operating area;

    v.   Average fleet age: it is equivalent to the calculation of the average age of the vehicles used by a company in an operation;

    vi.   Fuel consumption index: An index that expresses the amount of liters of fuel needed to travel a kilometer;

    vii.   ARLA consumption index: An index that expresses the amount of ARLA needed to cover one kilometer;

    viii.   Lubricants: it refers to the expenses with lubricants used;

    ix.   Tire life: An index that expresses the useful life of the tires, and it has as a unit kilometers per tire;

    x.   Expenditure with parts and accessories: it represents the company's costs with parts and accessories.

2. METHODOLOGY

In the light of previous sections, the concepts that were inserted in each operational variable for the changes of the GEIPOT methodology to the needs of the transportation of the State of Ceará that were already discussed, will be presented below.

i. Passenger payload quantity index (IPE)

Three main changes were made to this variable. The first relates to the importance of the passenger payload quantity index. While the GEIPOT uses an average number of passengers, the calculation was chosen according to the data obtained in proportion to the mileage traveled. The second point relates to the changes in regulations that impact on the definition of the amount of gratuities that transport companies must offer. And finally, after the calculation of the index, it was decided to make a comparison between the companies and the history report of each company, so that very low rates of passengers are not considered. This is due to the fact that very low indexes overtax the tariff and the transport company has a responsibility to monitor this index, since if a bus line is not viable, the company can request an operational change.

ii. Average annual route (PMA)

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[7] In Portuguese, the acronym *IPE* stands for Índice de passageiros equivalentes.
[8] In Portuguese, the acronym *PMA* stands for Percurso médio anual.

Some operating factors, such as the fleet, are flexibly used by some companies that operate in more than one operating area, and it impacts on cost savings. In the studied system there is a company that holds the concession of (02) two areas of operation and another company that operates (03) three different areas. So, when someone looks for, for example, the index of productivity of the vehicles (that is, how many kilometers a bus travels per year), a serious problem of allocation was presented. A minimally consistent number of this item could not be raised for each operating area if the buses constantly varied where they operate. So, adjustments were made to what the GEIPOT handbook sets for the incorporation of productivity gains obtained due to the joint operation of more than one area of operation in the cases that were cited.

iii.   Usage fator

The usage factor is calculated depending on the transport company's operational programming. The GEIPOT handbook addresses a methodology based on the features of the urban operation. Therefore, changes were made in order to adapt the calculation to interurban operation, considering that, unlike urban transport, where the week is more loaded than the weekend, the weekend is busier than the week. Another necessary change was related to the workday of the employees. As the Brazilian labor legislation has been updated, efforts have been made to faithfully incorporate such changes.

iv.   Standard vehicle

In the selection of the standard vehicle, some changes were made over time, and it resulted in the selection of the vehicle through the calculation of each chassis and body model per transport company. The quantities of each model are listed by percentage of participation in the total fleet.

v.   Average fleet age

In order to calculate the average age of the fleet, the adopted methodology is the GEIPOT. with upper and lower limit determinations of age, in accordance with the regulations of the State of Ceará. At the upper limit, it is considered the maximum age of 9 (nine) years, defined according to the existing legislation in the State, and vehicles with age above that are not allowed. At the lower limit, due to the discretion of the public administration, it was defined that the minimum acceptable age is 2,5 years. This definition was made in order to not overtax the tariff, since the consideration of average age less than 2,5 years does not reflect gains in safety and comfort for passengers.

vi.   Fuel consumption index

The fuel consumption index is calculated in the same way as stablished in GEIPOT. However, the consumption limits established in GEIPOT are based on urban transport, which has higher fuel consumption coefficients as vehicles that operate in more densely populated areas, being subject to a greater number of stops and lower operational speed. In interurban operation, vehicles have higher speeds and are subject to fewer stops. Therefore, the lower and upper limits accepted in the fuel consumption were adapted to the interurban reality.

vii.   ARLA Consumption index

In 2002, Resolution No. 315 of the National Environmental Council was published, which established that the additive called ARLA must be used to reduce air pollution. Thus, this component was introduced in the tariff costs,

through research with the suppliers, where it was detected that ARLA has a consumption of about 5% of the fuel coefficient. As this data is presented by the transport companies, the ceiling of 5% is adopted, and if the company presents consumption lower than this limit, the information given by the company is considered.

viii.   Lubricants

In this item there were no changes in relation to the methodology determined by GEIPOT. However, before validating the values to be used, the data were checked and compared with the transport company's own consumption history report and the average data presented by the other companies.

ix.   Tire life

In the calculation of the useful life of the tires were incorporated changes in order to consider the actual heterogeneity in the bus fleet. Before, the number of tires was fixed in the calculation and now the average tire of the fleet of each company is used.

x.   Expenditure with parts and accessories

In this variable, changes were made in order to receive data presented by the transport companies and weighted with the mileage traveled by each company and compare them with the data obtained in past reviews to verify the consistency of the received data.

