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Report on the Spring 1998 Mission

**Private Urban Transit Systems and Low-Cost Mobility
Solutions in Major Latin American Cities**

This TCRP digest summarizes the eighth mission performed under TCRP [Project J-3](#), "International Transit Studies Program" The report includes information on the cities and facilities visited, lessons learned, and discussions of policies and practices that could be applied in the United States. This digest was prepared by Tracy E Dunleavy of the Eno Transportation Foundation, Inc, the contractor for the project, on the basis of reports filed by the mission participants For information on prior ITSP missions, consult TCRP Research Results Digests 20, 22, 27, and 31

**INTERNATIONAL TRANSIT STUDIES
PROGRAM**

About the Program

The International Transit Studies Program (ITSP) is part of the Transit Cooperative Research Program (TCRP). ITSP is managed by the Eno Transportation Foundation under contract to the National Academy of Sciences (NAS). TCRP was authorized by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and reauthorized in 1998 by the Transportation Equity Act for the 21st Century (TEA-21). It is governed by a three-way memorandum of agreement signed by the NAS, acting through its Transportation Research Board (TRB); the Transit Development Corporation, which is the education and research arm of the American Public Transit Association (APTA); and the Federal Transit Administration (FTA). TCRP is funded annually by a grant from the FTA.

ITSP is designed to assist in the professional development of transit managers, public officials, planners, and others charged

with public transportation responsibilities in the United States. The program accomplishes this objective by providing opportunities for participants to learn from foreign experience, while expanding their network of domestic and international contacts for addressing public transport problems and issues.

The program arranges study missions for teams of public transportation professionals to visit exemplary transit operations in other countries. Each study mission is arranged around a central theme that encompasses issues of concern in public transportation. Cities and transit systems to be visited are selected on the basis of their ability to demonstrate new ideas or unique approaches to handling public transportation challenges reflected in the study mission's theme. Each study team is given a briefing before departing on an intensive 2-week mission. After this stimulating professional interaction, study team members return home with ideas for possible application in their own communities. Team members are encouraged to share their international experience and findings with peers in the public transportation community

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throughout the United States. Study mission experience also helps to better evaluate current and proposed transit improvements and can serve to identify potential public transportation research topics.

Study missions normally are conducted in the spring and fall of each year. Study teams consist of up to 15 individuals, including a senior official designated as the group's spokesperson. Transit agencies are contacted directly and asked to nominate candidates for participation. Nominees are screened by a committee of transit officials, and the TCRP Project J-3 Oversight Panel approves the selection.

Study mission participants are transit management personnel with substantial knowledge and experience in transit activities. Participants must demonstrate potential for advancement to higher levels of public transportation responsibilities. Other selection criteria include current responsibilities, career objectives, and the probable professional development value of the mission for the participant and sponsoring employer. Travel expenses for participants are paid through TCRP Project J-3 funding.

For further information about the study missions or individual travel awards, contact the TCRP (202/334-3089) or the Eno Transportation Foundation (202/879-4712).

About the Report

The following report is an overview of the eighth study mission. It reflects the views of the contributing participants, who are responsible for the facts and accuracy of the data presented. The report does not necessarily reflect the views of the TCRP, TRB, NAS, APTA, FTA, or the Eno Transportation Foundation.

PRIVATE URBAN TRANSIT SYSTEMS AND LOW-COST MOBILITY SOLUTIONS IN MAJOR LATIN AMERICAN CITIES: MISSION 8, APRIL 18--MAY 2, 1998

Introduction

The 2-week mission involved visits and discussions with transportation providers in Buenos Aires, Argentina; Montevideo, Uruguay; and Porto Alegre, Curitiba, and Sao Paulo, Brazil.

This mission explored:

- Private-sector financing and operation of transportation systems in Buenos Aires;
- Intermodal ground and waterborne transit in the Buenos Aires and Montevideo regions;
- Bus platooning, exclusive busways and a low-cost and low-tech transit system in Porto Alegre;
- Bus system and busway development that achieves ridership levels in Curitiba comparable to some heavyrail systems;
- Privately operated, government-supervised bus fleets

along with exclusive bus corridors in Sao Paulo;

- Pollution monitoring techniques and the tracking of the 16,000-bus fleet in the Sao Paulo metro region;
- Use of performance measures and public surveys to monitor transit system performance in Sao Paulo;
- Route restructuring to improve service to outlying terminals in Montevideo; and
- Integration of community services in transit terminals in Curitiba.

This report has two main sections. The first section presents an overview of the transit operations in each city visited, including information on public and private suppliers of transportation services. The second section focuses on the main transit strategies and technologies observed by the mission participants. The report concludes with a summary of policies and practices that could be applied in the United States.

Appendix A lists the names of the study mission participants and their titles and affiliations at the time of the mission. The study team learned much about specific urban planning theories and concepts, which are discussed in Appendix B.

TRANSIT PROFILES

This section discusses the transit services offered in the cities visited by the study mission team. It also examines services provided by some public- and private-sector transportation operators.

Buenos Aires, Argentina

Buenos Aires has developed one of the world's better urban transportation systems. The system evolved fortuitously around the unique, privately operated *colectivo-small* operators banded together into route associations. Travelers are seldom more than one block from a bus, and often they have a choice of buses to take.

The subway system, on the other hand, was designed for the Buenos Aires of an earlier era (the first line was constructed in 1915). The system has had diminishing adequacy in the modern city, given the two socially distinct, yet similar, patterns of commuting. Most professionals, businesspeople, and other white-collar workers commute downtown by car or train from the northern zones. Blue-collar workers generally commute across town, from residential to industrial sections, by colectivo.

Most city traffic is regulated by automatic traffic lights, but the city's residents are notorious for ignoring them. For many years, two major streets, Calle Florida and Calle Lavalle, were closed to motor traffic during part of the day to allow for a free flow of pedestrians. Today, Calle Florida, is reserved for pedestrians only.

The highway system in Buenos Aires includes several expressways that radiate out from the central core to connect with Avenida General Paz, which circles most of the city,

forming a spokelike pattern. Other main avenues connect the Plaza de Mayo, in the heart of the city, with outlying neighborhoods. Buenos Aires is the terminus of every major railway in the country. There are also electric suburban lines linking the city with the towns of Tigre and Moreno.

The international airport of Ezeiza, Don Torcuato airport, and El Palomar, the military airport, are respectively located outside city limits in the partidos of Esteban Echeverria, Tigre, and Moron. They are connected to the city by expressways. Jorge Newberry, the Buenos Aires City Airport, lies within the federal district and serves domestic airlines, as well as those that operate to and from neighboring countries.

During the second half of this century, tramways and trains were replaced by automobiles and colectivos as the dominant modes of transportation in the city. Unlike many other large Western cities, Buenos Aires is not yet ringed by a network of superhighways. A complete network was planned after World War II, but economic and political difficulties prevented its construction. By the late 20th century, the existing network of streets was severely congested with vehicular traffic, and the need to improve other modes of transportation seemed imperative as traffic jams and gridlock added to the more frustrating characteristics of contemporary Buenos Aires. Some progress was made in 1979 when the Metropolitan Railroad was established to cope with the capital's traffic problems. City and suburban authorities were coordinated, and in succeeding years, plans to expand and electrify the rail lines were executed. Newer Japanese-built railroad cars have replaced older cars on some lines.

National Transport Regulation Commission (CNRT). Created less than a year before this mission, CNRT is the national government's oversight commission for surface transportation (including urban and interurban bus, rail, and commuter services). CNRT has taken over the functions previously exercised by three separate government commissions dealing with buses, rail, and rail privatization. Its primary regulatory function is enforcing a 10-year vehicle age limit. This is considered an environmental and quality-of-service regulation.

This commission, operating under the authority of the Ministry of Economics and Public Works, seeks to ensure a level playing field among private operators by promoting competition and protecting the rights of passengers. It monitors the performance of private contractors, ensures quality control of services, levels penalties on operators for noncompliance with the provisions of their contracts, and approves fares. CNRT is not responsible for oversight of the recently privatized rail services.

Cometrans Consortium (Metropolitan Transportation Consortium). This private company, owned by 18 local medium- and long-distance bus companies, is one of the largest bus operators. It maintains a fleet of more than 2,100 buses and travels over 1,442 route miles. Cometrans, together with a Brazilian company, has just won a 20-year concession

to operate the Rio de Janeiro (Brazil) metro system.

Cometrans is part of an international consortium that includes two U.S. rail companies--Burlington Northern Railway Company (BN) of Fort Worth Texas, and Morrison Knudsen Rail Systems (MK), a subsidiary of the M K Corporation. This consortium has been awarded the operation of the subway, commuter rail, and light-rail lines in the capital region. Its objective is to improve the efficiency, productivity, and revenues of the public transport services. Cometrans competes with Metropolitano and Metrovias Consortia, which operate other commuter rail and subway lines.

Bus Services

Bus services are provided by route associations of independent operators (*empresas* or private bus companies) who own the colectivo mini- and midibuses that collectively account for 80 percent of all public transport. In 1997, these associations provided more than 7 million daily trips and carried an estimated 2.8 billion passengers. The current trend is toward consolidation with about 100 operators reported last year, down from about 130 in the early 1990s.

About 33 percent of the participants in the route associations are owner-drivers who operate a single vehicle, but most of the associations own fleets of varying sizes. The total number of privately operated buses providing service in the Buenos Aires metropolitan area is more than 11,000. In 1995, about 33 percent of the fleet (3,800 vehicles) was reported to be more than 10 years old and scheduled for mandatory replacement, but funding problems have delayed vehicle replacement. Higher quality express services with seats for all passengers are offered at higher fares on some routes.

The only public subsidy provided to bus operators is a fuel subsidy. Increasing competition from taxis and illegally operated old coaches and paratransit vehicles has cut into the ridership of scheduled services. Patronage has also been lost to the commuter trains whose services have much improved following privatization initiatives. Bus operators are under considerable financial pressure and have petitioned the oversight body for substantial fare increases.

Transportes Plaza. Also owned by Cometrans, Transportes Plaza is one of the largest of the *empresas* companies. It operates a fleet of 411 buses and runs 6 bus lines in the capital. The company reports an annual passenger load of 79 million and annual revenues in the range of \$40 million. Transportes Plaza is staffed by more than 1,200 people. Like all of the 100-plus *empresas*, it operates without a government subsidy.

Urban and Regional Rail Privatization

In the early 1990s, a national policy was introduced that mandated the privatization of state-owned enterprises. In carrying out this policy, three concessions to operate the metropolitan-area rail networks have been awarded by the government over the past few years. The privatized metro,

light rail, and commuter rail operations together carry 1.5 million passengers daily in the greater Buenos Aires area. There are about 500 miles of rail lines and 4,200 daily trains in the capital region. Cometrans is responsible for the combined operations.

Trenes de Buenos Aires (TBA). TBA, like the other major operators, is a joint venture comprising Cometrans, MK, and BN. Cometrans and MK each own 41.65 percent of the company's stock, and BN owns 16.7 percent.

TBA operates the Mitre and the Sarmiento urban rail lines to the northern and western suburbs of the greater Buenos Aires metropolitan region. The Mitre line is 115 miles in length with 55 stations; the Sarmiento line operates 120 miles with 44 stations. Respectively, these lines have carried 50 million and 90 million passengers annually in recent years. The 235-mile system, 25 percent of which is electrified, encompasses 97 stations. Since May 1995, TBA has made investments to upgrade rolling stock, renew infrastructure, and improve on-time performance (which has now reached 99 percent). Train and station security, as well as fare enforcement, have also improved significantly.

Metrovias. This private consortium is made up of the majority partner, (Argentinean) Benito Roggio e Hijos, S.A. (55.3 percent) and minority partners, Cometrans (28 percent) and BN (16.7 percent). Like other metropolitan-area rail networks, Metrovias receives government subsidies to operate its four-line subway system and its urban rail line. In total, Metrovias's network reports more than 500 million annual boardings.

Since the Metrovias consortium took over the renewable 20-year concession in January 1994, ridership has increased substantially, staff has been reduced to about 3,000, tracks have been renewed, communication systems have been upgraded, and 100 reconditioned railcars have been acquired from the Tokyo subway system.

Metropolitano. Metropolitano is the operating company of three commuter rail lines--Belgrano South, Roca, and San Martin. It has doubled ridership since the private takeover of the run-down lines in 1994. The network, which totals 314 miles, is being refurbished and accounts for an annual ridership in excess of 220 million.

Montevideo, Uruguay

Bus Services

Urban bus services in Montevideo are provided by a number of private cooperatives and companies, the largest of which is Compania Uruguaya de Transportes Colectivos SA (CUTCSA). Four smaller bus-operating groups (COETC, COME, RAINCOOP, and UCOT) provide service in the capital. COETC operates seven routes with 167 buses; COME, eight routes with 111 buses; RAINCOOP, seven routes with 119 buses; and UCOT, seven routes with 119 buses. The urban bus fleet in Montevideo totals 1,500

vehicles and carries 300 million passengers annually.

CUTCSA. The largest single private urban bus operator in South America, CUTCSA, operates 105 routes with a fleet of 1,025 buses of diverse origin (Leyland, Scania, Volvo, and Mercedes models). CUTCSA carries over 210 million passengers and covers more than 50 million vehicle miles a year.

CUTCSA has a staff of 6,000 employees. In 1996, the company launched a "zero accident" initiative and managed to reverse a 5-year trend by reducing incidents 17 percent in a single year. Drivers are given a bonus for accident-free performance. The vast majority of the CUTCSA fleet--more than 900 vehicles--is still operating with conductors. The company has embarked on a plan to convert to a one-person operation with magnetic fare cards. Bus service in Montevideo is managed by the city through the Ministry of Transport. Subsidies called "social fares" are paid to operators to carry students and riders with disabilities at lower fares.

