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RESEARCH ARTICLE

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## Abstract

*This article shows the situation of transportation in Brazil, in particular in the case of Joinville, a medium size city, contemplated with federal investment for improve the urban mobility.*

## Keywords

*Brazil, transportation, mobility, Joinville*

## 1 Introduction

Transportation in Brazil is in focus since the execution of the FIFA World Cup and the nomination for the Summer Olympic Games, and a lot of effort and money was thrown trying to improve the Brazilian mobility.

Brazil has continental dimensions and a population of over 200 million and lacks investment in efficient transport systems, such as the railway system, instead of the road system, decreasing the country logistics efficiency and increasing the traffic jams in the cities (Ivković et al., 2016; Abramović et al., 2016).

## 2 Transportation in Brazil

Since the 60's, the focus in Brazilian transportation is in the road transport system, resulting in 2014, a total of 1.7 million kilometers of roads, with only 12.9% of this amount being paved (Ministério dos Transportes, 2016).

With 58% of all transportation due to the road transport (Plano Nacional de Logística e Transporte, 2016), Brazil loses competitiveness against other emergent economies. Besides the economic effects, the general mobility of the Brazilian population is affected, as the consume increase there is the necessity of more vehicles in the streets to provide the resources for the inhabitants.

Especially in the big cities, like São Paulo and Rio de Janeiro, the situation is even worse, with daily jams and a regular commute to work that overpass two hours. With the 2016 Summer Olympics, Rio de Janeiro faces a complicated situation, the city needs to be prepared for the event, with new infrastructure through the city affecting already low level of mobility.

The need for fast investment to these major events, the World Cup and the Olympics, combined with the historical deficiency in transport infrastructure resulted in the creation of programs and plans to improve the situation, among them are the Program for Acceleration of the Growth (PAC)

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## 2.1 PAC - Program for acceleration of the growth

The PAC is an infrastructure program, from the Brazilian government, which promoted the planning and execution of huge civil works in different fields, like logistics, urban, social and energetic. The objective of the program, which has started in 2007, is to rescue the investment in important sectors of the Brazilian economy, creating jobs and increasing the general income (Ministério do Planejamento, 2016).

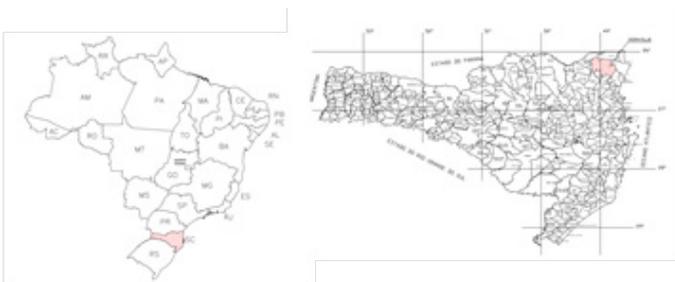
The improvements were based accordingly to the size of the cities, with target in the general mobility and the transportation systems, metro and buses.

In 2011 the PAC entered its second phase, with more focus in partnerships with states and cities, improving the quality of life in general.

In this scenario, the government launched the PAC 2 – Mobility Medium Cities, with focus in cities between 250 and 700 thousand inhabitants (such as Joinville – SC), with the resources going for construction of integration terminals for public transportation, new roads, bicycle paths, etc.

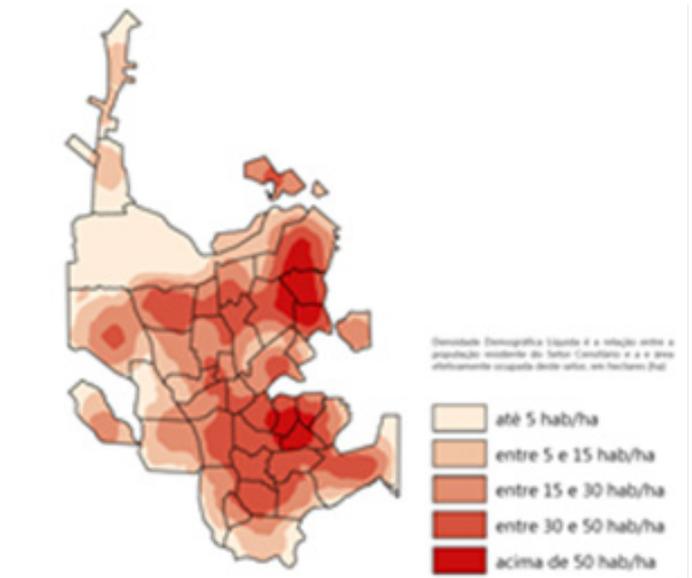
## 2.2 Joinville

Located in the South region of Brazil, Joinville is the largest city in the state of Santa Catarina. The city has a prominent economic activity in the metal-mechanical, textile, plastic, metallurgic, chemical and pharmaceutical sectors. Totalizing an area of 1125.70 km<sup>2</sup> and a population of 554.601 inhabitant (Joinville Cidade em Dados, 2015). The following figure shows Joinville's location:



**Fig. 1** Location of Joinville  
(Joinville Cidade em Dados, 2015)

Founded in 1851 by Europeans immigrants, Joinville is the third most populated city in South of Brazil, located in a plan region; the city was planned as an industrial polo. The development was based on a spread basis design, favouring long distances and the use of private vehicles. The following map shows the size and population distribution of Joinville:



