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International Transit Studies Program
Report on 1996 Missions

This TCRP digest summarizes the fourth and fifth missions performed under TCRP Project J-3, "International Transit Studies Program. " The digest includes information on the cities visited, lessons learned, and discussions of policies and practices that could be used in the United States. This digest was prepared by Tracy E. Dunleavy, Eno Transportation Foundation, Inc., the administrator of the project, on the basis of reports filed by the mission participants.

INTERNATIONAL TRANSIT STUDIES PROGRAM

About the Program

The International Transit Studies Program (ITSP) is part of the Transit Cooperative Research Program (TCRP). The ITSP is managed by the Eno Transportation Foundation under contract to the National Academy of Sciences (NAS). The TCRP was authorized by the Intermodal Surface Transportation Efficiency Act of 1991. In May 1992, a memorandum of agreement outlining TCRP operations was 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). The TCRP is funded annually by a grant from the FTA.

The 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 transportation problems and issues.

The program arranges study missions where teams of public transportation professionals visit transit operations in other countries. Each study mission has a central theme that encompasses issues of concern in public transportation. Cites 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 begins with 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 throughout the United States. Study mission experience also helps team members evaluate current and proposed transit improvements and 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.

CONTENTS

Transit properties are contacted directly and requested 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 up-and-coming transit management personnel with substantial, sustained 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.

In addition to conducting study missions, the ITSP administers an individual travel assistance program, which provides financial assistance to enable individuals engaged in U.S. public transportation management, operations, planning, and research to participate in international conferences and meetings held outside North America. Applicants must plan to participate in the event as a presenter, discussion leader, panelist, or moderator.

Additional information about the study missions or individual travel awards may be obtained by contacting the TCRP at 202/334-2886 or the Eno Transportation Foundation at 703/7297212.

About the Report

The following report is an overview of the fourth and fifth study missions, conducted during the spring and fall of 1997, respectively. This report 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.

Appendix A lists the names of study mission participants and their titles and affiliations at the time of their respective missions.

URBAN AND REGIONAL BUS OPERATIONS IN SMALLER EUROPEAN CITIES: MISSION 4, MAY 9-26, 1996

INTRODUCTION

Like their American counterparts, transit planners in small western European communities face a number of issues in designing and managing transit service to meet both market and social policy objectives.

To learn about the latest advances in small city transportation, a delegation of U.S. transit officials visited several European countries from May 9 through May 26, 1996. The study team visited the following cities: Zurich, Schaffhausen, and Frauenfeld, Switzerland; Dornbirn, Austria; Lindau, Radolfzell, Ravensburg, Detmold, Lemgo, Bad Salzuflen, and Muenster, Germany; Liege and Brugge, Belgium; and Breda, Dordrecht, and Maastricht, Netherlands.

A key purpose of the mission was to demonstrate the dramatic successes obtained by smaller communities in altering modal split by introducing or enhancing public transit. The mission looked at the policy, funding, accessibility, and passenger information aspects of several city bus systems, along with their traffic management and retail trade impacts.

In the late 1980s, Europeans were faced with the decision to create more roads or reduce automobile traffic. They chose to fund and expand public transportation with substantial public investment. This has resulted in dramatic shifts in travel modes in favor of public transit.

The success of transit systems during the past 5 years appears to be the result of a fundamental shift in views--from the views of transit systems and government officials to the views quickly adopted by the general public. Because of changes in European transportation in the late 1980s, officials and the general public started to view public transit as a convenience for everyone, not just a necessity for those without automobiles.

In general, European cities, both large and small, are very densely populated in compact areas with historic (and thereby a downsized) urban infrastructure. As automobile traffic increased, outpacing roadway and parking capacity, the result was tremendous congestion. Many cities visited by the study team employed integrated policies and practices to mitigate the increasing congestion. Key policy objectives were to reduce private automobile traffic, without adversely affecting urban mobility, and to improve the quality of urban life and cities' economic vitality. This report describes how various European cities have used specific tools and practices, including the following, to implement their transportation and quality-of-life goals:

- Signal preemption and intersection priority
- Dedicated preferential lanes for buses, bicycles, and pedestrians
- Other traffic treatments and strategies
- Automobile-free or restricted zones for transit and pedestrians
- Parking supply and pricing
- Special "central city" or central business district (CBD) strategies
- Passenger information systems
- Aggressive image campaigns.