Rail

The Uruguayan State Railways (AFE) contracts out a commuter rail service on a 40-mile line between Montevideo and a city named 25 de Augusto to private operator Rutalmar SA. The municipality is currently studying a seven-route light-rail network which would link the city center with the inner suburbs and run along segregated rights-of-way to reduce congestion on major roads. The first link is planned to open in 2000.

Porto Alegre, Brazil

Buses and Busways

Twenty-six private operators provide bus and minibuses services under the supervision of the city, which has established Comonor, a busway "platooning" system to speed bus traffic and lower congestion. The bus fleet totals 1,600, most of which are standard-size Mercedes models. About 150 minibuses are included in this number and Volvo articulated buses have recently been introduced to further increase capacity. The passenger count is 325 million annually. The bus operators also manage a fleet of 350 shared vans or taxis with 17 seats each that account for an additional 60 million passengers a year. Farebox revenues fully cover operating costs; there are no operating subsidies.

The exclusive bus lanes in the median of seven radial corridors that converge on the city center are used by both urban and regional lines. During weekday rush hours, bus flows on some of these corridors are in excess of 350 per hour, or about 6 per minute. The platooning system maximizes the capacity of the bus lanes. Buses from and to various destinations are held at lane entry points to travel in unison along the dedicated lanes. These lanes are up to 3.1 miles in length, reaching passenger flows of 20,000 per hour in each direction at an average speed of 12.4 mph. Passengers board at protected stations along the way. An express bus

service also operates along a dedicated lane with local feeder bus connections.

Municipal Transport Secretariat (SMT). Porto Alegre's privately run network is supervised by the city's SMT. The agency has developed a strategy for evolving the transit service to meet the changing needs of the region's population. This strategy centers on a grid system with regularly spaced terminals for easy passenger transfer.

Regional Metro

The Trensurb regional metro operates a single line, 16.76-mile system with 25 Japanese (Nippon Sharyo/Kawasaki) four-car trains. This heavily subsidized line (69 percent), used by 30 million passengers each year, is currently being extended by two stations (2.1 miles). This expansion is expected to yield an additional 40,000-plus passengers per workday. Trensurb runs along a regional development corridor and is operated and subsidized by the national government in line with its economic development plans. Farebox revenues account for only 25 percent of operating costs.

Aeromovel

This 0.68-mile, low-cost people mover has been in operation for nearly 20 years, primarily as a demonstration project, with financial assistance from the government. Powered by compressed air, Aeromovel has marketed its cost effective concept internationally with only limited success to date.

Curitiba, Brazil

Sixteen independent companies under contract to the city operate an exemplary integrated local transit system. Unlike Buenos Aires and Montevideo where various private operators compete for passengers and "own" the rights to various routes, operators in Curitiba perform according to detailed service specifications issued by URBS and are reimbursed on a per-kilometer basis.

Annual passenger ridership is 320 million on a total of 277 bus routes, covering a network of 755 miles. Fares pay all of the system's operating costs; passengers over 65 and persons with disabilities ride free. A system of high-capacity buses on limited-stop schedules provides an additional level of service and comfort within the existing network.

Curitiba's "busway" system has won worldwide acclaim for expanding a high-speed modern bus system into the capacity range of a metropolitan railway. The transit environment in Curitiba is characterized by five express busways flanked, one block away on either side, by high-capacity, one-way streets heading into and out of the inner city. Land-use legislation over the past 25 years has encouraged high-density, mixed-use development in areas adjacent to the busways. The system is entirely integrated with interdistrict and feeder buses that make it easy to transfer

from express to local buses, and vice versa.

Large, fully equipped bus terminals are located at the terminal stops of each of the five busways, while medium-sized bus terminals are sited just over 1.24 miles apart along the main axes. These terminals house newspaper kiosks, snack stands, telephones, postal counters, and small shops, and provide for transfers to and from feeder and interdistrict bus lines. Adjacent to several of these terminals the city has built "citizenship streets"--municipal complexes that offer government services. Services range from unemployment offices to recreational centers. The entire bus system is color-coded: red for express buses, orange for suburban feeder buses, green for interdistrict buses that link the suburbs, and yellow for *convencional* city buses on local routes.

System operators who collect the fares are paid by the kilometer rather than by the number of passengers they carry. This results in a balanced distribution of bus routes and eliminates destructive competition. Passengers pay a single fare to get into the system, and except for the high-speed dedicated central busway lanes, routes run along ordinary city streets and do not require excavations or tunnels. The city enforces bus speeds in key express lanes and bus operators on the main routes can preempt the traffic signals.

The most innovative features of Curitiba's network are the tubular boarding stations on the main routes. Fares are paid at a turnstile in the tube before boarding the bus over a nearly level ramp. At some stations passengers board at the front and exit at the rear--a technique that reduces dwell time and increases peak capacity. Dwell time has been reduced to a mere 19 seconds. The largest double-articulated Volvo buses in the 2,000-vehicle fleet have 5 lateral doors and hold 270 passengers each, providing one of the largest bus capacities anywhere in the world. Although there is about one private automobile per two city residents (one of the highest per capita automobile ownership rates in Brazil), 75 percent of all commuters--more than 1.3 million passengers a day--take the bus.

Curitiba tries to maintain the average bus fleet age at 3 years, helping to hold down bus emissions and contributing to Curitiba's low level of air pollution, which is among the lowest in Brazil. The city pays private operators 1 percent of the value of a bus per month and, after 10 years, takes possession of the retired vehicles, refurbishes them, and makes them available for human services uses such as neighborhood day care centers, shelters, and mobile classrooms.

Urbanizacao de Curitiba (URBS). The city's unusual system is administered by URBS, a municipal company established as the only franchise holder under authority of the provincial governor. The company is responsible for managing contracts of the operators that provide service. URBS establishes routes, sets fares, and decides on equipment that will be used. It is also responsible for customer service programs, marketing, and image-based efforts to keep the system growing.

Trolleybus Network (Projected)

Detailed plans have been drawn up by the city for a 36.6-mile trolleybus network. Designed to further enhance capacity, energy savings, and environmental benefits, the projected 87 articulated trolleybuses are expected to carry more than 200,000 passengers a day. The plans may be suspended because of budget considerations in favor of further expansion of the Ligeirinho (superexpress) articulated, high-capacity buses, which serve the tube stations along the main corridors.

São Paulo, Brazil

São Paulo is a major transportation hub. Three large airports and several smaller ones, provide São Paulo with international and domestic service. The Viação Aérea São Paulo (VASP), Brazil's second largest airline is owned by São Paulo state. Marine transport is provided through the port of Santos. São Paulo is also a hub of railroads, including a transcontinental line from Santos to Antofagasta, Chile.

Modern highways connect with inland cities, Santos, Rio de Janeiro, and almost all the states of Brazil. São Paulo's first freeway was opened in 1969, and its subway system was inaugurated in 1976. Automobile traffic in the city and suburbs is heavy. Despite street and highway improvements, congestion is a major and growing problem that has added to the city's serious air and noise pollution problems.

The transportation mode split in São Paulo is 33 percent private vehicle, 33 percent transit, and 33 percent pedestrian. Of the ten million plus daily trips by public transit in the São Paulo metropolitan area, 7.9 million are made by bus, the most popular mode by far. The high percentage of trips made on foot reflects two factors. One is that in many places, due to horrific traffic congestion, pedestrians move faster than cars. The other is that São Paulo has neither the resources nor the transit system capacity to subsidize travel by traditionally disadvantaged groups of riders such as the elderly or students.

State Secretary for Metropolitan Transport (SMT). The São Paulo state government has centralized the management of metropolitan area transport under a single authority--the SMT. This agency sets policy and plans, regulates the conduct of, and grants concessions for transport operations in the metropolitan region. The SMT oversees all rail systems and the operators of about 3,500 buses and trolleybuses outside of São Paulo proper. SMT supervises four agencies which are responsible for train, subway, bus, and transit planning.

Bus Network

A total of 48 private companies with 54,000 employees provide services using 11,100 buses over 800 routes in individual fleets that range from 30 to 400 vehicles. Almost 2 billion bus and trolleybus boardings are reported annually. About 66 percent of all daily trips in the metropolitan region are made by public transit. Daily bus patronage on the major corridors, alone, was 3.2 million in 1996.

São Paulo Transporte SA (SPTrans), State Metropolitan Railways (CPTM), and Metropolitan Bus Transit Agency (EMTU). Bus and trolleybus services in the city of São Paulo and most of the metropolitan region are provided by private operators through service contracts with SPTrans, the municipal transit authority. The metro is operated by a company jointly owned by the city, state, and federal governments and is supervised by the SMT. SMT also supervises interurban metropolitan rail and bus services, provided in a complex arrangement by CPTM and EMTU. SMT is implementing an innovative regulatory system that will evaluate bus route providers based on a customer satisfaction survey.

Trolleybus Network

Whereas the catenaries, infrastructure, and vehicles (more than 480) are owned by the municipality, service is provided by three private operators. The aging system (the average vehicle is 13 years old) is now undergoing a major overhaul, funded by SPTrans. There are 18 trolleybus routes, all of which are completely integrated with the motorbus network, and nearly 50 percent of the bus and trolleybus routes feed metro or suburban rail stations.

Another 23-mile suburban trolley bus feeder network, managed by a private operator and separately administered by the EMTU, operates 46 trolleybuses and transports 350,000 passengers daily.

Busways

The dramatic increase of traffic congestion in the city led to the development of exclusive busways over the past 20 years. Sixteen dedicated busways totaling 113 miles are now in operation. Eighteen dedicated transit corridors with 33 interchange terminals are under construction. Services along the busways are operated by 29 private companies with a combined fleet of 1,674 vehicles. Of these, 1,226 are articulated and 70 are trolleybuses (the majority of the latter are also high-capacity articulated types). Daily passenger totals are about 3.2 million.

The São Paulo busway model, arrived at after considerable experimentation, consists of offset islands located to the right of the bus flow in both directions. Highplatform stops allow level access to buses, thereby reducing dwell time, and vehicles are fitted with extra doors on the left side.

A recent effort to contract out the construction and operation of future busways to the private sector has run into funding difficulties. The city is now building more corridors on its own and has asked the operating companies to increase the capacity of their fleets.

Metro

The Metropolitano de São Paulo (CMSP) claims to be one of only two or three systems in the world to fully cover its

operating costs from farebox revenues. In 1996, revenues were 106 percent of operating expenses. Passenger trips on the 27-mile, 3-route network were 701 million in 1996. The system operates with 588 cars formed into 6-car trains. Access to the system is controlled by electronic turnstiles at the network's stations.

Existing metro lines are being extended by two short segments measuring 2.1 and 1.8 miles. This action is expected to generate an additional 190,000 daily trips. Construction is also underway for Line 4 (5.65 mi, 10 stations) with initial demand projections of 660,000 additional daily passengers. Partial construction funding has been obtained from the World Bank.

CMSP controls four major bus terminals that generate nonfare revenues. In addition, it oversees construction of feeder trolleybus routes. In cooperation with private sponsors, CMSP also operates a lively station arts and entertainment program.

Suburban Commuter Rail System

CPTM operates a suburban heavy-rail system that carries about 800,000 weekday passengers. The system is divided into east and west branches, which cover 119 miles, 163 stations, and 48.4 miles, 35 stations, respectively. Headways are as low as 4 minutes during peak periods. Modernization and upgrading of the aging electrified network has been underway for more than a decade.

An additional 30 four-car trains are on order from the GEC Alstom/Adtranz/CAF consortium. Discussions are also in progress with Spain's national railway to purchase 50 used Class 440 EMUs to be modernized before export. The current fleet consists of 998 cars formed into 293 trains, not all of which are available for service. A considerable part of the fleet dates back to 1956 and 1962; the newest cars are 10 years old.

LESSONS LEARNED

This section focuses on the main strategies and technologies observed by study mission team members. Specific topics discussed are:

- Factors for success;
- Privatization of metro and commuter rail;
- Models of government regulation;
- Busway planning, design, and operation;
- High fare recovery;
- Government enforcement of bus maintenance; and
- Customer service and users' opinions.

Factors for Success

The South American cities visited operate highly successful public transit systems and provide much to learn about moving enormous numbers of passengers efficiently and effectively. Innovative techniques and supportive factors

have yielded bus transit systems that carry higher peak-hour, peak-direction movements than any light-rail system in North America. While most of the cities studied have accomplished this with excellent farebox recovery, vigilant, supportive public policy and continued innovation will be necessary to sustain the success in the future.

Porto Alegre, Brazil

This metropolitan region has a population of approximately 2.8 million and, as in other South American cities, extremely high densities are concentrated in major travel corridors and a compact, multiuse downtown area. Along major travel corridors served by an exclusive busway system, population densities vary from 15,000 to 50,000 people per square kilometer. Government policy, fuel cost the equivalent of more than US\$3 per gallon, and low automobile ownership rates support usage of the mass transit bus system. The privately operated bus system is supervised by the city's SMT and carries approximately 1 million passengers per day.

The hallmark of the Porto Alegre transit system is the low-cost development of seven radial bus corridors that converge on the city center. Figures 1 and 2 illustrate how the exclusive two-lane busway is built within the median of major arterial roadways. Median station stops with passenger shelters, which occur every 0.30 to 0.62 miles, are also shown in the figures.

The busway, which is approximately 24 feet in width, can accommodate extremely high passenger movements that approach 20,000 passengers in the peak-hour, peak-direction of movement.

Built at approximately \$3 million per kilometer, this low-cost initiative is enhanced by running buses in a convoy to provide frequent service to multiple destinations (Figure 3). Upon arriving in the central city, the busways serve major transfer and transit centers which allow convenient transfer to numerous destinations. One of the major downtown terminals, shown in Figures 4a & b, can accommodate 48 buses at one time in six bus lanes. This low-cost passenger terminal accommodates 400,000 passengers per day.

