

BUS PUBLIC TRANSPORTATION SYSTEM AND ITS EXTERNALITIES

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ABSTRACT

The accelerated process of urbanization that took place in the last decades in many countries and the car use popularization contributed to a series of problems such as jams, accidents, mobility and accessibility reduction, air, water, soil, sound and visual pollutions which, in turn, declined life quality (PAES, 2006)

The urban public transport service, when well planned, correctly dimensioned and supervised reduces the mentioned problems, promoting large cities economic vitality as well as social justice, life quality and efficiency.

But when this system is not properly planned, it can cause several negative environmental impacts which require immediate responses for recovery to avoid significant fines established by law.

This work has the purpose of identifying the environmental negative impacts caused by the public transportation system which reduce the service environmental sustainability, as a base to compose an environmental management system for such a service.

Keywords: public transportation, sustainability

INTRODUCTION AND OBJECTIVE

The accelerated process of urbanization that took place in the last decades in many countries, specially in Latin-American ones, and car use popularization contributed to a series of problems such as jams, accidents, mobility and accessibility reduction, air, water, soil, sound and visual pollutions, which, in turn, declines life quality (PAES, 2006). The urban public transportation service, when well planned, dimensioned and supervised reduces these problems promoting economic vitality in large cities as well as social justice, life quality and efficiency.

According to the National Association of Transportation Enterprises, NTU, (2007) public transportation in Brazil is responsible for the displacement of 59 millions of passengers per day. The “bus” segment that counts in this country with a fleet of 95 thousand vehicles is responsible for 92% of total urban displacement.

The substitution of cars by buses allows to reduce the investments in road infrastructure as well as redirection of economic resources into other relevant social aspects such as health and education (ARRUDA, 2004). Also mobility opportunities are created for the population that does not have cars, or is unable or unwilling to drive.

According to the annual report of FETRANSPORT (2006), institution that congregates transportation companies of the city of Rio the Janeiro, buses are the type of vehicles most used in the Brazilian urban centers, being responsible for daily transferring 76,5% of all the reported passengers. Buses are followed by vans which transport 14,8% of total transferred passengers. Reminder vehicles (trains, skips and subways) transport 8,7% of passengers per day.

But when this system is not properly planned, it can cause several negative externalities provoking associated environmental passive for which it is necessary to plan and perform a series of responses to avoid significant fines established by law.

This work has the purpose of identifying negative environmental impacts caused by public transportation system which reduce its environmental sustainability, as a base to compose an environmental management system for such a service.

Due to the importance of the bus public transportation system in Brazilian urban centers, this work focuses in this mode presenting its components and related environmental impacts.

THE BUS PUBLIC TRANSPORTATION SYSTEM

The public transportation service by bus is an essential service in Brazilian urban centers. According to data published by the National Association of Public Transportation (ANTP), (2008), this system was responsible for the transportation of approximately 14 billions passengers, including in and inter municipals in 2007 and even when investments are applied to improve bus transportation, this system is not able to take care of the increasing demand.

As a consequence, the use of automobiles is stimulated increasing jams as well as the pollution levels in large urban centers.

Being so, it is necessary to exam the Bus Public Transportation System looking for its sustainability, satisfying passengers expectations of comfort, security and expedite and also promoting the system productivity (PLANMOB, 2007).

The Brazilian laws, especially its Federal Constitution, make the federal government responsible for all public services including transportation. This service could be executed directly or indirectly through autarchies entities or through state-owned companies or it could be performed by private companies through concessions, permissions or authorizations.

Independent on the way this service is provided, the bus transportation system will provoke positive and negative environmental impacts which have to be known in order to improve the service and to compose an environmental management systems, useful to control the system associated general pollution.

The System Externalities

According to FOGLIATTI et all (2004), externalities or environmental impacts will occur when implementing and operating any transportation system. Negative impacts can constitute liabilities to the operating company.

The bus public transportation promotes some positives externalities such as :

a) Accessibility

Due to the fact that this mode of motorized transport way is the one with the lower unitary cost as established by the National Association of Urban Transport Companies – NTU (2006), it becomes more accessible to the population, as shown in Figure 1.