The *Stadtbus* or "City Bus" model systems in Germany, Switzerland, and Austria, with some variations in Holland and Belgium, that the study team visited were developed to achieve many objectives, including managing traffic and relieving congestion (see Figure 1). The study team identified a common theme among the Stadtbus cities, where increasing automobile congestion was choking the central cities with gridlock. This gridlock was threatening the quality of life and many historical urban environments. The City Bus systems, such as those in Detmold and Bad Salzuflen (Germany), Dornbirn (Austria), Dordrecht

(Netherlands), and Brugge (Belgium), were key elements of an overall city transportation plan, with comprehensive strategies for managing traffic congestion, enhancing urban livability, and stimulating economic vitality.

Although some European systems have developed imaginative service planning and operating practices that warrant emulation in the United States, the study team recognized the distinct cultural, institutional, and historical differences between the European countries visited and the United States.

This study mission was the first to concentrate on urban and regional bus service. Earlier missions (1994 to 1995) highlighted commuter rail and hightech systems, intelligent transportation systems, policy, marketing, and traffic management innovations.

At each site visited, the study team asked city and transit professionals what three things they did best or what three things primarily contributed to their success. Even though the study team came back with strong impressions in areas of technology and public policy, most systems prided themselves on their passenger amenities, customer information, and frequency of service. Appendix B lists what city and transit professionals consider to be the most successful aspects of their systems.

SWITZERLAND

Unique Transit Features

Switzerland established a national policy that limits the use of cars by restricting traffic patterns in the CBDs of its cities. In addition, and perhaps equally as important, Switzerland imposes a gas tax, which contributes to the high cost of fueling a private car. The gas tax is used as a financial base to support the cost of operating transit in each of the cities and cantons (cantons are comparable to U.S. counties or regional areas). The people in major cities such as Zurich, with its wellintegrated intermodal system, believe that decreased congestion, reduced noise levels, and improved air quality are valid reasons for such national policies.

Increasing costs and attempts to place a cap on funds allocated to transit from tax revenues have led to the privatization of services in many European cities. The privatization model is credited to Frauenfeld, Switzerland, where the current Stadtbus has been provided by a private contractor since its inception in 1984. The private contractor provides the buses, drivers, and maintenance. The city manages fare policy and provides street amenities, marketing, and service planning.

Zurich

Transit Profile

Zurich is the largest city in Switzerland, with a population of 341,000 (1991 estimate). The city's fastgrowing suburbs have brought the population of the metropolitan area to nearly 1 million.

The canton of Zurich has been served by the Zurcher Verkehrsverbund (Zurich Transport Association or ZVV) since 1990. This system is made up of more than 40 public and private transit providers, operating a total of 262 commuter rail, light rail, bus and trolley bus, mountain rail, and cable car lines and paddle-wheel lake steamers.

Since a popular referendum in 1988 authorized an integrated rail network, daily public transit passenger totals have increased by more than one-third in Zurich and by about 14 percent in the ZVV region to just under 1 million. The modal split among daily commuters to Zurich has increased from 50 percent to 59 percent public transit. Farebox receipts, which covering 56 percent of the system's current annual operating costs, amount to SFr 800 million ($715 million); the shortfall is covered equally by the canton and its 171 communities. Calculation of the local contributions involves a complicated 80/20 formula that takes into account the number of daily departures from station stops in each community and the community's tax base.

The network contains a total of 2,700 route km. The regional rail (S Bahn) serves as the main distributor, with 27 station stops inside the city limits. Neighborhood feeder buses and vans bring passengers to the main stop.

Transit operators in Zurich are very conscious of air and water quality and noise control. The system consists mostly of electrified trams and trolley buses, but much of the bus fleet is diesel. A recent proposal called for the electrification of all bus lines, removing diesels from the system. Given the very high front-end fixed cost of the overhead power grid and the conversion or replacement of buses, the proposal was determined to be too expensive.