Curitiba, Brazil

Curitiba has become a model city because of its high quality environmental, social, and physical attributes which are primarily the result of one of the most successful city and transit planning efforts anywhere in the world during the 20th century.

The plan, conceived in 1965, emphasized the integration of land use, the road system, and public transportation. It encouraged high-density development along linear structural axes running in the north-south and east-west directions. A fifth structural axis has also been developed in the southeast area of the community. The plan purposely oriented the major freeway system away from the city center to minimize the impact of automobiles and maximize the use of public transit; it also encouraged a pedestrian-friendly city.

Despite having one of the highest per capita incomes



Figure 1. Two-lane median busway with passenger station stop in Porto Alegre.



Figure 2. Porto Alegre busway positioned between arterial roadway main lanes.



Figure 3. Busway with convoy operation in Porto Alegre.



Figure 4a. Porto Alegre downtown transfer terminal with open-air passenger shelters.



Figure 4b. The Rui Barbosa transfer terminal handles 400,000 daily riders at the end of a four-block, bus-only street.

and automobile ownership rates in Brazil, the Curitiba bus system carries over 70 percent of all trips made in the city and cars carry only 22 percent. This has been achieved by the implementation of an extremely high-performance bus system utilizing 37 miles of exclusive busways developed by URBS, a public company owned by the municipality of Curitiba. The median busways (Figure 5) have directly supported the development of high-density, multiuse buildings along each major structural axis. Densities along the major corridors approach 30,000 to 50,000 people per square kilometer. This mixed use development generated even directional splits on the busways, supporting an efficient transit operation.

The busways utilize a double-articulated vehicle (Figure 6) that is capable of holding 270 passengers in a crush load. Peak-hour, peak-directional passenger movement on one of the busways has exceeded 27,000 and is close to saturation. The busways and their innovative tube-loading stations have been developed at an extremely low cost of less than \$1 million per kilometer. In the downtown area, major streets are dedicated to transit vehicles and transfer movements (Figure 7) and larger passenger loading tubes (Figure 8) allow efficient movements of large numbers of passengers. At the ends of most busways, major terminals are adjacent to "citizenship" streets that integrate social services with transit (Figure 9).

Sao Paulo, Brazil

São Paulo operates an extremely efficient rail transit system with an expanding bus system utilizing low-cost yet very high-performance busways in the outskirts of the city. A visit to the south side of São Paulo and a tour of EMTU facilities revealed a network of busways 20.5 miles in length which carry over 240,000 passengers per day. These busways are an extension of the subway system constructed at lower cost and capacity. One of the busways visited was 24 feet in width and ran adjacent to or in the median of arterial roadways, with on-line station stops. The busways also used integration or transfer terminals at nine different locations. Bus queues approaching one of the major terminals is shown in Figure 10. Plans are being proposed to expand the system over 185 miles.

São Paulo's busways serve 20,000 passengers per hour in the peak direction and have been constructed for approximately \$3 million per kilometer. These busways experience extremely high usage throughout the São Paulo region, in part because fuel costs are high (equivalent to more than US\$3 per gallon) and automobile ownership rates are relatively low. However, traffic congestion and air pollution are so severe that the SMT policy favors expansion of subway and commuter rail lines.

Busways provide large savings to the operators relative to the mixed-traffic bus routes which deal with significant congestion (Figure 10). Additional environmental improvements are forthcoming with electrification of these metropolitan corridors and utilization of trolley buses.

Privatization of Metro and Commuter Rail

This section explores the historical and cultural influences that have led Buenos Aires and São Paulo to their current policies with respect to rail transit. It also focuses on contracting requirements and how these requirements have made private operation of rail services desirable to the private sector in Buenos Aires.

Buenos Aires, Argentina

Transit development in Argentina has been influenced by a series of nationalizations and privatizations that took place throughout this century. In the early 1990s, Argentina developed a program of privatization designed to improve the infrastructure and increase ridership. Commuter rail was separated from freight rail and turned over to concession along with the subway system. While under public operation, the system had deteriorated, resulting in steady losses of ridership and operating deficits.

Since the transition to private operation is still in its early stages and already threatened by political changes, it is premature to declare the Argentina model a success. However, the Buenos Aires region has several characteristics favorable to long-term success for private operation.

The population in Buenos Aires is heavily dependent on public transit which carries over 50 percent of all daily trips in the region, primarily on bus. The current privatization effort is designed to move commuters to subway and rail. Automobile ownership is significantly lower than in the United States. Many can walk to transit. The cost of fuel and lack of parking facilities encourage even automobile owners to use transit on a daily basis. Congestion in the inner city is significant and transit is generally accepted as a viable way to travel in and around the city. These factors combine to create an appealing opportunity for the private sector. Private operators and concessionaires can benefit by showing an improvement in system amenities and services, thereby attracting new rail riders. They also have the opportunity to increase profits by eliminating the historically high levels of fare evasion common under public operation.

When Argentina first considered privatization, the government was interested in selling the assets as well as the operation. It was finally determined, however, that purchasing the assets would be too expensive for the private concessionaires. Recovering the investment in the assets from the operating revenues would be impossible. Argentina sought private-sector partners for operation of the rail services and rehabilitation and construction of rail facilities, but retained ownership of the rail infrastructure.

The goal of the privatization effort was to attract the private sector. The contracts featured several items to achieve this goal including long-term contract opportunities, profit motive, limited investment risk, and aggressive use of concessions. The request for proposal set out the government's priorities for service, described the desired capital improvements, and identified the projects and the schedule for completion. Private operators were asked to



Figure 5. Curitiba median busway with tube stations.



Figure 6. Double-articulated busway vehicle in Curitiba.



Figure 7. Curitiba major downtown transit street and transfer zone.



Figure 8. Bus tube-loading platforms in downtown Curitiba.



Figure 9. "Citizenship streets, " built adjacent to outlying terminals, offer a variety of commercial services and are emblematic of the commitment in Curitiba to enhancing the quality of life in neighborhoods as part of transportation investment policy.



Figure 10 Midday traffic jams in downtown São Paulo with mixed traffic bus routes.

establish subsidy requirements and payment for fees and set prices for a group of capital projects identified in the proposal. Final award was based on cost; the winning bid was the lowest cost proposal. Contracts were for 20 to 30 years with additional 10-year options for a total of 40 years. Fares and provisions for increases, subsidies, and profit margins were established in the contracts. The government may amend the contracts.

The subway is concessioned to two companies while five companies operate various commuter lines. The two largest contracts for commuter rail are Metropolitan and TBA.

Fares are established in the contracts and monitored by the government. The contracts are structured with strict criteria for fare increases. As a result, profit must come from increased ridership and improved operation efficiency. Fares may only be increased for inflation adjustment and improved service. When the operating cost structure increases by over 6 percent, an adjustment is made for the concessionaire by increasing the fare or adjusting the subsidy or fee.

Private operators can choose subcontractors for services such as marketing, retail, and business development. This flexibility in establishing the terms of the subcontracts also helps the concessionaire make additional profits. The private sector does not have the right to amend the contract. If the company can do the project for less than its bid, the company makes an additional profit.

Having a long-term contract makes successful capital investment attractive to the private sector because they can reap the benefits in increased fares over the long term. Long-term contracts also allow the private sector to make management and efficiency decisions based on the long term. This flexibility along with the ability to retain profits seems to make the private sector willing to take operational risks. On the capital side, the company makes the initial capital investment and is reimbursed on an annual basis according to the terms of the contract. Thus, the private investor has only one year of capital outlay at risk at a time due to the annual reimbursement.

Sao Paulo, Brazil

São Paulo has taken a very different approach than Buenos Aires in its rail transit system development. The subway system is fairly new and very similar to modern systems in the United States such as San Francisco Bay Area Rapid Transit (BART) and Washington Metropolitan Area Transit Authority (WMATA). The government continues to operate the system and is very successful, having one of the largest farebox recovery rates in the world.

Pressure is mounting, however, to privatize the systems. Most of the bus systems in Brazil were turned over to the private sector. As an example, one new line in the Sao Paulo system is being developed entirely by the private sector as a build-operate-transfer financing model. The World Bank is a partner with a private investor who will operate the line for 25 years and then return it to government control. The attraction to privatization is the same in Brazil as it is in the United

States--the potential for a large infusion of private funds by selling state assets with the hope of improved service.

In São Paulo, the public sector operates Metro and commuter rail under the authority of the Secretary of Metropolitan Transport. The Metro system consists of three lines for a total of 27 miles. The current administration is planning a massive expansion program, doubling the size of the system with projected ridership exceeding 5 million. Sao Paulo is clearly emphasizing rail as its desired premiere transit service. The desirability of bus service is limited because buses compete with automobiles on the heavily traveled and congested roads. Rail service in São Paulo is in transition. In the past, commuter rail serviced poorer populations. Today, the state is enhancing and expanding the system in the hopes of servicing higher economic populations.

Metro costs have gone down due to downsizing and new third-party negotiations that lowered the costs of contracts and increased ridership. As a result, the farebox recovery rate has gone from 70 percent to over 100 percent.

Summary

The cities of Buenos Aires and São Paulo have the same goals for their transit systems--improve service and increase ridership. Their approaches to date are very different: one is privately serviced while the other is publicly operated. Each system, however, would be considered a success in the United States for ridership, farebox recovery rate, and mode share.

Models of Government Regulation

In all of the cities visited, bus and some rail transit operations are performed by private "concessionaires" under contract to public regulatory agencies. This section compares and contrasts the different regulatory models observed among the five cities.

Buenos Aires, Argentina

The twin underpinnings of the regulatory model in Buenos Aires are:

1. Ridership is so strong that low fares still produce profits. Thus, the possibility of even small fare increases is an effective incentive for improving performance.
2. Recent experience with public operation of commuter rail and subway service found it to be inefficient and deteriorating, which led to privatization of these services.

Transit regulation in Buenos Aires is performed by CNRT, a federal agency that has only been in existence since 1997. The functions of three formerly separate commissions responsible for bus, rail, and privatization were merged in CNRT which "monitors and controls" bus, passenger rail, and freight transport throughout the country. CNRT has a total employment of 200, with an additional 200 contract

personnel. CNRT is organized around seven "managements": customer service, safety, technical, concession management (i.e., contracting), administration, legal, and licensing.

With regard to buses, CNRT performs functions similar to the former U.S. Interstate Commerce Commission--granting operating rights, approving new routes, setting fares, and enforcing basic safety and environmental standards. Bus transit was historically privatized in Argentina, with numerous owner-operators of individual buses or small fleets. In turn, these small operators banded together into *colectivos*, establishing a pattern of consolidation that continues today.

CNRT is not nearly as involved in many aspects of bus operations as its counterpart agencies in other cities. CNRT's vision is for continued consolidation among the hundred or so remaining enterprises.

CNRT regulates bus operators in terms of safety, air pollution, and customer service. The city's 10-year bus life requirement is the principal means of improving emissions and safety. CNRT has also issued technical specifications for bus emissions that are enforced through 6-month and random vehicle inspections by field personnel.

Interestingly, the requirement to replace buses after 10 years, which is just now taking effect, will almost certainly impact some undercapitalized companies that cannot afford new vehicles. The less profitable companies will be absorbed by others, resulting in better service for users.

In terms of rail services, CNRT controls the concessionaire through a quality index that reflects the numbers of coaches operated, service reliability, and on-time performance. Favorable performance is "rewarded" by the granting of fare increases; adverse performance results in financial penalties.

With regard to the regulatory environment, a few observations are noteworthy. While the municipal government has little control over the subway operation, municipal police authorities provide the primary enforcement to prevent fare evasion. The most recent increases authorized by CNRT were opposed by the municipal administration, which is apparently now refusing to help police fare collection. Negotiations between federal and city agencies are underway. This suggests the same kind of policy disagreement between different levels of government that were observed in Sao Paulo (and that was so markedly absent in Curitiba).

For *Metrovias*, this translates into CNRT exercising more regulatory oversight of subway versus bus operations because the rail system still receives an operating subsidy. *Metrovias's* concession contract was considerably more involved on such issues as vehicle maintenance and technical specifications.

In the oversight of CNRT-sponsored capital projects, CNRT is very involved in technical details (e.g., deciding which type of ties to use in a rail renovation project). On the other hand, once projects are underway, CNRT is far less involved in financial and subcontracting issues.

In summary, the regulatory model in Buenos Aires is best described as a work in progress. CNRT is still early in its development.

Montevideo, Uruguay

Regulatory oversight of bus transit is provided by the Division of Transit and Transportation of the city of Montevideo. Under Montevideo's "magic formula," the municipality sets fares at a level sufficient to cover operating expenses, including the lease cost for new vehicles and a 6 percent profit. The municipality also pays about \$18 million per year in operating subsidies that include reimbursement for discounted "social fares" (i.e., reductions of up to 70 percent for senior citizens and low-income riders).

In recent years, private operators obtained new buses on a lease basis financed by the National Bank of Uruguay. In effect, the bank owns title to the vehicles, and operators pay a monthly mortgage. Between 1990 and 1995, over 60 percent of the bus fleet in Montevideo was replaced through this mechanism. Unfortunately, the bank financing was also a one-time deal. How bus replacement will be financed in the future is uncertain. Moreover, private operators expressed dissatisfaction that the formula apparently does not take into account their interest expense on the leases.

In contrast to Buenos Aires, where high ridership is a central element of the financing formula for transit, Montevideo has experienced a continuing decline. Total transit ridership decreased from 500 million annual passengers in 1960 to 300 million in 1997, and municipal officials estimate the decline since 1994 at about 2 percent per year. Most of the decline is attributed to unemployment and general economic conditions that have closed some local industries, although increasing automobile use is also a factor. (Interestingly, the last thing the study mission's bus passed en route to the Montevideo airport was a giant new shopping center surrounded by acres of parking lots and the sign for a fast-food drive-through!)

