

# Innovative Solutions for Public Transport; Curitiba, Brazil

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## ABSTRACT

Curitiba, capital of the Brazilian state Paraná 400 km south east of São Paulo, has over the last 30 years developed a non subsidised, private owned, public transport system. Today it stands as a model recognised internationally. Insightful, long term planning with several innovative solutions has provided the citizens with an effective system that gives priority to public instead of private transport. It has the highest user rates of all Brazilian state capitals, 75% of all weekday commuters. All this during an unprecedented city growth.

## INTRODUCTION

During the last fifty years Brazil has, as many countries in the South, witnessed a rapid urbanisation. People leave the countryside and the shrinking agrarian sector for the seducing city lights in hope for a better life, but unlike the urbanisation process of Europe at the turn of the last century there are no longer any factory floors to accommodate the growing labour force. The influx of people from the country-side combined with a growing population created city growth numbers around five per cent annually.

The last years burdensome financial situation of the Brazilian economy and the crippling effect of widespread corruption put the bureaucracies of all levels of state under increasingly high pressure to accommodate the basic services expected from the public, including a functioning public transport system. Curitiba is, in this aspect, no exception: since the 1940s when the population was around 140 000, it has increased ten-fold and the city proper now has a population of 1.6 million citizens with a metropolitan population depending on the services of the state capital reaching 2.3 million.

The key features of Curitiba's transportation system began to evolve in a process in the late 1960s. City planners decided to address the increasing growth by developing a master plan for the city. This master plan, designed by several Brazilian architect firms in cooperation with city planners, had five key principles:

- changing the radial urban growth trend to a linear one by integrated land use, road network and transport strategy;

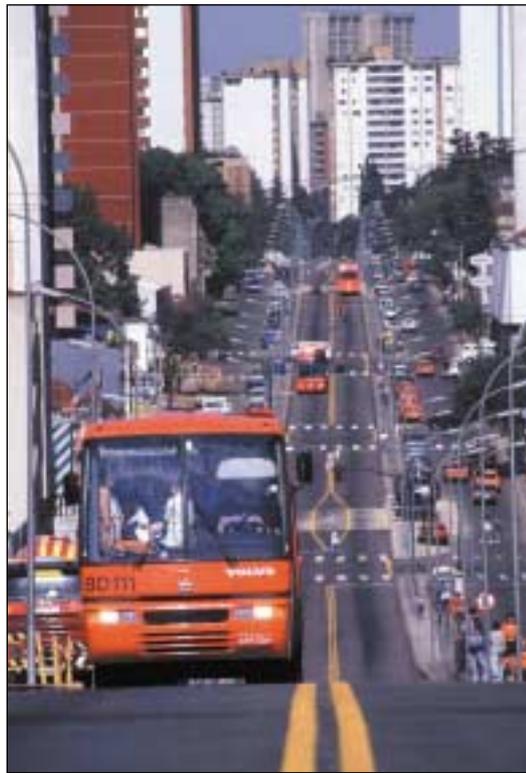


Figure 1  
Along the structural corridors the building density is high, changing the city growth pattern from radial to linear. Here the buses run on exclusive lanes



Figure 2 (below)  
Two of the special bi-articulated buses with a carrying capacity of 270 passengers at a tube station

Figure 3  
The direct bus has special platforms for quick docking at the tube station



- decongest the city centre and preserve its historical buildings and neighbourhoods with legislation and economic incentives;
- demographic control and management;
- economic support to urban development; and
- infrastructure improvement.

These principles established in the master plan have guided the city growth for more than 30 years now and the plan, by now revised a number of times, still has these principles at its core.

The planners recognised that the transportation systems can serve as the backbone for the development

**TABLE 1. CAPACITY OF BUS OPERATIONS IN CURITIBA**

Bus Configuration	Capacity (passenger/day)
Conventional bus on average street (80 passengers)	1,000
Conventional bus on bus way (150 passengers)	1,800
Double (Articulated) bus on bus way (150 passengers)	2,500
Direct route with boarding tubes (110 passengers)	3,200
Biarticulated bus on bus way with boarding tubes (270 passengers)	4,000

Note: These figures are a simplification of operational data, taking in to account the capacity of the vehicles and their respective commercial running time.

Source: URBS, Urbanizacao de Curitiba

and growth of the city in the future. Unlike many other Latin American cities at the time, the city planners of Curitiba did not embark on brutal reconstructions of its downtown area or large scale highway constructions, which has a tendency to give only temporary relief from the problems of congestion as can be seen in the United States.