A system objective is to have a bus stop within 300 m of each doorstep. Throughout the region, there are more than 1,400 bus stops, served by more than 600 buses and trolley buses operated by 28 companies that together operate more than 30 million km a year.

Another objective of the Zurich S Bahn light rail system is to provide a seat for every passenger. Standing is considered an exception to be tolerated only for brief periods. This requirement reflects the desire for comfortable travel and an amenable, egalitarian transit environment for all passengers.

There is full-fare integration throughout the region, which is divided into 45 tariff zones. Zurich uses the honor system; tickets are purchased off the vehicle, and fare inspectors randomly check tickets. About 35 million single, multiple, monthly, and annual tickets are sold each year. According to a study conducted by an independent research institute, this works out to 560 public transit trips per inhabitant per year, a level far above that registered by other metropolitan regions in western Europe.

What Could Be Applicable to the United States?

In Zurich, the same organization is in charge of transit and land use

planning. Coordination of these two functions is considered a high priority. Officials are working to increase densities at commuter rail stations. In the long term, they see the need to get people closer to transit services, to increase ridership, and to affect the economy in a positive manner.

In the canton of Zurich, the cities, the canton, and the federal government make up the difference between fare revenues and costs. Fares are fully integrated. Regional and local bus operators and the federally operated rail systems use the same prepaid fare within the canton. All revenues collected in Zurich are retained by the ZVV, which reimburses transport companies for their costs.

Zurich is a pioneer in prioritizing intersection signals. The country's computer system sets traffic signals at intersections throughout Zurich to optimize transit, automobile, and bicycle flow. The system has special transit signals, giving light rail vehicles (trams) and buses special priority.

An innovative program in many of the cities studied is a car-sharing arrangement, organized as a membership cooperative, which facilitates short-term car rental. The program in Zurich appears to be the most mature. A small fleet of microcars is based at a rail station. By using an interactive voice-response telephone system, a customer can make a reservation for a car at a certain date and time.

To encourage consumer input, Zurich surveys passengers, nonusers, and businesses for their opinions regarding routes, headways, and suggestions for improvements.

Schaffhausen

Transit Profile

Schaffhausen, the capital of the canton of the same name, has a population of 34,000.

The nine-line Schaffhausen urban public transit network (VBSH) carries 12 million passengers annually with its fleet of 30 buses and 13 trolley buses, which typically run at 10-min headways. Passenger totals and farebox receipts have risen consistently, even after fares were raised by 10 percent in 1994. Between 1984 and 1994, annual passenger totals increased from about 9 million to 12 million, and during the past 5 years, annual farebox receipts rose from about 6 million to 9 million Swiss francs, the latter of which is equivalent to $7.6 million. Operating revenues, including parking and advertising fees, cover about 60 percent of operating costs.

More than one-third (12,700) of Schaffhausen's residents purchase a monthly or annual pass for the regional transit system, which gives them full access to local and intercity bus, trolley, and commuter rail services. Tickets or passes are sold in all post offices and at the railway station. Annual pass holders increased more than 10 percent (to 5,540) last year. The VBSH is very active in the areas of passenger information and public relations, distributing pocket guides and schedules to all households, training drivers in customer relations, issuing name tags to all drivers, and instituting electronic bus stop announcements in the vehicles. The system operates with a total of 131 employees of all categories.

What Could Be Applicable to the United States?

A very sophisticated signal priority system and on-board (bus) computer system has improved on-time performance significantly and produced considerable cost savings through reduced delay. On-board computers provide a comparison between scheduled and actual times at control points and control traffic signals with bus preemption at most intersections. The computer gives buses priority over automobiles if two or more buses are waiting at opposite legs of the intersection. The computer assigns a higher priority to a bus that is behind schedule or that is carrying a higher passenger load.

In European cities that use offboard fare collection, it is difficult to obtain a reliable count of customers at the route or stop level. Some systems are experimenting with passenger counters. Schaffhausen uses an optical beam above each of the doors on 5 of its 43 buses. This system determines the number of passenger boardings by stop. Regional and local bus systems sell their own tickets. However, within the city, users can ride the regional or city bus with either ticket. The boundaries of the city system coincide with the zonal boundaries of the regional system.