While the formula seems to be a serviceable arrangement for the moment, the municipal authority is seeking to implement two initiatives that represent fundamental changes in the current transit system. One is to substantially reduce competition between operators for passengers on trunk lines served by multiple bus routes. The municipality grants route permits to the various operators for 10-year periods, after which the city is theoretically free to restructure the entire system.

Clearly, the permits initially granted were for the operators' existing service. In many places, several routes operate along the same arterial streets, creating duplication of service and competition for passengers. Restructuring will not only alleviate this competition, but it will facilitate the second initiative which is to increase service in low-density areas outside the central city.

The municipality's ultimate goal is to merge what it views as five separate companies into one regional transit system with more integration of management and more coordination of service. A key element of the second initiative is to establish new bus terminals in outlying areas served by feeder lines. While the municipality pays the cost of constructing the terminals, the individual operators are required to pay for maintenance.

The emphasis on improving service to low-density areas outside the central city clearly reflects the administration's "social concept." In Montevideo, as in the other South American cities visited--and in contrast to many U.S. cities--these outlying areas are where the largest numbers of low-income people reside. Reducing redundant service in the central city and redirecting resources to increase service in outlying areas is a high priority in the current administration.

Porto Alegre, Brazil

In Porto Alegre, regulation of transit service is performed by SMT, a municipal agency, which, like its counterpart in Montevideo, was established in 1989 when the current labor party won control of the government. The system at that time was characterized by stiff competition among private operators, with a badly deteriorated vehicle fleet. Unlike Montevideo, however, 10 years of public regulation has achieved a significant transformation of the system into a world-class bus operation. The average age of buses in Porto Alegre is currently 4 years, with the oldest ones only 6 years old. All buses are subject to examination by SMT inspectors every 45 days.

Porto Alegre is a prosperous industrial city, and a major port. Transit ridership remains robust to the point that farebox revenue supports all of the private bus operations, although the municipality provides a considerable subsidy for the rail line. Bus operators are reimbursed on a per-kilometer basis.

The most remarkable aspect of transit regulation in Porto Alegre is a new automatic monitoring system, SOMA, that is now being implemented at the city's expense. When it is completed, all 1,500 buses will carry transponders that communicate with 45 signposts throughout the city. The system will eventually interface with automatic passenger counters aboard the buses.

Among all the cities visited, Porto Alegre was the only one in which the municipal regulatory agency was substantially investing in technology.

Curitiba, Brazil

Regulation of private transit operators in Curitiba is performed by the URBS. Although there are 10 private providers who operate under long-term concessions from URBS, their identities are virtually invisible, except for a small notation on the buses. URBS specifies the types of buses to be used on each route and has established a renowned color-coding system to distinguish buses used in different types of service.

All farebox revenue is turned over to URBS, and, in turn, the operators are reimbursed according to a per kilometer formula that is calculated separately for each type of vehicle. The formulas are truly comprehensive, including everything from employees' uniforms (at about \$0.003 per km), to a flat 13 percent administration allowance, to depreciation on vehicles and profit for the companies. As in other cities, operators can increase profits by achieving efficiency improvements. Profits are about 8 percent to 10

percent per year. The same operators have been in business so long that they hold titles to all their own facilities. Thus, it is difficult for any new enterprise to enter into competition with the existing providers.

Interestingly, although the reimbursement formula includes an amount for depreciation, some operators have apparently found it more remunerative to pocket the depreciation and finance new vehicles on a lease basis.

São Paulo, Brazil

São Paulo has two separate mechanisms for regulating transit. One is the state of São Paulo whose Metropolitan Transport is responsible for four departments: EMTU, CPTM, Metro, and EMPLASA. The state-regulated operations carry about 56 percent of total metropolitan-area ridership.

The other is the city of São Paulo whose SPTrans oversees 60 private companies operating 11,000 buses within the city proper. The city-regulated operations carry about 44 percent of total ridership.

There is currently significant conflict between the two agencies. The main cause of the division between state and city is political. Simply put, the two principal rival political parties in São Paulo each control one level of government. In this politically charged atmosphere, a lack of cooperation and coordination between the two enormous mass transportation networks has unfortunately resulted.

Three broad initiatives are being undertaken by the state for its portion of the regional system: (1) a very clear emphasis on rail, (2) massively restructuring the bus service regulated by EMTU, and (3) substituting public opinion polls for governmental inspection as the basis of incentives and penalties for performance. This last initiative would result in a major reduction in "governmental interference" in day-to-day bus operations. Concessionaires would be required to pay for independent surveys of public opinion on such attributes as on-time performance and the cleanliness of buses.

SPTrans uses Total Quality Management (TQM) techniques to measure customer satisfaction. Concession contracts with the 60 companies signed in 1994 specifically require participation in the quality management program, PQTU, with results to be measured using the Malcolm Baldrige Award criteria. The first round of PQTU evaluations was performed in November 1995, and subsequent rounds are performed annually. There has been a marked increase in quality measured from each round to the next.

Busway Planning, Design, and Operation

A low-cost transit solution that was evident on this mission was the use of busways. A busway is an exclusive right-of-way used by buses. Busways can dramatically improve transit service and operations by increasing the speed of transit vehicles, reducing travel time for transit riders, and increasing the reliability of the system. Busways are considerably less expensive than comparable rail options, and provide greater flexibility since the same vehicle can generally travel on either the busway or a normal travel lane.

This section examines the planning, design, and operation of the busways in Porto Alegre, Curitiba, and São Paulo.

Porto Alegre, Brazil

There has been little effort to tie busway and station development to the city's land-use patterns. While the city allows greater density of development in exchange for donations of land for transit purposes, there was no formal or concerted effort to create higher density development along the busways.

Six exclusive radial bus lane medians converge on the city. These bus medians are used by urban and regional buses. The buses are held at huge *paraderos* or terminals with a capacity of up to 70 buses. During weekday rush hours, bus flow is at a rate of 350 per hour at an average speed of 15 miles per hour; passenger flows reach up to 20,000 passengers per hour in each direction.

The typical median busway has a width of 29.5 feet; each bus lane is 11.5 feet wide. In the areas between stops, there is a 3.25- to 6.5-foot concrete median between the two bus lanes. Bus lanes are separated from other traffic by a painted solid line with pavement "buttons." Passenger stops are located along the busway and are staggered--a stop in one direction followed immediately by a stop in the other direction. At the stops, the bus lanes shift to one side of the 9 meter busway width. The bus lanes narrow so that a passenger platform of about 9.75 feet in width can be constructed at the stop. This system of staggered stops and a median between the stops allows the busway width to remain a constant 29.5 feet along its entire length.

The busway system is designed so that buses operating in the neighborhoods continue onto the busways into the city center. This has reduced the need for transfers by customers, but has resulted in excess capacity along the busway corridors. Fifty percent of buses go to the city center, while only 30 percent of riders have destinations in the central area. As a result, the city is now planning to convert to a "feeder/trunk" system, with separate neighborhood buses and corridor buses. This way, bus capacity and frequency can be more closely matched with demand. This will require the construction of transfer stations where neighborhood buses meet corridor buses.

Interestingly, buses are sent through in platoons during peak travel times. This allows buses to pull into the bus stops in an order that corresponds to the boarding positions at the bus stops. This results in faster boarding and eliminates the need for buses to overtake each other to reach the proper boarding area. This "bus platooning" system evolved from the Comonor convoy system, which involves not only bus ordering but also grouping of buses into convoys at the start of a busway.

Curitiba, Brazil

The Curitiba public transportation is currently an all-bus system that includes neighborhood service, interdistrict

(cross-town) operations, direct (limited-stop) service between downtown and major transfer points, and busways. Buses operating each of the different types of service are color-coded. Despite the fact that there is one car for every two residents (a high rate for Brazil), annual bus ridership is approximately 325 million, and 75 percent of worktrips are taken by bus. The heaviest busway corridor carries 27,000 passengers in each direction during a peak hour, a figure that exceeds most light-rail corridors and approaches many subway lines.

The Curitiba fare system is fully integrated, so that one fare can be used for multiple bus boardings on any type of bus route, as long as transfers occur at a bus terminal. The buses operating on the busways and in direct service require prepayment of fares. Fares are collected by a station conductor at either an access-controlled bus terminal or at a "tube" boarding stop. The terminals are located at the ends of the busways and about every 1.25 miles along the busways. Passengers pay a fare to enter the terminal on foot or they enter by bus, in which case, they have already paid the fare. Within the terminal, all bus boarding is unrestricted. With neighborhood and interdistrict buses, an on-board conductor collects the fare when passengers get on.

Tube stops are designed as large glass cylinders with an entrance at one end and an exit at the other (Figures 11a & b). Riders pay when entering the tube. Buses pull alongside the tube and extend "flaps" from the door to the tube platform, providing level access between the bus and the passenger platform. Wheelchair access is provided via a lift at the tube entrance.

Prepayment of fares and level boarding, systems typically found in rail systems, create a very efficient boarding and debording process. A bi-articulated bus (a 5 door, 82-foot bus built by Volvo and currently used only in Curitiba) with a load of 270 people can board or deboard in about 20 seconds. The average speed of buses using the busway is 13 miles per hour--twice the estimated speed for operating in the same corridors in mixed traffic.

There are five busways, each between 5 and 7.5 miles long, radiating from the city center. The most recent busway was completed in 1994 at a cost of \$1.5 million per kilometer. There are plans to add circumferential busways to link key suburban areas.

Busways operate in the median of a street. They are flanked by one-lane roads on either side that handle local traffic and have on-street parking. The main flow of automobile traffic was shifted to parallel streets one block to either side of the busway. This system has removed highspeed traffic from the lanes adjacent to the busway and allows for easier and safer pedestrian access to tube stations along the busway. The tube stations are located approximately every 547 yards.

A typical busway is designed with two travel lanes for buses of 11.5 feet each, flanked on each side by a curbed area that ranges in width from 1 to 2 meters. On-street parking is immediately next to the raised curb. Adjacent to bus stops, parking is eliminated and that extra width is used to accommodate the tube stations.



Figure 11a. Curitiba tube station---at level boarding platform.



Figure 11b. Curitiba tube station--fare collection before entering.

The busway uses a signal priority system. However, because the frequency of buses operating on the busway can reach one bus per minute during peak hours in the peak direction, there is a limit on the amount of priority that can be given to the bus without creating unacceptable delays for cross traffic. As a result, buses operating on the busways were observed stopping at several of the signalized cross streets.

The city is nearing the capacity limits of a busway. The peak-hour frequency of buses and the size of buses cannot be increased within the constraints of a busway operating at grade and intersecting city streets. The next step in the continuing evolution and improvement of the transit system is to create a grade-separated transitway (probably rail) in place of the busiest busways. Plans are to have the first gradeseparated corridor in place in about 6 or 8 years.

Sao Paulo, Brazil

Busways are used extensively in the Sao Paulo region. There are 16 busway corridors in operation, with a total of 113.5 busway miles. Additional busways are under construction. Most of the busways are located in cities and regions on the outskirts of Sao Paulo. Very heavy public transportation demand in the heart of the city dictates the need for grade-separated systems, rather than busways, to meet capacity requirements. This high demand is evident from the São Paulo subway's second-place world ranking in passengers per kilometer.

The São Paulo busways are typically built in the median and designed to be a minimum of 36 feet wide, with two 11.5-foot travel lanes in the center. Raised curbs with a width of 6.5 feet are set between the bus lanes and traffic on either side. The width at bus stops increases to accommodate the boarding area. The width of the passenger boarding platform at terminals is 30 feet. Some of the busways are electrified, and there are plans to convert more of the busways to electric trolley operation.

The busways have been deemed very successful, as evidenced by high ridership and public opinion polls. The EMTU, which is planning to construct an additional 209 miles of busways, estimates that busways have a capacity of 15,000 passengers per hour per direction, have double the operating speeds (to about 11 miles per hour) of mixed-traffic operation, and reduce operating costs by about 22 percent. The productivity of buses using the busways (in rides per hour of service) is six times higher than for the regular bus system.

The public has reacted very positively to the busway system. Using a public opinion scale of +100 to -100, riders surveyed have rated busway service at +90, while rating the regular bus service +3. By comparison, using the same rider opinion scale, Metro, the modern subway, has a rating in the high 80s, while the old commuter rail line is rated -15.

The busways do not have traffic signal priority when crossing streets at signalized intersections. In addition, there are sections of the corridor where the busway stops and the bus must travel in mixed traffic. These occur primarily in commercial centers.

Many of the bus terminals served by the busways are

access controlled, enabling riders to transfer between buses easily and without paying an additional fare. The terminals primarily provide connections between the suburban lines and buses and rail that connect with the Sao Paulo city center.

High Fare Recovery Ratio

This section provides insight into how Latin American transit systems achieve high fare recovery ratios.

System Perspective

The density of the cities, availability and frequency of service, operational standards, existence of capital infrastructure, and integration of retail and public service facilities to transit centers all play a key factor in system success.

Density. Densities of the cities make movement within the areas a monumental task (Figure 12). Traffic congestion and air pollution are on the rise. The cities are not designed to accommodate a large number of vehicles. Driving becomes inconvenient and people, by choice, do not want to drive their automobiles. Also, many people cannot afford a car.

Availability and Frequency of Service. Transit service connects people to work, shops, and home. Service is easily accessible and very frequent. In Curitiba, a bus comes every 20 seconds during peak time; in Sao Paulo a train arrives every 90 seconds. To ride transit is not an inconvenience but rather a better alternative to driving.

Operating Standards. The transit systems operate under different regulatory requirements. There are few mandated requirements. There are few safety standards and no regulations addressing air quality and service to the disabled. In addition, the transit systems visited had low labor rates, few financial reporting requirements, no workers' compensation, and no risk management.