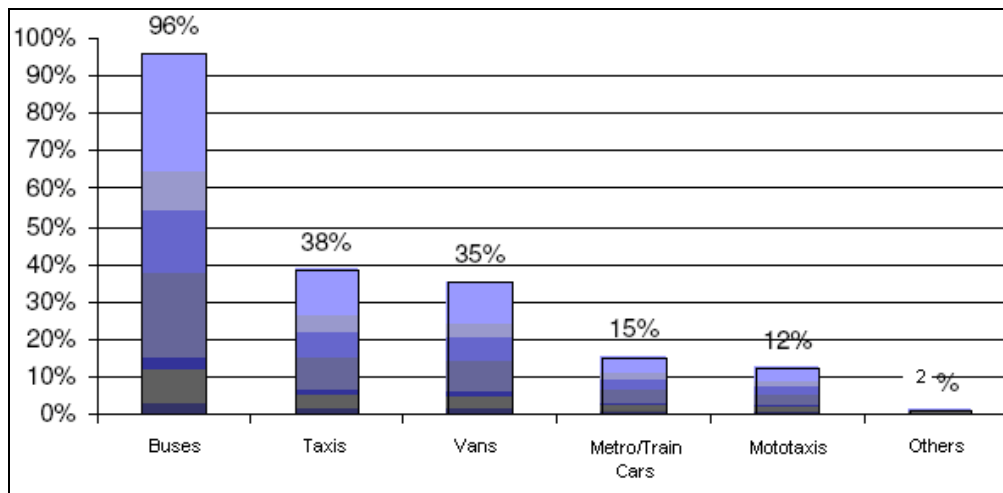


Figure 1 – Availability of Transport Vehicles
Source adapted from NTU: A Urban Population Mobility Research (2007)

b) Mobility Democratization

Buses contribute to the mobility of the population that has no access to private automobiles, is disabled or unwilling to drive.

c) Reduction of the number of accidents, of atmospheric and sonorous pollution and of city jams.

According to FERRAZ and TOWERS (2001), studies show that the road space needed to transfer one passenger in a private automobile is, in average, 18 times larger that the same space when using a bus. This proportion can increase to 40 during rush hours. Being so, the bus public transportation system is an alternative to reduce jams.

Also technology has made it possible improvements such as engine encapsulating which allows reducing noise and sonorous pollution.

In a study developed by the Brazilian National Department of Transport, DENATRAN, (2006), motorcycles and automobiles are responsible for up to 69% of the total reported accidents in urban centers.

According to an study about Mobility developed by the Brazilian National Association of Public Transports (ANTP), (2006), automobiles are responsible for 60% of all emissions of pollutants, while buses are only responsible for 36% of all.

Yet spite all positive externalities, the lack of adequate planning in the implementation and operation of a Bus Public Transportation System can cause severe negative impacts that decline life quality. These impacts have to be controlled and measured, and actions to reduce their consequences have to be implemented. To do this environmental indicators are useful.

ENVIRONMENTAL INDICATORS ASSOCIATED TO THE BUS PUBLIC TRANSPORTION SYSTEM

Environmental Indicators are selected aspects closely related to the system or service being studied, thus representing its sustainability through their corresponding measures. These indicators can be quantitatively or qualitatively obtained.

For the bus public transportation system, authors like FERNANDES (1998), COAST (2003), FERRAZ and TORREZ (2004), SAINTS (2004), BREADS (2006) and MACEDO (2007) established the following indicators:

1. Indicator of Pollution: includes atmospheric, water, soil, visual and sonorous pollutions. It can be modified by:

a) Fleet average age

According to BREADS (2006), the age of buses influences directly the air quality through the emission of pollutants, even when their maintenance is practiced on regular bases.

Limits for the circulating of public buses according to vehicles ages are stated through municipally laws. In the Rio the Janeiro City, this limit was established to be 11 years.

Some researchers as FERRAZ and TORRES (2001), considered a bus to be in good conditions to run in a city if it is less than 5 years old, in regular conditions when it is between 5 and 10 years old and in bad conditions when its age is superior to 10 years.

b) Kind of fuel used to run the fleet

The kind of fuel used to run the bus public transportation system in Brazilian cities is the diesel, which emits several pollutants into the atmosphere.

The norms to control these emissions are becoming more restrictive so, alternative sources of energy, like biodiesel and natural gas, are being tested by the automobile industry.

These new kinds of energy also emit pollutants into the atmosphere, so new kinds of vehicles, like those moved by electric energy, are needed.

c) Average of fuel consumption in liters per km

This aspect is directly related to the maintenance of the vehicles engines and of their exhaust fans and also depends on the drivers skills to conduct the vehicles through routes.

d) Number of maintenance programs and engines regulations performed in regular bases

Maintenance programs and engines regulations help to correctly mix air and fuel (BREADS, 2006). So, when these programs are not applied systematically, gases emissions as well as vibrations and noises will increase, degrading the service quality, increasing fuel consumption and contributing to air pollution.

e) Liquid and solid Amounts of Residues generated in buses terminals and garages

These quantities of liquid and solid residues should be measured (in kilograms or cubic meters or in liters) to control their generation as well as their final deposition. These residues, provoked by the fleet maintenance and its cleanness needs, have to be kept at its minimum to prevent unnecessary air, water and soil pollutions.

2. Indicator of Comfort: this indicator is influenced by aspects that collaborate with the passengers well being. Some of these aspects are:

a) Drivers behavior

When driving buses, drivers should pay attention to passengers and to all citizens that share the ways. They should attend stop-points with corresponding period of time needed to embark-disembark passengers, they should ride only with closed doors and perform all needed maneuvers smoothly. Drivers behavior can be measured by the number of reported accidents associated to each driver and by the number of complains received.