Like many cities visited, Schaffhausen is already built out. Most of the city's development is infill, where a high level of transit service already exists. The presence of and access to public transportation have become important criteria for residents in choosing where to live.

The cost of delivering new schedules annually to homes in Schaffhausen is covered by a local department store's ad, which appears on the schedule (the bus company also makes some money from the ad). The city also produces a semiannual newsletter that is delivered to all homes in the area.

Frauenfeld

Transit Profile

Frauenfeld, a town of 20,000 in habitants, is one of the smallest communities in the study.

The nine-bus system operated for Frauenfeld by a private local firm is overseen by a city employee. Ridership grew from 470,000 passengers in 1982, when the City Bus system was launched, to more than 1.4 million last year. Intersection priority, some separate bus lanes, and other design changes keep buses moving quickly; three wide entry doors and the honor fare system cut dwell time. The clearly marked hub-and-spoke route system with color coding for each line and bus

stop make the system easy to use and understand.

Advertisers have paid entirely for the comfortable, covered bus stops with clear and complete schedules and amenities such as seats, public telephones, mail boxes, and some bike storage stalls. More than 90 percent of the population is served by the six bus lines, which leave the main station together at 15-min intervals and return to the station terminal about 15 min later. Transferring between lines and to other transit modes, such as trains and regional lines, takes place at the terminal. Children up to the age of 6, blind individuals with their guide dogs, people in wheelchairs, and on-duty military personnel ride free.

Farebox receipts cover about 60 percent of operating costs; the balance is subsidized by the town and canton, currently at a cost of about 4 percent of local tax revenues. Frauenfeld promotes the use of annual passes by deducting monthly charges automatically from patrons' bank accounts.

The buses are supplemented by the regional PubliCar on-demand service. These vans offer a reduced fare to Frauenfeld subscribers. The service operates a nightly service every hour from 7:00 to 11:00, leaving the station and bringing passengers to their homes.

The town of Frauenfeld, like Schaffhausen and practically all Swiss cities, is tied into the larger regional network of multimodal public and private transit providers offering fullfare integration.

What Could Be Applicable to the United States?

The city has contracted transit operations to private companies. The private company actually purchases buses for the city and provides bus operators and maintenance. Passenger revenue becomes property of the city when collected by the private company. The city then reimburses the company for certain expenses. In the event the city chooses a different company for transit operations, the new company would purchase the shares of the other company, including the rolling stock. City officials believe that operating a new and expanded service by a private company is more efficient than using public employees. They also believe that the motivation to receive additional contracts will provide a good incentive for the contractor to keep costs down and provide quality service.

One feature of the Frauenfeld system that is applicable to the U.S. transit industry is its approach to bus stop shelters. A third of all bus stops in the city have shelters. All stops will be equipped with shelters in the near future.

Although many of the shelters are owned by the city, some are owned by private businesses. Under this cooperative agreement, the initial investment comes from the private sector, which retains ownership and accepts responsibility for maintaining the shelter in exchange for the right to advertise on it. The shelter contains all the traditional amenities including a telephone, seating, and bicycle racks. The transit system places route maps and schedule information in the shelter.

AUSTRIA

Dornbirn

Transit Profile

Dornbirn, with a population of 42,000, was the only city in Austria visited. The Dornbirn city bus system, which started in 1991, has been phenomenally successful. The sevenline system, which operates only 13 buses, grew from 437,000 riders in 1991 to more than 3 million riders in 1995. The system operates with a timedtransfer pulse system.

In timed-transfer systems in most cities, all routes are comparable in length and are assigned a single vehicle. In Dornbirn, however, one of the routes operates at 15-min headways all day, and the other six routes operate at half-hour intervals.

A relatively low-tech, low-cost strategy is used in Dornbirn to reduce bus emissions. Bus engines are shut down during pulse layovers (of approximately 3 to 5 min) at the central transfer hub. This action lowers noise and minimizes unnecessary diesel fumes and emissions in a concentrated area.