Capital Infrastructure. Major capital infrastructures (railway system, subways, busways) are in place. However, the capital resources are not in place for future expansions. Capital equipment, such as buses and trains, is aging. Modernization efforts are ongoing. Many buses and trains do not have air conditioning. In Argentina, the Metrovias subway cars still have manual doors. Maintenance facilities are old and generally have very low technology.

Integration. Public service facilities and other retail establishments are focused around transit facilities. This provides an added convenience to taking transit. In Curitiba, public service centers are located at transit centers. Citizens can pay their utility bills, mail letters, and purchase postage.

Socioeconomic Perspective

The combination of personal income, cost of living,



Figure 12. Tall buildings as far as the eye can see show the density of Sao Paulo.

social standards, and low fares make public transit a popular mode of transportation.

Personal Income. The average salary (by U.S. standards) is low. The average income for a South American worker is approximately \$500 to \$1,000 per month. A bus operator earns \$630 in Curitiba.

Cost of Living. While rent, food, and other basic commodities did not appear any less expensive than in the United States, for the average South American they are expensive. In recent years, South America has experienced runaway inflation and the cost of living is very high in the cities. More people are moving away from the city core and must commute into the cities for employment. Very few people own their own cars. However, car ownership is growing. Of the cities visited, Curitiba has the highest number of automobiles per person--1 car for every 2.4 persons. Cars are expensive to buy and to operate. Moreover, ample parking is not available.

Social Customs. Crowded buses and subways are the norm. In Curitiba, the service loading is 6 passengers per square meter and a 0.5-kilometer walk to a bus stop. In Sao Paulo, the Red Line service loading is 7.8 standing passengers per square meter. Most buses and trains do not have air conditioning. This lack of passenger amenities is not a deterrent to using transit for South Americans because the lifestyle is oriented toward walking and public transit. There are many pedestrian malls, outdoor cafes, and retail stores around transit facilities. Produce vendors, newspaper stands, food service, and public service offices are common around transit facilities. Typically, 33 percent of the individuals walk to their destinations.

Fares. Fares are controlled by the government. Average bus fare is \$0.70. Commuter rail fare is approximately \$1.00. Fares did not seem to be interchangeable between modes of transportation. They are interchangeable within a system. In Brazil, as a result of the most recent experience with runaway inflation, the government made a decision to set the price of fares. A program was developed between the employer and employee where the cost of public transportation would not exceed 6 percent of the employee's salary and the employer would pay the difference in cost. The government would provide a tax incentive. Fifty percent of the riders use this method.

Summary

The combination of densities, lower wages, lessmandated requirements, system standards, established infrastructure, and social acceptance allow the cities of South America to have a high fare recovery ratio. Low-cost technology and huge ridership have proven successful for this region.

Government Enforcement of Bus Maintenance

This section compares how the governments of the cities visited require the private concessionaires to provide an adequate, preventive, and corrective bus fleet maintenance program.

Buenos Aires, Argentina

The CNRT concentrates its efforts on controlling and regulating the activities of the private concessionaires. Regulations have been developed to optimize the private concessionaires' operations. Generally, private concessionaires report chassis and body specifications of their operating fleet to the CNRT for approval. Structural tests of body and chassis materials designated for the construction of transit buses are performed by the state or third parties.

The CNRT must certify the velocity control equipment and front and rear door mechanisms for security purposes. Routine inspections are performed on transit buses for emissions, noise, comfort aspects, cleanliness, licenses, and mechanical components.

At the Transport Plaza maintenance facilities, no documentation was provided on preventive maintenance procedures for its fleet. Enforcement of regulations by CNRT is not as comprehensive as that in the United States. The maintenance shop was not well organized nor was it particularly clean. The buses were not as clean as expected, especially the engine and transmission.

Montevideo, Uruguay

The municipal administration of Montevideo serves as a facilitator of the transit industry. Its major concerns are the coordination and control of public transportation and implementation of renovation programs of the bus fleet as well.

To ensure better bus fleet conditions, the government has instituted several regulations:

1. Since 1990, the state has obligated private companies to contract with external auditors to certify maintenance information, including preventive maintenance procedures.
2. Private companies must present a bus fleet renovation plan that is acceptable to the local oversight authority. (As a result of this regulation, at least two companies went out of business.)
3. Private companies must provide certification on emissions, cleanliness, and security of the bus fleet.

A few factors indicate why government regulations are not as strong in Montevideo and Buenos Aires, as they are in the United States.

- Bus transit services in both cities have been redesigned in all aspects since 1990 when privatization began. Both systems are relatively new and need time to develop.
- Since both cities have basically new systems, their priority is to improve the service (e.g., increase trip frequencies, develop reliable schedules, construct new

terminals, acquire new buses). When the conditions improve, there will likely be more attention given to the redesign of maintenance procedures and construction of new maintenance shops.

- Most of the companies visited in these two cities are in the process of reorganization.

Sao Paulo, Brazil

Of the three cities visited in Brazil, Sao Paulo provided the best information on regulations concerning preventive maintenance. All private companies that operate bus lines in the city must convert or acquire their buses with natural gas propulsion in 10 years. In addition, the private companies must submit fleet maintenance reports at any time to the Sao Paulo government. Maintenance procedure inspections are performed at the concessionaire facilities. The operator is notified by the government official no more than 15 days prior to the inspection. Vehicles that do not pass the inspection are not permitted to operate until the problem is resolved. If a bus is put in service that has not passed inspection, the government will retain the vehicle and fine the company. The permit to operate can be dissolved.

The government has established a system in which the different components of the bus are classified in groups. The groups are inspected and measured by points from 0 to 100. The groups are: brakes, suspension system, tires, power train, chassis, body, luminaires, interior of the vehicle, electrical system, security equipment, maintenance shop conditions, and internal maintenance procedures.

The government coordinates visits to a property with an inspection team. The team is required to perform a 1-hour inspection on each bus, on 160 buses per day. Private companies provide inspectors with all materials, documentation, and personnel needed to perform the inspections.

The maintenance shops observed at EMTU and JABAQUARA (a private company) were organized, secure, and clean. Their written maintenance procedures and quality control procedures were excellent (Figure 13).

A strong regulation enforcement was noted on properties visited in Sao Paulo.

Customer Service and Users' Opinions

In each of the cities visited, there is extremely high transit ridership per capita. There are several reasons for this: the high cost of fuel (equivalent to more than US\$3 per gallon); high car registration fees (\$125 every 2 months in Buenos Aires); low per capita wages; extremely high population densities; and heavy congestion on major highways and main streets.

Although automobile ownership is on the increase, public transportation is still the mode of choice in these cities. The high market share and huge amount of service provided in the South American approach to customer service makes it

different from that in the United States or those observed by previous study missions to Europe and Asia. This section outlines the customer service features and delivery systems observed in each of the five cities visited in South America.

Buenos Aires, Argentina

In the 1980s, the public and transit customers, in particular, perceived the quality of government services to have deteriorated. There was general alarm that the costs of providing services were too high and out of control. In addition, there were no ideas as to how to pay for increasing or improving services. In the 1990s, the city experienced public demand for more and improved services while in an economic environment where government could not afford it. This led to a radical shift in the balance of power between the government, concessionaires, and the public.

In the early 1990s, government privatized a whole host of services. Bus services had already been privatized in 1965. By 1996, privatization of rail occurred. The hope was that getting government out of service delivery would result in better service at less cost to taxpayers and consumers.

Polls indicate that 70 percent of the public approve of the changes in the bus system. The new fleets are more comfortable and reliable. Ninety percent of the public reports that bus service quality is better and they approve of the changes.

Private concessioners are motivated to improve because public approval has a bearing on whether they can successfully negotiate rights to new corridors, corridor extensions, or new types of services such as executive minibus service. Operators of the new minibus services can charge a higher fare than the rates set by government for other services. This minibus service is seen as a growth market. It is popular with suburban residents because it is very personalized. Riders who use the service are guaranteed a seat, and the express buses run to the city center. The comfort level is good, with no overcrowding, and the trip is fast because there are no stops in the developed ring around the city center.

On-street information is sporadic and inconsistent. Bus stops, which are located a few hundred feet apart, sometimes include a traditional bus stop sign, showing route numbers and names of buses stopping there. Other stops only show a bus stop sign, while others are marked with a sticker wrapped around a pole. There appears to be little coordination with the municipalities who are responsible for placement and maintenance of shelters. No customer information displays, such as schedules, maps, or public telephones, were found at bus stops. Public schedules, maps, and visitor's guides were not apparently available. Some of these options are being considered by company and government officials. Bus operators and collectives rely on their ability to provide high frequencies and a wide range of services to ensure customer satisfaction. Observations confirm that customers approach



Figure 13. Maintenance shops in Sao Paulo were organized, secure, and clean.

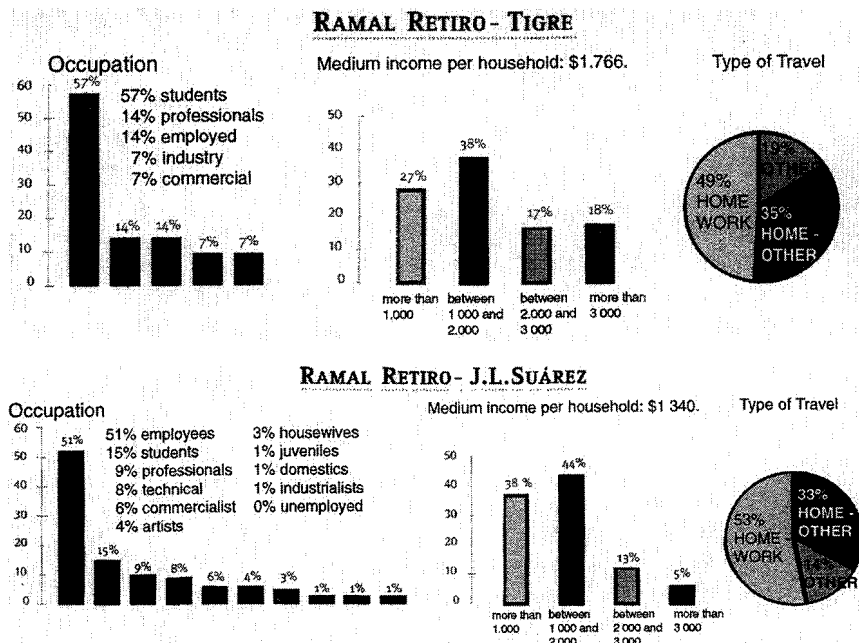


Figure 14. Results from socioeconomic surveys of Tigre and Suarez lines.

stops and seldom wait more than 1 to 2 minutes for a bus to arrive. In Buenos Aires, frequency and information appear to be the best forms of customer service.

The new umbrella rail corporation, TBA, attributes its success to its focus on the passenger. The company's improvements to rail elements have had overwhelming public support and the public has reacted very positively to new low floor buses that were recently added to the fleets.

TBA conducts detailed socioeconomic ridership profiles by line. Figure 14 presents the survey results of two lines. White-collar workers are the predominant users of the Tigre and Victoria lines. Users of the Mitre and Suarez lines are more mixed in terms of occupations and incomes. The Sorrento Line is generally made up of middle-class to lowermiddle-class riders. TBA is trying to use this information to guide investment decisions.

TBA routinely conducts surveys to gauge consumer approval. The company had 10 years to reach the quality of service standard required in its concessioner contract, but did so in the fourth year. TBA's market research shows customers will tolerate up to a doubling of fares if service improves simultaneously.

The city's subway had been allowed to deteriorate over the past 25 years and needed a large infusion of capital investment. Metrovias, the concessionaire for the subway, was awarded a 40-year contract. Its immediate focus was on maintenance and improving on-time performance. Improvements are obvious, from the restoration of the historic tile murals on walls at existing stations to the addition of new stations and more service. Two new stations opened in 1997, and capacity was added when cars were bought from Japan allowing frequency of service to go from every 5 to every 3 minutes. Riders are registering their approval by returning to the system. As a result of better conditions and service, ridership has increased by 53 percent in 4 years.

When passengers on Metrovias's Urquiza Line complained about lack of security, the concessionaire responded to this issue. Improvements in passenger security not only restored the users' confidence, but also reduced fare evasion which had been a major problem on this line. Currently, the biggest passenger complaint concerns a lack of air conditioning. Metrovias is responding by changing the ventilation system in the cars.

Metropolitano, another concessionaire, runs three commuter rail lines and has 45 percent of the market share. The rail system was near collapse at the time Metropolitano took over. Major strides have been made in the last several years, but there are still many improvements to make. Improvements have started on the 120 stations and locomotives have been purchased. Concentrated efforts in defensive maintenance are paying off. On-time performance was 84 percent whereas it is now at 97.4 percent. The quality index in Metropolitano's contract called for a 1.15 percent improvement by the tenth year, but it achieved 1.24 percent as of January 1998.

One of the biggest challenges facing both TBA and Metropolitano is the reintroduction of feeder bus service to the rail stations. Buses used to feed the railways, but when rail

service quality declined, the bus operators obtained government authorization to run parallel to the rail lines. This arrangement continues today with bus routes and rail lines competing against each other. Now that ridership is shifting back to rail, however, the buses are suffering declines in ridership and consequently, they have an incentive to coordinate.

Transportes Plaza, an operator of six bus lines, wants a reorganization and is encouraging the governmental regulatory body to do so. Concessions for the new executive minibuses routes have been granted, but little progress has been made toward bus route restructuring. It will take public pressure to speed up the change because there is great and growing consumer demand for feeder bus routes to the rail stations.

Although there are signs of stations being improved on the rail lines, in many cases there is no room for good bus interface or park-and-ride elements (Figure 15). Most of the rail lines are dependent on walk-up customers.

TBA has recently completed the new San Isidro Station for rail/bus interface with a park-and-ride element on the Metro. Riders are noticeably fond of this beautiful new facility.