Even if the city today has the second highest car per capita ratio in Brazil, the city gives priority to its public transport instead of individual vehicles. Curitiba decided to use buses as its primary means of public transport, not only because it was the choice of transport in the past; it was also the most cost effective means of transport. According to calculations done by Instituto de Pesquisa e Planejamento Urbano de Curitiba (IPPUC), the institution responsible for planning the implementation of Curitiba's master plan, the biarticulated bus system as it is developed in Curitiba costs 3 million USD/km to construct compared with 8–12 million for a tram system and around 50–100 million USD/km for a Subway.

The backbone in the combined land use, road and transport system are the structural axes and the road hierarchy. In 1974 the most significant changes in the transportation system were taken with the creation of the road hierarchy and land control system. In coordination with the master plan the planning department began to construct the first two out of five arterial structural roads that would eventually form the structural growth corridors and dictate the growth pattern in the city.

These structural corridors are composed of a triple road system with the central road having two restricted lanes dedicated to express buses. Parallel to the express bus lanes were two local roads running in opposite directions. They allowed local traffic to pass through the city.

In 1982, all five structural corridors were completed with inter-district and feeder lines. In accordance with these structural roads, zoning laws were set in place to structure the growth of the city. Large buildings holding a high density of people were permitted to be built along these corridors, but as one moved away from these central corridors the admissible densities declined from urban apartment buildings to residential neighbourhoods.

The 60 km of bus way along these axes are 'fed' by 300 km of feeder routes which concentrate passenger demand on strategically placed terminals. On these terminals, but only here, the passenger can change between different lines on the same fare with extending public transport access to 90% of the city area. These terminals are linked in turn by 185 km of circular inter district routes (Interbarrios). This network is supported by 250 km of 'direct' bus routes (Ligeirinhos) that stop only at special 'tube' stations.

The average operating speed of the buses is:

biarticulated	20 km/h
direct	30 km/h
conventional	18 km/h

compared with the average speed of the MTA Subway system of New York of 32 km/h and other Brazilian cities with conventional bus system where the actual speed can go below 10 km/h due to traffic congestion during peak hours.

The tube stations were constructed to speed up the system. Passengers now enter from the tube station at an even level to the bus floor and the passengers pay their fares by tokens or in cash to an attendant at a turnstile when entering the tube station. Boarding times are thus reduced, approaching those of subway passengers, and the short waiting times are in a relatively sheltered and safe environment. The tube stations are structures made

of steel and glass that are 10 m long and 3 m in diameter and they are equipped with side elevators to allow access for the physically handicapped and old.

The latest improvement to the system is the biarticulated buses that were specially designed for the Curitiba system in cooperation with Volvo do Brazil. These huge buses operate in the special lanes and have a capacity of 270 passengers. Due to the system design with special lanes, pre-paid passenger boarding and the priority the buses receive in road hierarchy, the bus system can operate with a much higher capacity than traditional city bus systems.

**ECONOMY AND MANAGEMENT**

The Curitiba Integrated Transport Network is managed by URBS, *Urbanizao de Curitiba*, a state-owned company created in 1963. They monitor and coordinate the system, the private companies that operate the bus lines, and maintain the infrastructure of the system. The buses are owned and run by 16 private companies who receive licences for specific lines and who are paid not per passenger but per km. URBS monitor both the mileage and the number of passengers, adapting the number of bus lines and frequency according to demand. The system is completely financed by the bus fares without any public subsidies. The fare is based on calculations done by URBS and it covers the profit percentage for the bus companies, personnel costs, maintenance and depreciation of the bus fleet. To avoid an inflated fare price, a law established in 1990 states that revenues from the transportation system can only be used to pay for the system itself. According to another municipal law, the buses must not be older than ten years, resulting in a fresh bus fleet with an average age around five years. Due to this fact, combined with the regulated regular maintenance, the buses are in good condition which helps to keep the exhaust pollution levels down. Experiments are conducted at URBS with different diesel additives like soy oil and ethanol to bring down pollution levels further.

Curitiba's use of the public transport system is the highest of all Brazilian state capitals with 75 per cent of commuters using the system on weekdays. As a result, the city's fuel consumption is 30 per cent lower than in eight comparable Brazilian cities.

**INTEGRATED TRANSPORTATION NETWORK**

To accommodate the growing population over the past 30 years, the mass transportation system has grown to utilise varying types of bus services that cater to the needs of passengers within the metropolitan areas and surrounding municipalities. The Integrated Transportation Network that has evolved between Curitiba proper and its surrounding metropolitan area, now operating with 1902 buses, is designed to allow the passenger to make travel bookings to a certain destination without paying more than one passage. The Curitiba Integrated Transportation Network today covers about 900km of routes in eight neighbouring cities. On an average day 1.9 million passengers use the system, with an 89% approval rate according to a survey done by URBS.