Part of the city's fleet of 13 buses is owned and maintained by the postal system. The city funds bus maintenance and operation out of its general budget. A private contractor is responsible for supervising bus operators, ensuring that schedules are maintained.

What Could Be Applicable to the United States?

Dornbirn has an aggressive advertising philosophy: "Get into the newspaper every week." The transit system uses newspapers to thank customers, bus operators, the police, and the postal service. The system's budget, including cost per capita, is published in the newspapers.

The transit system reports that 60 percent of its passengers use the annual pass, which costs less than $90. Children under 6 travel free on most of the system.

City officials believe that a private contractor arrangement is the best way to manage its new and expanded transit system. The private transit manager has a contract that is subject to renewal every year, which the city believes provides a strong incentive for the manager to provide good, strong direction and management.

A customer service center is located in a major regional shopping area near the main transfer point of the bus lines. The train station is located 2 min on foot from the transfer and customer center areas. Although regional service coordination has not occurred, regional fare integration has been successful. The customer service center in Dornbirn and those throughout the entire region effectively communicate service and fare information to riders.

GERMANY

Unique Transit Features

The German *Stadtwerke* (municipal public utility) is a unique method of operating and funding city services. The Stadtwerke is a publicly held corporation, with 100 percent of the shares held by the city, region, or both. A Stadtwerke is allowed to generate profits from their operations, which may be used to fund transit and other public services.

In many of the German cities the team visited, the cities are responsible for supplying all utilities including natural gas, electricity, and water and sewer. These services are profitable, as they are in the United States. Municipal administration of public transit is frequently located within the Stadtwerke. Despite the fact that the provision of utility services in Germany is clearly a municipal public enterprise, because it is profitable, the German government taxes the profits of the Stadtwerke. Municipal authorities have funded transit deficits from the profits of the municipal utilities to reduce their federal taxes.

The cross subsidies received as a result of activities of the municipal public utilities provide a sustained source of local funding to operate the city transit system, or as it is frequently referred to, Stadtbus (City Bus). Although, as indicated previously, there are many practical reasons for administering the transit system as an enterprise of the utility system, the Stadtwerke model says a lot to citizens about the role and importance of public transportation in community life. Public utilities, by definition, are essential to the well-being of the community. By including transit service within the Stadtwerke, transit is defined as an essential utility service. If applied in the United States, this model could do much to elevate the public's perception of transit as a utility-like essential service.

In a number of German communities, some evening service is provided through a *Nachtbus* (night bus) system. A single bus is assigned to cover two or three routes at diminished frequency. This is similar to the "owl" service operated in some larger U.S. cities at very late hours.

A more innovative way of providing night service in many communities is through a taxi service that operates solely between bus stops. Customers call the transit system dispatcher, who contacts a taxi service dispatcher. Customers are given a confirmation time and are required to get into the taxi at a bus stop. An approaching taxi may contain other customers when the customer is picked up. The fare for this service is usually twice the regular route fare, paid to the taxi driver. The taxi contractor is paid the difference between the contract price negotiated with the transit operator and the fare paid by the customer. This system has the beneficial effect of preserving exclusive-ride taxis as a private (unsubsidized) product, while providing some level of mobility during low demand times. Further, the transit operator does not subsidize exclusive-ride taxi customers through this system. This service is called Sammel-taxi (scheduled taxi) in Muenster and Bad Salzuflen.

Lindau

Transit Profile

Lindau is a tourism and convention center on the northwest shore of Lake Constance, in the German state of Bavaria. Lindau has a population of 28,000 and is a rail hub on the international trunk lines connecting Germany, Switzerland, and France.

Community leaders decided to dramatically increase local public transportation to reduce automobile traffic and promote a more pedestrian environment in Lindau. In exchange for the 80 percent capital funding received from Bavaria, Lindau guaranteed that its contribution toward providing funding for operation would remain at the start-up level.

The four-line city bus system was inaugurated with a major citywide festival in October 1994, replacing an earlier limited service. Passenger totals have increased since then by 500 percent to about 6,000 per day.