Montevideo, Uruguay

The customer focus in Montevideo is on stabilizing ridership and implementing capital and service improvements that will reclaim lost ridership. Along with reorganized service, a number of customer amenities have been added in an effort to win back transit customers. Approximately 80 percent of the 4,500 bus stops in the city have been marked with new, consistent signage. New signs clearly mark bus stop areas and serve as a symbol of the reorganized transit system (Figure 16). Nearly 20 new bus terminals have been constructed at key points throughout the system. Although modest by North American standards, these functional facilities provide customers with convenient places to wait for buses and to transfer between lines operated by different cooperatives. All facilities have covered places to wait for buses, restrooms, telephones, and small retail establishments where customers can make quick purchases. The cooperatives that operate services are responsible for terminal operation and maintenance. Cooperatives decide which buses use the terminal, where customers will board, and how the concessions are operated. According to public opinion polls conducted by the city, customers are pleased with the new terminals, especially the convenient transfer opportunities. The city is also investing in new curb-side bus lane construction in downtown Montevideo (Figure 17a & b).

Since 1990, approximately 60 percent of the bus fleet has been replaced. At the present time, the fleet average age is 4 years. The renewed bus fleet, installation of new bus stop signs, and the construction of centrally located bus terminals are the first steps in the government's effort to win back customer confidence and provide a level of service necessary to attract new customers.

The city and the cooperatives have begun to introduce



Figure 15. Major investments in tracks and stations are underway in Buenos Aires but many of the stations have no room to accommodate feeder bus service or park-and-ride lots.



Figure 16 A typical downtown bus stop in Montevideo clearly marked with new signs.



Figure 17a. Buslane construction in Montevideo is funded by the city for use by private bus operators.



Figure 17b. Bus congestion during rush hour on Montevideo streets.

a new diversified route structure which better matches supply to demand. Prominent among these offerings is the extension of bus routes into lower income suburbs on the outskirts of the city; rerouting of service to better serve major shopping centers located outside the central city; establishment of express service from middle-income suburbs; and the elimination of duplicative routes operated by different cooperatives on major arterials.

The city is currently working on Montevideo's first transit route guide. Officials hope to have this completed within a year. The city is also working to develop public schedules and route maps which can be distributed to customers and posted at major bus stops. A large database is being created containing service, ridership, and performance data. The database will also include information about customers which will be used to communicate with them and to promote improved services. The city has begun imagebased marketing using flyers and brochures to promote the city, special events, and the transit service, which can be used to travel throughout Montevideo.

Porto Alegre, Brazil

The public generally supports mass transit, but because of rapid growth, Porto Alegre needs to reallocate its bus resources to achieve better coverage. Almost 50 percent of the buses going to the city core can be redistributed, and 34 percent systemwide can be redistributed to other existing or new routes.

Trip patterns are getting longer. For this reason the city is focusing on creating the fastest long-distance travel possible. The city's transportation planners realize that the current radial system of busways is not adequate, and it will become less relevant to travelers as travel patterns become more disperse. Plans call for additional busways and the incorporation of a stronger grid network of routes with an overlay of intercept stations for people to transfer from bus to bus.

Recognizing that 20 percent of riders currently transfer between buses in making a trip, it is important to make the transfers as smooth as possible. Customer input has been very positive to the ideas in the expansion plans. Customers expect there to be greater flexibility with the grid overlay. Figure 18 shows the strategy for evolving the transit service in a way that meets the changing needs of the population.

Customer requests for minibuses led to a rapidly expanding new service. Minibuses guarantee customers a seat and provide more amenities (e.g., air conditioning) than what is found on conventional service. Many customers are willing to pay more to receive these amenities. Eighty minibuses are in the public transit coordinated system and there are another 330 minibuses outside the coordinated regulated system.

Responding to customer inquiries and surveys is a high priority for officials in Porto Alegre. The existing system is well designed and effective. However, it needs to be modified and expanded to keep pace with surging automobile ownership and accompanying congestion. STM is promoting many of these new customer service features to the general

public to draw more people away from the automobile usage.

The customer focus in Porto Alegre is on service improvements and the development of information to make the system easier to understand and to use. STM is installing an automated monitoring system to provide real-time schedule information for customers. The system collects information from buses, processes it, and makes it available to customers. The system has 32 monitoring points throughout the network. The monitors collect information from buses as they pass through collection points, transmitting information to a central computer every 3 minutes. Once data is processed, schedule information is branched to an automated telephone system where customers can access it. The information is also branched to STM control centers for a variety of other uses. There is no radio system on buses. This monitoring system is used in place of a traditional radio system.

STM is installing automatic passenger counters on buses and will integrate them with the monitoring system to provide better network information for customers. The agency has developed good system maps and static information displays which are posted along the busways. On-street information is clean, basic, and useful. STM is banking on the automated system being a substitute for maps and advanced street information and plans to use the system in image advertising to attract customers to the bus system.

Curitiba, Brazil

In Curitiba, urban social services, housing, land use, transit, and roadway beltways are planned together to achieve a unified strategy for creating a liveable city with a high quality of life. Although it is a fast-growth city, the development path has led to less pollution, slightly lower crime rates, and higher educational levels among its citizens than elsewhere in Latin America. One of the strategies that has led to Curitiba's success is the priority placed on the pedestrian environment and public transport.

Customer input is encouraged and surveys are done almost constantly, especially along busways and in the boarding tubes. URBS continually conducts surveys and takes complaint investigation seriously. The agency has a feel about public approval and a good grasp of public desires, opinions, and support levels.

Customers display pride in the system, its uniqueness, quality, and level of service. The community also reflects this pride with tourist shops selling models of buses and bus stop tubes, Curitiba T-shirts, and film for cameras.

The creation of people-friendly places (Figure 19) offers transit users convenient, comfortable, and generally secure facilities. Trees line the streets and pedestrian amenities are along sidewalks and plazas. URBS has established an easy mechanism for customer input at municipal government centers, and "citizen streets," which are located throughout the city. These mini-city halls are located on busways with turnstile controls so customers do not leave the system, which would require an additional fare. In addition to commenting about public transit at the citizen street, a customer can renew

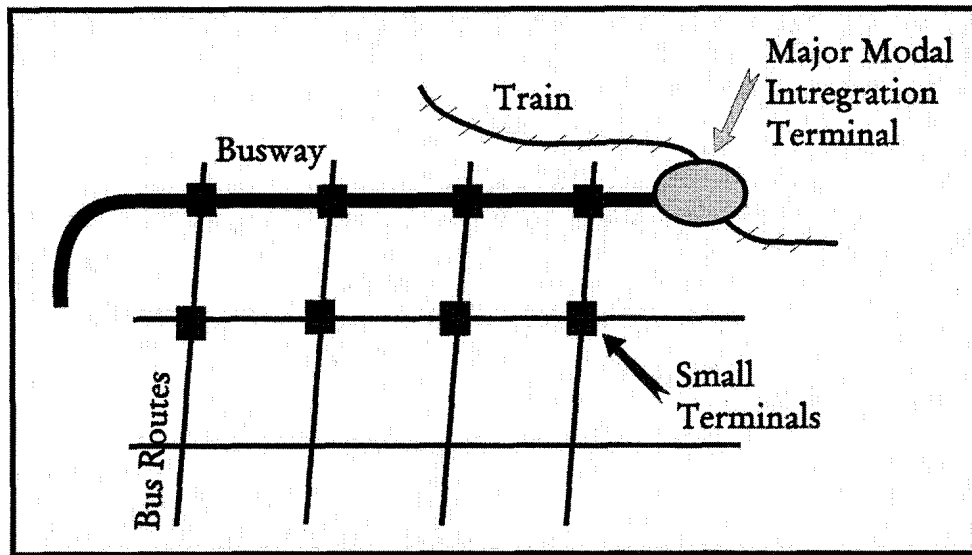


Figure 18. A grid system with regularly spaced terminals for passengers to transfer easily will allow Porto Alegre to add to the existing network of radial busways.



Figure 19. Curitiba has a large urban park and plaza downtown. The area is organized as a bus hub; the park is ringed with shelters and bus loading is on surrounding streets next to the plaza.

a driver's license, pay taxes, or talk to government officials. Citizen streets also include recreation centers and services for children. The intent is to bring the consumer closer to government and the services it provides.

Busway tubes create a subway-like boarding environment and provide weather protection, wheelchair lifts at stops rather than on buses, fare collection curbside, security, and information (Figure 20).

Bus design and the color-coding schemes also reflect the needs of customers (Figure 21). "Speedy buses" which provide limited-stop service between downtown and suburban areas have doors on the driver's side of the vehicle to allow operation on one-way streets. Red, biarticulated buses which are used for express service on the busways, have five doors to speed boarding at tube stations. The system is accessible to people with disabilities. All tube stations are equipped with a lift or ramp for wheelchairs. Once in the tube, a person who uses a wheelchair can move themselves onto the bus and into a designated space.

Bus stop signs and overhead destination signs were the best of those observed in any of the cities visited. It is obvious that customer information is given priority. System maps were placed at all terminals, boarding tubes, and at major bus stops and shelter locations. At terminals, the appropriate place to board specific buses was clearly marked with an effective strip display. All tubes had trash receptacles and public telephones. Terminals had the same along with restrooms, information booths, and light-retail outlets.

São Paulo, Brazil

São Paulo is an amazing industrial center and public transportation is absolutely essential for it to function. Over 20 million transit passenger trips are made daily on transit. This is about 50 percent of all trips taken.

Many of the riders are very poor. When an employee's transportation costs exceeds 6 percent of his or her wages, the employer is obligated to subsidize the travel. About 50 percent of transit riders fit this situation. Ten percent of the population is unemployed and, therefore, without a transportation subsidy their mobility suffers. This situation is resulting in significant increases in the number of pedestrians.

Sao Paulo will undergo a reorganization of bus routes and procurement for operators. Concessionaires will be required to use buses that meet clean energy standards and will be evaluated based on public opinion established from surveys. Sao Paulo will take advantage of customer receptivity to surveys as part of future concession awards to contractors for bus operations. Concessions will require contractors to achieve minimum satisfaction ratings on public opinion polls. Contractors with low public opinion polls may have penalties levied against them or risk termination of their service contracts.

Customer polling, which will be coordinated by university research teams, will measure contractor performance in a number of areas such as timeliness, cleanliness, load factors, and employee courtesy. Most important, the rating will be done by customers, not field

checkers or system supervisors. Contractors will be allowed to add, delete, or modify service offerings as long as it meets with public approval via the polling mechanism. In addition to giving customers more say about service, the state believes innovation will save money, reduce the requirement for street inspections, and increase contractor responsiveness. The opinion poll system is expected to better match demand with supply, and account for specific neighborhood and demographic differences throughout the metropolitan area. By allowing the marketplace to evaluate quality, the state hopes to improve customer service and the delivery of surface transit in Sao Paulo.

The city has spent much time, money, and energy on capital-intensive modes, such as rail. One exception is commuter rail service which is in serious need of investment. Eighty percent of the commuter trains are out of service due to age and bad condition. Though there are 600,000 daily riders on the commuter trains, there is a high level of dissatisfaction with the service. On-time performance, reliability, and comfort are problems. Sao Paulo has one of the world's largest bus systems. Over 48 private companies, operating a total of 11,100 buses on more than 800 routes, transport 2 billion bus and trolley riders annually. Within the next 2 years, state-issued smart cards will be available. The cards will be used as a social security card, bank card, and credit card. Officials hope to fully integrate transit fare payment options onto the card shortly after implementation.

Congestion in Sao Paulo is intense. Buses, which are mixed in traffic, have been experiencing losses in ridership partly due to bus trips taking too long because of congestion. Another serious problem is duplication of service: often there are multiple bus companies operating in the same corridor while other corridors are not serviced (Figure 21).

Minibus services are very popular, especially with suburban riders. Unregulated bus and minibus operators are springing up in response to consumer demand. Often these operators have direct contracts with employers to pick up and transport workers.

There has been very little coordination of bus services and no overall strategy in Sao Paulo. The regulated operators fight over rights not only for new regular bus routes but also new trunk, feeder, and minibus/van routes and service areas.

There are 18 trolley bus routes in the city which are fully integrated in the bus network. There are 500 trolley buses on the fleet operating in the city. There is also trolley bus service in the suburban areas consisting of 46 vehicles. Sao Paulo Transport is working with the manufacturer Marco Polo to design and manufacture state-of-the-art trolley buses.

There is a strong history of public opinion surveys being used in Sao Paulo for the purpose of providing input for public policy development. Figure 22 presents survey ratings of Sao Paulo Transit and EMTU. Approval ratings are higher for EMTU which typically delivers services with newer equipment.

CMSP has a very high approval rating. It is the mode of choice and its attractiveness is growing. The system recovers 106 percent of costs from farebox revenues. There are almost 600 cars in the system. It is clean, efficient, and on time. (It is

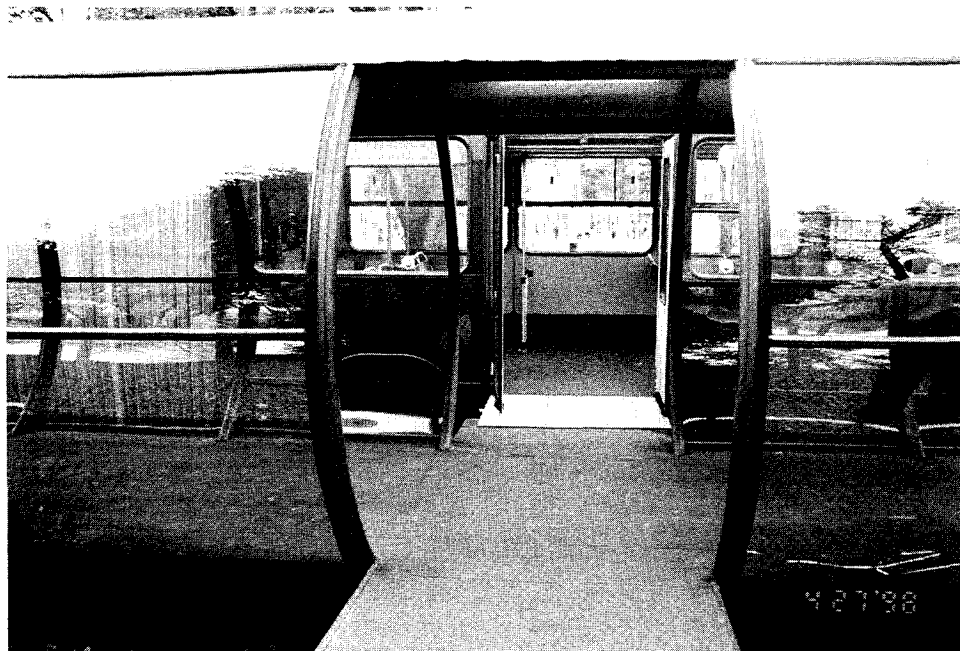


Figure 20. Curitiba's 220 tube stations allow for at-floor, prepaid boarding.