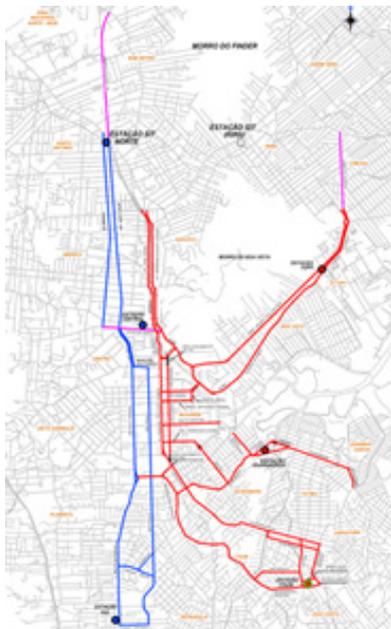
**Fig. 2** Population Density of Joinville  
(Joinville Cidade em Dados, 2015)

In the decade, from 2000 to 2010, Joinville achieved an annual growth of 1.69% in population (Joinville Cidade em Dados, 2015), which, combined with the lack of investment in transportation infrastructure and in public transportation, increased the traffic and, consequently, traffic jams.

As the majority of Brazilian medium cities, Joinville does not have a railway system for transportation. While the fleet of vehicles culminated in a peak of 359.993 vehicles in 2014, reaching a ratio of 1.54 inhabitant per car, the number of passengers in the public transportation only decreased, from 2000 to 2014, the number of daily passengers dropped 10,54% (Joinville Cidade em Dados, 2015). With these numbers, Joinville subscribed to be part of the PAC 2 – Mobility Medium Cities, trying to recover the passengers of public transportation and avoid the increasing traffic jams.

## 3 Joinville and the PAC

Joinville was contemplated with a total fund of R\$105.089.910, around 27 million euros from the federal government. The project was divided in two parts, North/South and East, as the following map shows:



**Fig. 3** PAC2 - Joinville – Blue=North-South and Red=East (Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville, 2016)

The North/South program will receive a total amount of 7.7 million euros, while the East part will receive 17.8 million euros, with more 5% counterpart from the city hall. The whole program will include 55 kilometres of benefited lanes, as new pavement, new bus lanes, new signalization, 91 new bus shelters, 134 new bike parking spaces near the bus stops, 3 new bridges, reform of all bus stations and the construction of a new one in the University area and a total of 286,389.56 m<sup>2</sup> of sidewalks, with accessibility and bike lanes. The project includes the signaling, geometric, drainage, ambiental, paving and earthwork project, and the work is estimated to start at the second semester of 2016, finishing after 36 months.



**Fig. 4** Sample of a signalization project (Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville, 2016)

The focus of the project is to reduce the time wasted for the buses in mixed traffic, providing exclusive lanes and priority at traffic lights, reducing the time in a 15km route from 120 to 43 minutes. With the increase of speed, and level of service, is expected, in a long term, the return of the passengers to the public transportation, and in the future, with the increase of income for the companies, the fare could decrease.

Currently only 2 companies operate in Joinville, Gidion and Transtusa, each one attend a different part of the city, in an integrated system, with one ticket you could travel to the entire city. But the ticket is for a single trip, there is not any temporal ticket, like a daily, weekly or monthly, with the cost of R\$3.70-€0.95 pre-bought and in the vehicle for R\$4.50-€1.15, corresponding to 0.42~0.51% of the minimum wage (R\$880-€225.5).

#### 4 Economic Impact

The PAC, with a cost of 27 million euros, is financed by the federal government, specifically through the Caixa Econômica Federal, a public bank, with the contracts, North/South and East, signed at 31 of August of 2014.

About the contracts, there is a drawdown of 45 months and a waiting period of 48 months, ending at 11 of December of 2018. The repayment should take 240 months, after the end of the waiting period, with a rate of interest of 6% by year. There are some fees, as the administration fee, 2% by year, and the utilization fee, 0.3% by year.

With these numbers was possible to calculate the final cost of the project after the end of the payments, with a discount rate of 14.25%, at the end of the repayment period the total cost of the PAC 2 – Mobility Medium Cities for Joinville IS 245 million reais, approximately 63 million euros.

As this is a non-profitable project, the main purpose of the PAC 2 is to improve the general mobility and the quality level of the Joinville inhabitants, these money will not come back directly to the society, but will be transformed in a better traffic situation, less time lost in traffic, better comfort in the buses.

A study developed by IPPUJ, shows that with the reduction of time, from 120 minutes to 43 minutes in a 15 km route, with the improve of velocity of the buses from 12 km/h to 25 km/h should represent in a more efficient fleet, more travels for each buses, and with higher frequency, the rate of occupation should decrease from 5 passenger to 4 passenger from square meter.

Led by the road safety improvement, and the segregation of buses, the numbers of accidents is expected to decrease, which by consequence will reduce the cost upon the health and emergency systems (Ambros et al., 2016)

## 5 Conclusions

This article intends to show a brief situation about transportation in Brazil, especially in Joinville, a medium Brazilian city, but already with mobility problems, and the efforts of the government to revert these problems.

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