The system consists of 10 lowfloor midibuses custom built by Neoplan (see Figure 2). Operated by a private contractor (RBA Augsburg), the bus network features a high-class corporate image reflected in coordinated interior and exterior designs, colors, logo, tickets, and ticket-vending machines. Instead of commercial advertising, the distinctive color-coded buses, with a separate color for each line, carry a stylized city emblem and have helped foster community spirit.

The network comprises about 20 mi and covers an estimated 90 percent of all residential districts, with bus stops within 200 m of the town's public offices, schools, retailers, shopping centers, sport complexes, retirement homes, churches, and industrial facilities. All 110 bus stops are served on the hour and half hour from 5:30 a.m. to 11:30 p.m. The maximum point-to-point transit time in the huband-spoke system is 27 min. All lines connect with a central bay in the CBD, departing every 3 min and allowing "painless" transfer between the four lines. Short dwell times and high speed are ensured by wide doors, signal priority, and bus stop bays retrofitted along the routes.

During the first full year of operations, approximately 900,000 route km were operated and more than 2,000 annual passes were sold to residents. Farebox receipts cover about two-thirds of the operating cost. The current DM 3.6 million ($2.5 million) deficit for the operation is covered with DM 2.2 million ($1.5 million) from parking revenue, DM 1 million ($0.7 million) from the municipal utility, and DM 0.4 million ($0.3 million) from the

national government for passengers with disabilities.

What Could Be Applicable to the United States?

Although many U.S. transit systems contract for operations, it is unusual for these privatized systems to contract for management of the customer service center. Lindau is probably the exception in the European community as well. The city's transit system has a staffed customer service/information center adjacent to the central transfer facility. One reason for this decision is that the dispatch center and customer service center are one and the same. Activities at this multipurpose center include radio communications, vehicle dispatching, dispersing of smart cards and other fare media, and providing printed schedule information. The facility serves as a "transit store," selling monthly and annual transit passes and other items such as tee-shirts.

As in Dornbirn, Lindau shuts down bus engines during pulse layovers at the central transfer hub. This reduces noise and minimizes unnecessary diesel fumes and emissions in a concentrated area.

The transit system provides onboard information by displaying "nextstop" information by means of an electronic, rotating straight-line drawing that details many stops along the route and highlights the next stop (see Figure 3).

In terms of printed information, the system not only delivers schedules to homes, but also to visitor centers and hiking and backpacking clubs.

Radolfzell

Transit Profile

A regional center of 30,000 with a light industry-based economy, Radolfzell contains many health spas and is a railway and lake shipping hub.

The Radolfzell transit system is operated for the city by the South Baden Regional Bus Company (SBG), which directs a fleet of 50 buses and leases 75 (see Figure 4). The total fleet of 125 vehicles provides services in a two-county region.

The weekday passenger total for the entire fleet is approximately 15,000, which works out annually to more than 5.5 million passengers. The system encompasses 6 million km and has revenues of DM 20 million ($14 million). The urban service consists of six bus lines running with a 15-min headway during peak periods and at 30min intervals the rest of the day. All lines leave from and return to the railway station. Magnetic-strip farecards are available in addition to onboard, single-journey tickets.

The SBG operates a "disco bus" to get weekend night owls home safely as well as a transborder EuroRegion bus to link the German border region with Mulhouse and Colmar in France and Basel in Switzerland.

The SBG regional maintenance depot is a state-of-the-art facility that uses recycled rainwater to wash the vehicles.

Fare integration with the cooperation of all public and private transit providers in the county of Konstanz is now under way. This integration will include urban, regional, intercity, and commuter rail systems. Single-day tickets and discounted weekly, monthly, and annual passes recently become available.

What Could Be Applicable to the United States?

A key element of the bus system in Radolfzell is the integration of transit service with the public and private parking system. The city increased parking fees to encourage greater transit use and inhibit automobile travel in the central city. This successful strategy generated additional revenue and saved the cost of providing additional parking facilities. The increased parking revenues and city general funds are used to cover the city bus subsidy.

The central rendezvous transfer center for the city bus is at the central rail station, affording close coordination between the city bus, regional bus, and commuter railway lines.