2.1 Discussion

In the changes that were made, the main issue identified was related to the type of service. In the GEIPOT handbook, the tariff calculation is based on the features of urban transport by bus. However, the need for application of the methodology by ARCE is in the interurban bus transportation. Urban transport and interurban transport have some very specific differences, such as the days and peak times of the operation of the service. The urban transport is more used during the week, but the interurban transport presents greater movement at the weekend.

Another factor to be highlighted in the methodology of GEIPOT is that it considers the organization of the transport network by isolated lines. In the State of Ceará, as the transportation network is organized through its operating areas, the economic and financial viability considered is related to the grouping of lines contained in the areas.

Finally, another great difficulty found in the direct application of GEIPOT is the need to adapt to the new reality of operation of the transport service. As the developed method is already more than twenty (20) years old, some aspects that are now required by the regulations of the public administration are not incorporated in this procedure, such as the use of specific additives in the fuel to reduce air pollution, changes made to labor laws, maximum age of the vehicle that can be used in the transport system of State of Ceará.

In addition, mechanisms of efficiency goals were incorporated with the aim of maintaining the service operating with quality standards and guaranteeing its stability. For this, the data are compared with other realities, including a comparative between the companies of the interurban service of the State of Ceará and with the operational history report presented by the company itself. This practice is also adopted as an attempt to minimize the negative effects of information disagreement.

As a result of the changes made according to the highlighted aspects, and considering only the items that are cost-related, a comparison with the percentages that each item has on the final cost of the service is presented in Table 01. It should be noted that the percentages presented by the use of the GEIPOT methodology without any changes were based on the calculations made in 2009, at the time of firming the contracts between the transport companies and the government, which are still in force today. The percentages presented by the changes made to the GEIPOT methodology were calculated according to the average obtained from the calculated costs of the areas of operation at the last tariff revision in 2016, though.

Table 01 - Comparison of the cost composition between the two methodologies

Operational Cost Item	GEIPOT Methodology (2009)	Adjusted GEIPOT Methodology (2016)	% Variation
Usage factor	16,2%	28,7%	77,2%
Average fleet age	10,8%	4,4%	-59,3%
Fuel consumption index + ARLA consumption index	27,5%	25,4%	-7,6%
Lubricants	0,3%	0,3%	0,0%
Tire life	3,0%	1,9%	-36,7%
Expenditure with parts and accessories	6,1%	3,9%	-36,1%
Operational cost items	63,9%	64,7%	1,3%
Other expenses	36,1%	35,3%	-2,2%

Source: ARCE

According to the presented data, it is observed that the methodological changes that were presented resulted in very significant impacts on the composition of costs of the tariff calculation in the operational items. Most of the items obtained variation of more than 35%.

The greatest increase in participation in the composition of costs occurred in the item of factor of use, that was one of the parameters that most suffered changes both in the methodology and in obtaining data. Over the years, it was necessary to adapt it to considerations in the calculation of particularities in the interurban service. Another issue was the changes in labor legislation that had to be incorporated. Finally, the calculation of this item is directly related to the organization of the bus lines, that today is very different from the reality of 2009m due to the new mobility needs of the population.

The largest reduction in cost share was observed in the average fleet age. The main change that occurred in this item was from regulatory origin order. In 2009, the maximum allowed age of fleet was 5 (five) years. After much observation related to the provision of the service with comfort and the tariff impact, today the buses are allowed to operate with a maximum age of 9 (nine) years.

By analyzing the sum of the percentage of operating costs items and the percentage of other costs, it can be inferred that the change occurred in the form of distribution of operational items, but that the representativeness of these items in the tariff almost did not change, it evolved from 63,9% to 64,7%, with a variation of only 1,3%. Consequently, the influence of other costs that are not directly related to the operation, such as taxes, also did not have large impacts, it went from 36,1% to 35,3% with a -2,2% change.

3. CONCLUSION

The designation of the fare to be paid by the public transport user must be well-established for two main reasons: ensuring the population's access to the service through a fair fare and guaranteeing the stability of the service through the economic-financial balance of the contracts firmed by the government and the transport companies. Therefore, it is essential that the tariff calculation represents the closest to the reality of the service's operation. In Brazil, this is more evident due to the fact that in general there are no subsidies in public transportation, besides that, the cost of transportation compromises a significant portion of the budget of the lowest income population.

Thus, due to the lack of a methodology that faithfully represents the current operation of public transportation by bus through cities, studies and changes based on a traditional methodology in Brazil developed by GEIPOT were carried out, and resulted in significant advances in the calculation tariff of public interurban road transport for passengers of the State of Ceará.

However, it is still necessary to progress in data collection and the defined methodology. Mechanisms that aid access to operational data without interference from transport companies should be sought. Regarding the methodology, improvements to adapt the described operational reality should be considered.

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