Figure 21. In Sao Paulo, it is not uncommon to see many buses moving down the street abreast of one another. Buses are often operated by different companies offering duplicative service.

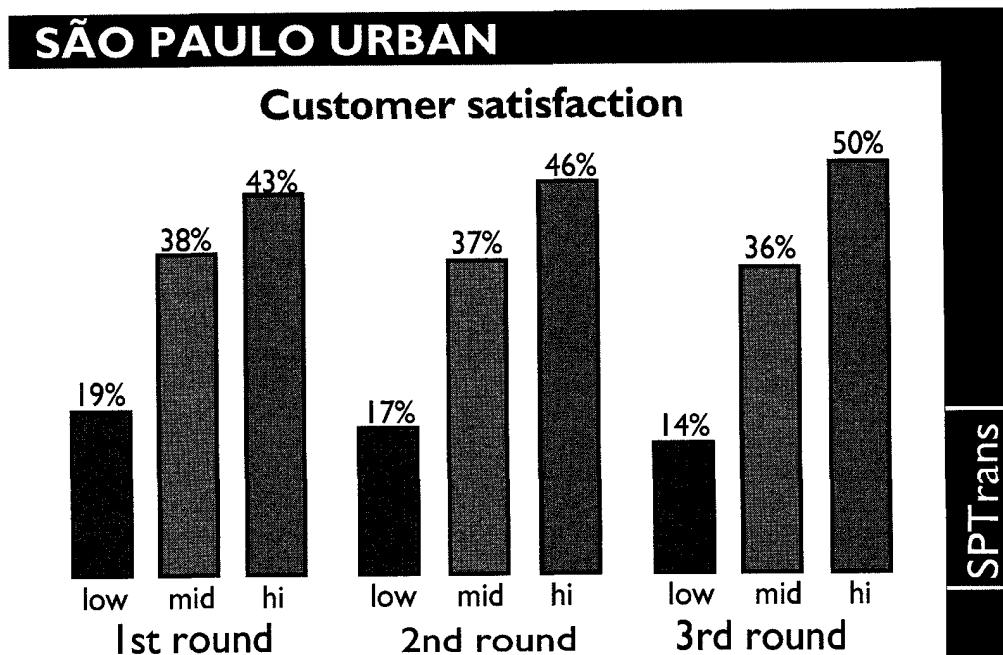


Figure 22. São Paulo and EMTU survey results.

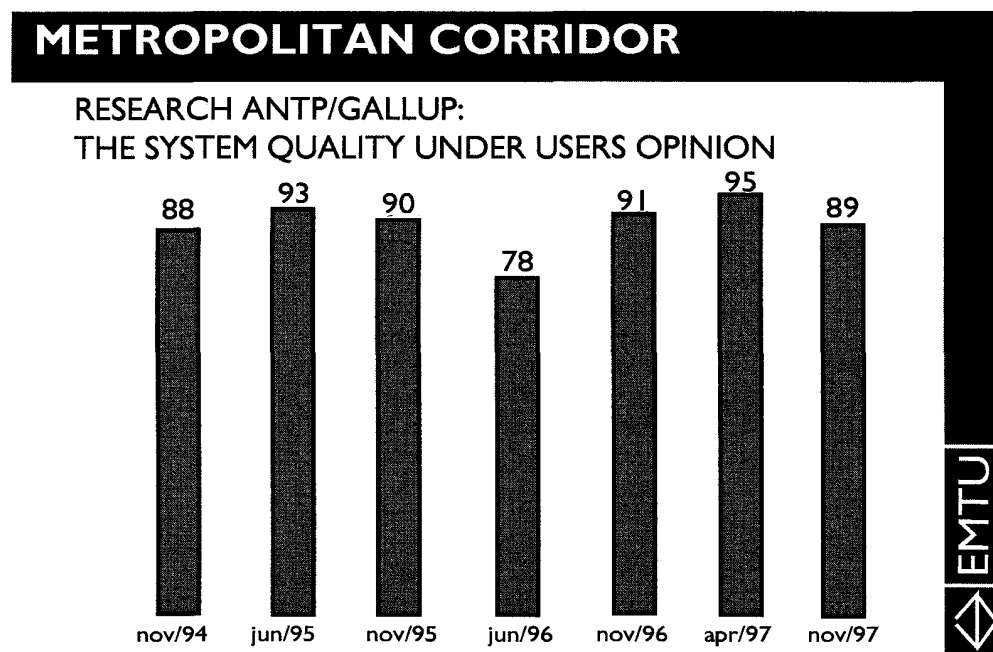


Figure 23. Results of Gallup and Metro polls.

an astonishing sight to see CMSP employees scrubbing floors and walls of subway stations during rush-hour periods when load factors reach seven people per square meter.)

Surveys conducted by CMSP evaluate its service quality and company image in terms of comfort, speed, reliability, security, and other factors. CMSP is most interested in learning whether service rendered is in accordance with users' wants. Survey results are used by management to identify areas to improve. Figure 23 shows the results of Gallup polls, followed by a chart summarizing user opinions from CMSP polls on the red, blue, and green rail lines. The survey results show that the public wants security, ride comfort, efficiency of ticketing, station comfort, and reduced headways between trains.

Commitment to the customer is exemplified by the cleanliness of the subway and bus systems; they are the cleanest of all the systems visited. There are few cities that enjoy the same level of transit cleanliness. This achievement is astounding in a city with a population density four times that of New York City, traffic congestion that clogs the streets and highway network from sunup to sundown, and significant air pollution. Cleanliness standards, station art exhibits, and attention to detail in this regard are unwavering in Sao Paulo. Officials say that without this focus, customers would consider other modes of travel. It is an impressive base for a successful customer service program.

Metro information is quite good. Signage is clear and easy to understand. System maps are posted in prominent locations in stations and duplicated on subway cars. Information is comparable to North American standards. Station design is orderly and expansive, but not large enough to handle crushing customer load factors. There are adequate bus stop signs and shelters on the streets. Again, as in all of the cities visited, there were no public schedules available for review. Buses arrived very frequently (every 1-2 minutes), overhead destination signs matched the route name and number on the bus stop signs, and customers boarded and alighted with relative ease. Load factors during most of the day were at least equal to that of the subway system. The biggest difference was that buses did not move much because roads were congested at all times of the day. It is not unusual to see 25 to 30 buses stacked bumper-to-bumper on congested roadways, all with capacity loads. Without the establishment of more busways (there are some in areas abutting the central city) or Herculean efforts to reduce congestion, it appears that bus ridership will continue to fall as people shift to the expanded Metro or renovated commuter rail system.

SUMMARY OF POLICIES AND PRACTICES APPLICABLE TO THE UNITED STATES

It is possible to apply some of the lessons learned during this study mission to the United States; however, many factors that contributed to the success of these applications in Latin America are not present in the United States. Differences in population densities, political structure, car-ownership rates, income levels, and cultural perspectives of public

transportation suggest that transferability of transit strategies from the cities studied to U.S. cities must be carefully evaluated. There are, however, some policies and practices that can be applied in the United States.

Privatization

The expected outcomes for privatization in Latin America are not the same as in the United States. In the United States, privatization is expected to be more cost efficient through increased competition and fewer bureaucratic requirements. In Latin America, privatization has resulted in duplicative bus services, systems that do not connect, and labor policies that would be considered very inefficient in the United States.

The United States sees privatization as a way to generate competition. As developed in some Latin American countries with 30- to 40-year contracts, increased competition is not a goal of privatization. Privatization has been a viable alternative to ensure that a wide array of services is provided with limited public investment. Bus transportation has been privately provided in Argentina for many years and the positive experience is now being tried with rail services.

The history of transit development in South America, plus the cultural, economic, and demographic differences, make comparisons with the United States very difficult. This does not mean, however, that there are not lessons to be learned from the public-private rail partnerships in Latin America. In order to attract the private sector to the transit industry, Argentina has been very flexible in developing its service requirements. The primary interest is quality service, and the contracts focus on outcomes, not process. The concessionaire is permitted to make a profit based on the quality and efficiency of the infrastructure and the service. Incentives and profits are tied directly to service enhancements and ridership. Long-term contracts provide a great incentive to the private sector, allowing them to develop a long-range plan. The government was willing to continue subsidization giving the private sector time to make service improvements. In return, prices established for construction are firm, putting the responsibility for project costs and schedule on the private sector. Latin American countries are also less likely to impose costly design and safety standards on their rail providers. Environmental requirements are less stringent as are other business and labor practices. The concessionaires have the flexibility to select subcontractors for engineering, construction, marketing, and business development.

Latin America offers examples of the types of opportunities that attract the private sector and the operating flexibility that is necessary for the private sector to conduct its business. As transportation officials make decisions to form partnerships with the private sector, public officials need to be realistic about the goals and objectives of the partnership. Roles should be clearly identified and the public must recognize the profit motive aspects of the private sector. Compromise in the "normal" governmental requirements may be necessary and must be weighed against the goals for the

private service. Long- and short-term political and financial interests should be considered. Decisions should be based on long-range goals. The answers may not be simple and the solutions may not be obvious.

Busways

Busways provide a transit option that can be applied in a wide range of circumstances. The Brazilian experience suggests that the capacity of busways, which can be as high as 27,000 riders per hour in each direction, is high enough to accommodate transit ridership in all but the busiest corridors in the largest U.S. cities. On the other hand, the relatively low cost of busways (approximately \$1.5 to \$2 million per kilometer based on Brazil's experience) makes them a viable option for a smaller urban area that wants to improve its transit service but cannot justify the large expense of a light-rail system.

Busways are also very flexible in their design and development. A very important benefit of busways is that they can be built incrementally over time as demand evolves and funding becomes available. Buses can easily switch back and forth between an exclusive lane and mixed traffic along a corridor. Such a mixed system can be the first phase of a full busway development, or the final design. This flexibility for partial implementation contrasts sharply with a rail system, which requires a fully connected line before the first train can operate. In addition, a bus-only transit system can start to use busways with existing equipment and facilities.

Integrated Approach

An integrated approach, in which new busways are combined with other transit improvements, is much more effective than if the busway is built without the supporting improvements. For example, transit signal priority, prepaid fares, and platform passenger boarding contribute to the success of the Curitiba busway design. These supporting elements of the Curitiba system combine with the busway to create a greater reduction in travel time, as evidenced by the higher speeds of the Curitiba system despite higher passenger loads. The busway by itself would be much less effective if a greater amount of time was spent waiting for red traffic lights or for passengers to pay their fare and board. The actual elements that are used to support the busway could vary from city to city.

Median Busways

The Brazilian experience suggests that busways in the median are preferable to curbside busways. Porto Alegre has built both types of busways and determined that any future busways will be built in the median. Median busways have the primary advantage of fewer conflicts with vehicles turning from or into side streets and driveways, allowing for faster and safer bus movement. They can be safely designed for pedestrian access to bus stops, and bus stops should be designed with sufficient width and/or protective barriers so

waiting passengers do not feel exposed to nearby traffic. A disadvantage of a median busway, which may be more important in the United States with its high automobile use, is that the busways provide a barrier to direct left-turn access to property. Eliminating this access can be very difficult in some situations.

Feeder-Trunk System

There is a clear benefit of using the same vehicle for neighborhood service and the corridor connection into downtown. Such a system eliminates the need for a transfer, which has been conclusively demonstrated to be a disincentive to use transit. However, there are also advantages of using separate vehicles for the neighborhood feeder and the trunk route. One benefit is that separate vehicles allow for the frequency of service to be closely matched to demand. Porto Alegre, for example, discovered that having every neighborhood bus operate on the corridor resulted in overcapacity on the corridor and inefficient use of resources. As a result, they are converting to a feeder-trunk system.

In addition, the design and capacity of the vehicle can be tailored to busway operation. For example, the Curitiba system uses biarticulated coaches on the busways. These coaches have five doors and are designed to fit with the boarding platforms to allow for at-grade passenger access. Such a bus works extremely well on the busway but would clearly not be appropriate for neighborhood service. Similarly, the use of separate buses allows for small bus service in neighborhoods, which may be more appropriate for the narrower streets and more acceptable to neighborhood residents.

Another advantage of a feeder-trunk system is the simplicity of passenger information and operations. A single route along a busway eliminates the need for passengers to determine if a particular approaching bus is the route they need. It also eliminates the operational need for bus overtaking facilities or bus ordering along a busway.

The actual decision to separate the neighborhood service from the busway service is one that must be carefully considered by each system. Important factors to consider are the passenger amenities available at the transfer point and the frequency of service and the possibility of timed-meets between the neighborhood and corridor buses. In the absence of high-frequency service (10-minute headways, at a minimum), or a timed-meet, it is likely that using the same bus for neighborhood and corridor service will be the preferred option.

Land-Use Coordination

Perhaps the most important factor in achieving high transit ridership is the coordination of land-use planning with transportation planning. Such coordination will yield few short-term results, but will have great long-term benefits.