Many of the systems studied provide transit and other useful information in their next-stop programs. Radolfzell, for example, displays electronic next-stop information and announces the information by means of recordings. In terms of printed information, Radolfzell produces a quarterly newsletter, which it gives only on request.

The system prides itself on its good image and logo; passengers think in terms of the system as "our bus."

Ravensburg

Transit Profile

A large county seat and regional shopping center serving an agricultural region, Ravensburg has a population of 45,000.

To restore the old city to pedestrian use, through traffic was banned in 1986 and an underground garage for 400 cars was excavated under the traffic-restrained main square in 1989. By 1990, the entire old town was designated as a traffic-restrained zone, paved with cobblestones for pedestrians and concrete blocks to channel residual traffic flow. At the same time, major renovation projects backed by community groups restored the facades and connected groups of 15th-century houses to create a city museum documenting life in Ravensburg over the centuries.

To retain its position as a regional shopping center while reducing the number of cars in the city, Ravensburg added private train service to connect its nine local bus lines with other cities in the region.

The bus system, operated by the city's public utility department, has 33 relatively new buses (average age is 3 years). In 1995, the fleet carried a total of 4.2 million passengers. Farebox coverage of operating costs currently stands at 77 percent, and the DM 2.2 million ($1.6 million) annual shortfall is

covered by internal cross subsidies from profitable gas, water, heating, and parking operations.

The bus system prides itself on lean management; clean, comfortable equipment; and a uniform color scheme.

What Could Be Applicable to the United States?

The transit systems studied are going to great lengths to encourage pass use. Single-ride tickets have a premium charge, especially if purchased on the bus. Some cities are experimenting with "chip cards." Ravensburg is exploring a chip card for a range of municipal services, including downtown garage parking and use of the swimming pool.

Because of the linear nature of the city and region and its location, Ravensburg has no central hub for all modes. However, users can take the light rail system from Ravensburg to the next regional city, where they can link with the Lake Constance ferry to Switzerland. There also are 20 bus connections daily in each direction linking Ravensburg with the German National Railway.

Traffic has been banned from the old city center, making the area a vital transit- and pedestrian-only place. The zone is effective, but there are concerns about traffic conflicts between buses and pedestrians.

Ravensburg's newsletter is delivered to households and is available on the trains.

Detmold

Transit Profile

Detmold, a city of 70,000, is the administrative center for the state of North Rhine Westphalia.

Since the fall of 1994, a fleet of 18 midsize Neoplan buses has been providing a four-line city bus service with a 15-min headway during peak periods and 30-min intervals the rest of the day. The city operates the bus lines, but fleet maintenance has been contracted to a regional operator. Since the start of the system, monthly passenger totals have trebled to 180,000.

The city's traffic plan aims at substantially reducing private car use during the next 10 years by promoting an attractive, comfortable, speedy, and economical city bus service. Monthly fare cards are available for as little as DM 25 ($17), and a chip card electronic purse is being phased in for both public transit and parking fee uses.

The Detmold City Bus network and the two other city bus systems are linked with the regional Verkehrsgemeinschaft Lippe, which includes 12 independent service providers. The public and private members of this transit association cumulatively control and operate a fleet of several hundred buses. Full-fare integration is practiced in the region, with many ticket and pass options. One of the most interesting is a monthly "job ticket" bought by companies for their employees as a fringe benefit. For close-by areas, it costs about $16; the price goes up the longer the commute.

What Could Be Applicable to the United States?

Each of Detmold's Neoplan buses is equipped with electronic route maps. These visible, colorful displays, located toward the front of the bus (on the side behind the driver), depict route information for riders. The display shows the progression of stops, with the upcoming one appearing in a different color than the rest. The display changes automatically once the bus departs each stop.

Even though other European systems also display route information on board, this technology offers the distinct advantage of providing riders with continuous route information. Detmold's technology might be explored by U.S. transit systems, particularly systems with longer route lengths and many stops. Transfer points could also be depicted on the electronic map.

Special accommodations have been made at bus stops for visually impaired riders, such as special curb cuts and textured brick on sidewalks. An audible signal at the intersection tells the visually impaired individuals when it is safe to cross the street.