**CONCLUSION**

Even if the system today shows some signs of fatigue with crowded buses during peak hours, it is still a good model for many other cities to consider. The long-term urban strategy and the political will to implement it has demonstrated positive results, not only in the field of public transport

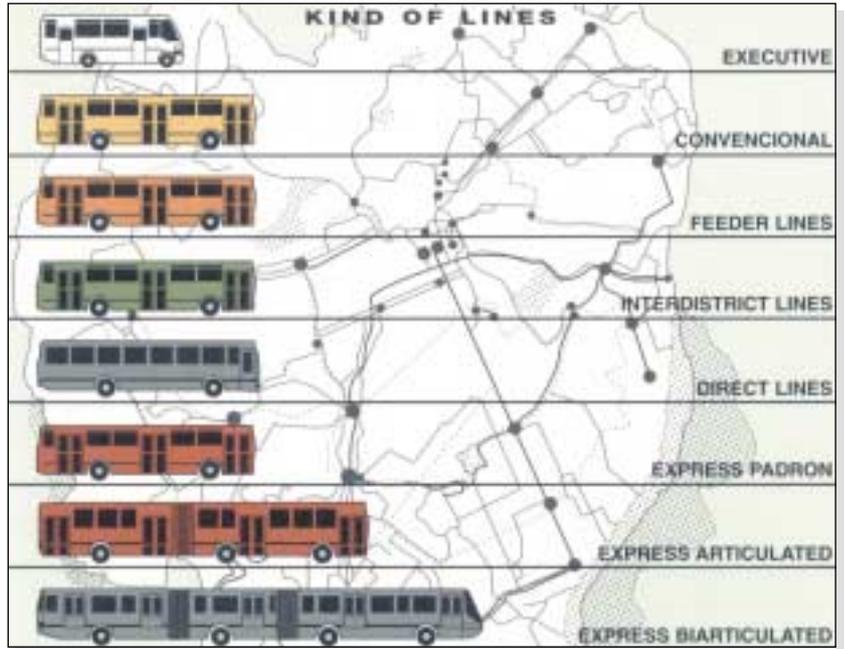


Figure 4 (above)  
The Curitiba Integrated Transportation Network uses 5 different bus models that serve 8 different kinds of lines. The buses are colour coded for easier recognition

Figure 5 (middle)  
The interior of a tube station; boarding is facilitated by the elevated floor and the prepaid passengers who pay at the turnstile when entering the tube

Figure 6 (bottom)  
By creating a road hierarchy that prioritise public transport the bus system of Curitiba can operate efficiently

Figure 7  
The express bus system with its special lanes and tube stations serves the citizens with fast, safe transport throughout the city



but in the overall integrated strategies of the city.

Curitiba was for example the pioneer in Brazil when it created its pedestrian network in the centre of the city in 1971. There are also several garbage recycling and collecting schemes, bicycle paths, and lots of green areas and parks giving the city not only recreational areas and beautiful landscapes but also important flooding control and protection for biotopes and freshwater sources. The city has also developed methods and strategies for the preservation of historical neighbourhoods, saving its culturally important parts from land speculation. There is also an incentive mechanism for developers to use part of their plots for green areas, giving them the opportunity to build higher than the land use legislation would otherwise allow. An example of the integration of the transportation with the rest of the city management are the so called 'citizen streets'. At some bus terminals in the suburbs, city hall has built satellite offices for the different branches of administration to facilitate the contact with the people.

The development has most of the time been driven by the staff of different municipal institutions without strong public participation in the planning stages. The lack of participation from the public might not be so strange as the process started in the 60s and 70s when Brazil was still under authoritarian rule that believed in the bliss of technocrat expertise, but as the system continues to evolve a greater involvement from the public might be necessary to continue the strong support.

What is then the main reason for such a widespread use and popularity of the system?

Studies have shown that 28% of the car-owning population regularly use the system.

It seems that the explanation is connected to practical reasons. The buses are fast, the network of lines covers the city very well and it's a lot cheaper to go by bus than by car. Compared with some other cities in Brazil, it's a wonder of efficiency and speed.

Fact still remains that nearly 700 000 cars are used in the city almost every day. The figure is rising along with the economic growth of the city and cars still hold a strong symbolic value as attributes of prosperity. If unregulated, the cars of Curitiba will once again start to create traffic congestion and deteriorated air quality in the city.

With simple innovative solutions the city planners have been able to create a system that is an economically self supported mix between private companies under public control serving the many thousand citizens of Curitiba and its suburbs with effective, reasonably cheap transportation in their daily lives.

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#### ABOUT THE AUTHOR

Lars Friberg is a Swedish student of Political Science from Uppsala University who did a case study on the Curitiba public transport system as his Masters thesis during the summer of 2000.

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