Bus companies should offer drivers courses regarding relationships with passengers as well as provide them with psychologically support.

b) Cleanness of vehicles

This factor can be measured qualitatively based on the hygienic conditions of the interior of vehicles, of stop-points, of terminals and of garages.

It is necessary to perform the cleanness tasks as well as to apply actions to avoid inadequate trash deposition and to prevent passengers from discharging garbage through vehicles windows.

This factor can be evaluated based on passengers and on employees of terminals and garages perceptions, and through related complaints, if they exist.

c) Security level

FERRAZ and TORRES (2001) understand that this security level comprehends accidents involving public buses, and any kind of act of violence (e.g. aggressions, robberies) that take place inside vehicles and in the stop-points.

It can be measured by the number of registered occurrences or by their frequency.

d) Existence of equipments to help special needs

There are some passengers that need special equipments to perform their displacements. These equipments should be carefully designed and implemented to provide accessibility in a democratic way.

e) Existence of equipments to provide passengers security

This equipment includes electronic systems that prevent from running with open doors, that control speed and the system named “bus guard angel” that control the buses speeds as well as the doors opening/closing.

f) Existence of acclimatization system

This factor provides comfort to passengers and it is specially needed during summer.

g) Number the passengers per square meter inside vehicles

Ideally, all passengers should travel seated, but this would increase the service cost . In Brazil and during rush hours, it is accepted a maximum of 7 passengers per square meter (FARIA, 1985 apud SANTOS, 2004).

3. Service Environmental Indicator: comprehends factors related to the quality of the service. These are:

a) Line’s frequency

The frequency of a given line corresponds to the number of vehicles that passes through a given point of the route in a given period of time or to the mean period of time between vehicles. This frequency is affected by the time vehicles spend in stop points.

Some authors consider an adequate frequency when time between vehicles is inferior to 15 minutes, regular when this is between 15 and 30 minutes and poor when exceeds 30 minutes.

b) Adequateness of vehicles to the route

In the Brazilian market there can be found different vehicles in terms of dimensions, of power of engines, of capacity, of ray of bending and kind of energy used.

Being so, it is necessary to select the vehicles considering their performance in a specific physical route condition that imposes limits to the vehicle power, to the vehicle height, to its ray of bending and to its dimensions.

The selection of a correct fleet diminishes its maintenance costs, allows higher speeds that reduces the trip time and the fuel consumption, with corresponding reduction of pollutants emissions and brings more comfort and security to passengers (LEITE, 2002)

c) Trip's time

The trip's time, which is the time spent in the vehicle, depends on the mean speed and on the distance to be traveled.

d) Fee

The fee is the value being charged to the passenger to use the public service. It is usually a fixed value independent on the route and on the distance being traveled.

e) Available passengers information

The availability of information about schedules and itineraries as well as the bus company capacity to receive and process complaints and suggestions contribute to improve the quality of the service and to conquer new passengers.

4. Indicator related to Stop Points: it is related to the sources of access to vehicles throughout their itineraries and it comprehends:

a) Stop-points localization

For security reasons these points should not be located in curves, neither in ramps or close to crossing points, and they should be uniformly distributed along the route to balance the distances passengers will have to walk.

b) Stop-points physical conditions

These conditions include covering, illumination, seats and others that would provide comfort to passengers.

c) Stop-points information

In these points, information about itineraries, schedules and number of lines that stop by should be provided to passengers.

ENVIRONMENTAL INDICATORS, ENVIRONMENTAL COMPONENTS, ACTIVITIES, MITIGATING AND CORRECTIVE MEASURES

Having identified environmental characteristics and having defined environmental indicators, some problems can be generated by the performed activities related to the service.

Those problems can create environmental passive under the company responsibility. Being so, actions to re-establish the degraded components conditions should be performed. These actions or mitigating measures can reduce the company environmental liabilities. When the environmental standards are not satisfied, corrective measures are needed.

To control the system it is very useful to understand the relationships among:

- Performed activities that can modify the quality of the environmental components.
- Environmental components that can be affected by the developed activities.
- Environmental indicators to measure the alteration of the quality of environmental component.
- Mitigating and corrective measures that can be applied to improve the environmental quality.

The basic way to reduce or to prevent the environmental degradation in the area being serviced is through the employees' environmental education that is to be provided by the company.

The elaboration and distribution of informative material about the importance to carry activities inherent to the service following environmental protection recommendations are essential not only to employees but also to customers, supplies and members of neighboring communities.

CONCLUSIONS

Understanding the relationships among performed activities and their environmental consequences as well as being prepared to correct them are essential to the sustainability of the service being studied.

They are also conditions to develop an environmental management system for the service that would prevent public transportation companies from significant fines.

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