Busways, like rail, provide opportunities for coordinating land-use planning with transit service.

The close tie between land-use plans and transit plans is the primary reason that the Curitiba system is so successful. In all its planning efforts, Curitiba has recognized the importance of the human element with pedestrian and transit priorities. Curitiba planned the development of the city and the transit system in a coordinated fashion 30 years ago. The highest density development was planned to occur along five major transit busways. At the time the plan was conceived, Curitiba had a population of about 400,000 people. It has since grown to a city of 1.6 million people. Remarkably, the city consistently followed through with its long-range plan for the last 30 years, and the city now has developed as intended. There is a clear, tiered pattern of development, with higher density occurring in the downtown area and along the busways, and density that is progressively lower as distance from the busway increases. This development pattern has provided direct, convenient access to very high-quality transit service for a large proportion of Curitiba's population.

Curitiba's top-down management approach has enabled city planners to coordinate land use and transit on a more detailed level. The location of city services, retail, and recreational

facilities with major busway transit stations has made transit use more convenient in Curitiba.

Clearly, Curitiba chose to integrate land use and transportation at a very opportune time in its development, just prior to a very significant population surge. Mass transit has become more than just a transportation system; it is an instrument to control and guide city growth. As a result, the benefits of this coordinated planning have been realized relatively quickly. The systematic approach to service delivery and the integration with land development is more important than technology or vehicle systems chosen. It is unlikely that many U.S. cities can expect such significant growth. In addition, many U.S. cities are at a mature point in their development, and significant redevelopment is unlikely.

Despite these limitations, it is still very important that land-use and transit planning be closely linked. It may take longer for the benefits to accrue, and the end result may not be as significant as in Curitiba's case. However, in the long term, coordinated land-use and transit planning may be the most important action a community can take. In addition, the smaller-scale coordination of encouraging transit-supportive activities in the vicinity of major transit facilities is important and can realize more immediate benefits.

APPENDIX A**MISSION PARTICIPANTS AND THEIR TITLES AND AFFILIATIONS AT THE TIME OF THE MISSION****Mission 8, April 18--May 2, 1998: Private Urban Transit Systems and Low-Cost Mobility Solutions in Major Latin American Cities****Participants**

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APPENDIX B

URBAN PLANNING IN CURITIBA, BRAZIL

This section identifies planning theories and concepts that are guidelines for Curitiba's urban growth and provision of a transportation system. It examines the strategies used to implement the main themes of the city's sense of direction and some of the most noted elements of the city's Integrated Transportation Network (ITN).

Curitiba's general planning theories and concepts--humane city, design with nature, comprehensiveness, and interrelatedness--are applicable to any city in the world. Curitiba's strategies are defined by the direction of the city's master plan. Political expediency, social responsibility, simplicity, incremental/continuous improvement, appropriate technology, and cost efficiency are the strategic applications used to accomplish what is becoming one of the best-known integrated land-use and transportation network models in the world. The specific elements of the ITN are even more location- and purpose driven.

HUMANE CITY AND DESIGN WITH NATURE CONCEPTS

The most important of basic urban planning concepts is the consideration of human beings within the natural and physical environment as the reasons for civic and social action. Humane city and design with nature concepts are the fundamental principles that guide the evolution of Curitiba. The guiding concepts are applied throughout all elements of the master plan but are best noted in land use and transportation. Quality of life is the city's trademark and has been consciously adopted by Curitiba as their identity.

The design with nature concept was institutionalized during the 1960s and formally adopted by Mayor Jaime Lerner in 1971. Curitiba is known as an "Ecological City" and the "Environmental Capital of Brazil." The city takes a "green" and "working with the environment instead of against it" approach in its work to plan the urban environment.

In Curitiba, human scale is a major consideration for limiting building heights. Setbacks for stories above the second floor have been established to reduce shadows on sidewalks, streets, and the transit way. High-rise buildings are permitted but are limited to the first block from the core of linear axes and must adhere to a mixed-uses criteria. Five-foot sidewalks are required between buildings and street curbs.

The city has developed an integrated transportation system that considers the "customer as the focus" and emphasizes the use of public transit, pedestrian ways, and bicycle paths. The customer is expected not to have to walk more than 550 yards to catch a bus. Transferability is facilitated by terminals and stations. Buses are designed with the comfort of people in mind. Easy boarding/unboarding, comfortable seating, limiting six passengers per square meter, and smooth bus travel are some of the built-in design standards that make using the transit system pleasurable. The

result is an intensified use of the transit system and one of the lowest rates of ambient air pollution in Brazil.

COMPREHENSIVENESS AND INTERRELATEDNESS

Each element of the municipal master plan has been carefully and thoughtfully analyzed and developed in relation to the other elements of the plan. No element is studied and planned in isolation or in a void. Most notable is the integration of the core network of land use, transportation, and the roadway system. An important lesson learned from the Curitiba experience is that a master plan can be accomplished with the aid of progressive leadership and the high approval rating of the general public. The outcome is a contrast to the general plan amendment approach that has become routine in the United States.

The development of Curitiba as one of the most consciously and environmentally "progressive" cities in the world took a long time. The evolution of this pedestrian-friendly, transit-oriented city can be categorized in three phases. Phase 1, which occurred between 1943 and the early 1970s, was mainly an evolution of a master plan, that in its inception was similar to any other automobile-oriented development plan. The Agache Plan, created by the French urban planner Alfred Agache, proposed a hub-and-spoke system of wide boulevards radiating to and from the core of the city with concentric ring roads. Extensive investment in road infrastructure would prepare Curitiba for what was expected as unavoidable, uncontrolled development.

Phase 2 developed because the city could not afford to implement the massive road infrastructure proposed in the Agache Plan. In 1965, Curitiba adopted the Preliminary Urban Development Plan which veered radically from the Agache Plan. This plan called for directing downtown overspill growth to two linear corridors as a way to limit the need for major investments on infrastructure. The center of the corridors would give preferential treatment to mass transit and pedestrians and give secondary consideration to automobile travel.

Phase 3 occurred from the early 1970s to the late 1980s when the master plan, that gave the city the initial structural form along two, and eventually, five linear axes, was implemented. The downtown area had become saturated and congested and its overspill was directed toward a north/south corridor. The primary tool for encouraging land development along the corridors was a trinary road system that gives transit priority status and the road system a supplementary role. At the center of the system is the two-way exclusive busway (one lane in each direction) and two local, slow-moving, one-way roads (one in each direction) that discourage the use of vehicles but give access to the buildings that front the core of the trinary system. One block away to either side are two, three-lane, one-way, high-capacity streets traveling in opposite directions. They serve long-distance travel to and from the downtown. Parking is not allowed along the roads of the trinary system. The next roads away from the three-lane,

one-way streets are local streets. The transportation system reinforces land-use development designation and zoning policy.

Mixed land uses are encouraged and directed to the area surrounding the linear axis. Densities diminish away from the main corridor. Retail, commercial, and residential uses are concentrated in high-rise buildings on the block fronting the main transit corridor between the busway and the one-way streets. The high densities guarantee the directional split required to maintain a high-capacity mass transit system. Next is a housing zone made up of mid-rise condominium and apartment complexes of 8 to 12 stories. These buildings are followed by low-rise structures of 3 to 5 stories. Even further out are residential units of row houses, duplexes, and single family detached houses.

The transportation system that serves this mixed-use corridor has one of the highest rates of transit ridership in the world and functions like a metro rail system that utilizes buses. Although economic problems partially account for the high rates of use, the majority reportedly ride the bus by preference.

In addition to the wide-scale effort to develop and provide mass transit, work was carried out to guide Curitiba towards nonmotorized and pedestrian travel. The creation of a linear growth axis away from the central business district (CBD) and the resultant reduction in congestion made it easier to promote walking in the city center. The city created a pedestrian network that today covers approximately 50 blocks in the downtown area. The closure of certain roads was a venture that took bold action against the wishes of many businessowners. Roads were torn out and converted to a pedestrian-way system. The pedestrian zone in the downtown area made shopping more pleasant for the pedestrian and became an economic and social success. Bus terminals at the boundary of the CBD and parking restrictions within the city center added to the success.

In 1992, the Curitiba Public Works Plan called for 93 miles of bicycle paths to be built along river bottom valleys, railway tracks, and the city's districts and neighborhoods to make the whole city accessible by bicycle.

The combination of the ITN, pedestrian facilities, and bicycle pathways helped to assure effective use of modes of travel other than the private automobile.

PLAN IMPLEMENTATION STRATEGIES

The successful implementation of Curitiba's master plan was made possible by adhering to several strategic concepts.

Political Support

There is a political constituency in Curitiba that has continued to support the plan over time, empowering the general plan implementation process. Much of the success can be attributed to the leadership of the architect, urban planner, and visionary, Jaime Lerner, and his supporters. The political agenda has continued to the present and can be credited for

continuous support of plan implementation.

Social Responsibility

Curitiba has a sense of responsibility to those who are economically disadvantaged. Development of industrial zones aims to give economic support and self-sufficiency to all the districts. This sense of obligation comes from the notion that a humane city needs to be fair to all its citizens. It is a responsibility that demands extra effort to provide resources to those who are most in need. This is most evident in some of its land-use and transportation policies.

The Municipal Housing Fund Act permits developers to purchase the rights to develop up to an additional two stories on a residential building. The funds from these transactions are used to purchase housing for low-income families. The higher densities are granted only for residential buildings within walking distance of the transitway where infrastructure can support intensification.

The availability of transportation for the economically and physically disadvantaged is further evidence of the city's goal of social equity. The cost of a trip to almost anywhere in the city is \$0.70. This price covers short trips, usually made close to the CBD by middle- or upper-income people or longer, interdistrict trips generally made by low-income residents. The outcome is that the average low-income resident does not spend more than 10 percent of his or her income for transportation, which is relatively low in Brazil.

In addition, free bus rides are available to the poor, the elderly over 65 years of age, postal workers, police officers, firefighters, students, and the disabled. Taxis pick up the disabled to connect them to the ITN. Poor families can collect bags of garbage in exchange for free transit passes.

Simplicity

Simplicity is the key word and basic strategy to implementing the desired effect in Curitiba. Simplicity serves two primary purposes. Keeping it simple means that it will be cheap to plan, implement, and achieve. It also gives way to the sense that if the general public can understand, then political support is likely.

Incremental and Continuous Implementation of the Master Plan

The land-use structure along five linear axes and the ITN are the outcome of pragmatic, incremental, and continuous work to develop Curitiba, its infrastructure, and its program and services. For more than three decades, the city has constantly responded to existing and new circumstances to upgrade the ITN by increasing the comfort and pleasure of the citizen, increasing the capacity and level-of-service of the system and its supportive pedestrian and bicycle facilities. The long-term results have been many small steps towards the dramatic effect of the goal to become "an ecological city." This approach continues as the city is faced with saturation of the ITN and is studying future plans of a guided light-rail

system for the internal core of ITN. There are too many cross streets to operate the busways as true, uninterrupted express trips, even with transit signal priority at every intersection. URBS and Instituto de Pesquisa de Planejamento Urbano de Curitiba (IPPUC) are considering grade separation to increase busway capacity. The city is also looking at viaduct pedestrian interdistrict connections, landscaped walkways and busways, and disincentives to automobile use.

Appropriate Technology

Any decision to apply the most modern and appropriate technology to any component of the ITN becomes an interactive process which includes the municipal government, the private sector, and the general public. Decisions on technological applications are placed mostly and appropriately with the technicians.

The public agencies that play the biggest roles in defining and applying the most appropriate technology are the IPPUC and URBS. The IPPUC, the city's planning and research institute, has broad authority to establish policy based on the master plan and to define how policy will be implemented. URBS implements transportation policy.

The IPPUC brings together a multidisciplinary and diversified team of professionals, architects, urban planners, engineers, sociologists, historians, economists, and the representatives of all functional areas of the municipal government to conduct studies and research and to produce policy documents that guide urban growth and the provision of city infrastructure, programs, and services. Participants in IPPUC activities are expected to stay abreast of the most updated research, information, and technologies of their disciplines. The expertise of team members is incorporated into the decision-making process.

The URBS manages and administers Curitiba's transportation system. It also oversees the planning, management, and operation, and financial component of the transportation system which includes roadways, mass transit, and taxis. URBS delegates the operations of the ITN to private companies on a competitive basis. The private companies make technological recommendations, but URBS is the determining factor. The general public is given the op-

portunity to have input through URBS's continuous monitoring and inspection where requests are made, as well as through surveys and the political process.

Solutions to problems are simple, efficient, and lowcost. They are implemented quickly with immediate results.

Cost Efficiency

The land-use development objectives, the decision to move humans not automobiles, and the desire to keep a tight fist on spending have been the main determinants for the cost efficiency of the bus network system. The decision to apply low-cost strategies to cope with rapid growth came from the dire need and conscious decision to keep a handle on spending. The land-use and zoning policy that directs development along a designated and limited number of linear structural axes helped to guarantee that expenses for infrastructure would be kept to a minimum. Evaluation was done to compare the cost difference between providing a bus network or an urban rail system. The decision was clearly to develop the trinary transport system.

The public/private funding partnership has also attributed to keeping the cost of providing bus network services at a minimum. URBS oversees and manages the integrated bus network system that is operated and financed by private companies. URBS guarantees quality control of the system. Private companies work to meet operational and service standards and minimize expenditures.

SUMMARY

Curitiba is one of the most socially and environmentally conscious cities in the world. Its citizens are happy and have a strong sense of community. Local government officials plan and develop the city in a way that considers how Curitibaños feel, live, and spend their leisure time.

The general philosophy in Curitiba is to work for the benefit of human beings and the environment. This way of thinking can easily be adopted by any community in the world. Even places that already enjoy being "livable" communities can do well by incorporating these values into their transportation and urban planning policies.