Many European systems use sign posts instead of traditional bus stop signs to communicate information. These systems take great care in determining both the location and design of the sign posts. The signs are always color-coded (see Figure 5), and in most communities, with the exception of express services, posts are located 200 to 300 ft apart. The design often includes a route map and schedule (headways) information.

In Detmold, the sign posts depict both route and schedule information. All four routes are color coded. The post is color coordinated with the buses and timetables. In addition, the routes and schedules are shown in a multiplefold, easy-to-read flyer. Although sign posts cost a little more than traditional signs, they are aesthetically pleasing to smaller communities. More information can be made available to the rider on sign posts, which makes them a good investment for some smaller U.S. transit systems.

Managing parking supply and pricing is used by some of the cities visited to reduce automobile traffic and congestion and to make public transit use an even more attractive alternative. In the 1980s and early 1990s, Detmold experienced very serious automobile congestion. During that period, bus service was poor, and parking was free. The city's primary objective in initiating a new expanded city bus system was to mitigate growing levels of automobile traffic and resulting peak-period gridlock. The city integrated the new bus system with a parking management policy that included increasing parking fees to help fund the transit subsidy (to cover costs that exceed fare revenues). Detmold is experimenting with chip cards that also will be used for parking meters.

The system's marketing philosophy is that it must do something to get people to ride the bus. The system increased the frequency of buses and introduced a reduced fare; it allowed

two adults and three children to ride on weekends with a monthly pass. When the transit system started, it organized a marketing campaign and offered a watch with the system's logo as the first monthly pass (which was good for the first 2 months). It also used historic Detmold money as a monthly pass.

Previous schedules were very complicated, large, and cumbersome. A separate card has been printed for one route, and the operator plans to do this for all the routes. There is a plan for a guaranteed ride home, a subsidized taxi ride, for all passengers.

A passenger survey conducted in Detmold found that passengers wanted the same upgrades often requested from passengers in the United States: more frequent service, affordable fares, fast and comfortable buses, easily understood schedules, and reliable and friendly service.

Lemgo

Transit Profile

In Lemgo, which has a population of 42,000, bus ridership soared from 40,000 to more than 1.4 million in 1 year after the City Bus was introduced in the fall of 1994. The three Lemgo lines, each between 5 and 6 mi in length, are operated by a private service provider under contract to the city. The lines depart from a central transfer point in the innercity every half hour until 7:00 p.m. Afterward, a collective taxi service transports passengers, at discounted fares, until after midnight.

The Lemgo transit system is owned by the city and cross-subsidized with city revenue from other utilities, including electricity, gas, and water services.

In a recent user survey conducted by an independent agency, approximately 40 percent of City Bus passengers said that they formerly used heir private cars to make shopping trips in the city.

What Could Be Applicable to the United States?

The transit system in Lemgo set up large-lettered, easy-to-read signs at bus stops. The signs include the name of the bus stop and when the bus leaves.

In most of the countries visited, the bus route name and number are electronically displayed on the front of buses and the bus route number is displayed on the rear. In Lemgo, the route number is also displayed on the side of the bus. The system currently operates above its peak-period capacity during most months.

Bad Salzuflen

Transit Profile

Bad Salzuflen has a population of 56,000. The four-line Bad Salzuflen City Bus system, introduced in September 1994, almost tripled its ridership to nearly 1 million during its first year of operation. A quarter of the new passengers formerly used their own cars for trips to and within the city.

Described as a "quantum leap" over the previous public transit situation, the City Bus system operates with comfortable, lightweight, and energy-efficient midsize "metroliners," a carbon-fiber vehicle developed by Neoplan (see Figure 6).

Buses traverse the pedestrianized CBD until 7:00 p.m.; collective taxis are used until midnight.

A local private service provider operates the system under the supervision of the city's public works department. The system, which is based on the Dornbirn (Austria) model, is characterized by a central transfer bay in the heart of the shopping district, where all interline transfers take place. About 70 percent of the city's residents live within 300 m of one of the new bus stops.

What Could Be Applicable to the United States?

Like many transit systems visited, the Bad Salzuflen system takes great pride in offering convenient customer service centers with useful, servicerelated information. The system offers a model customer service center in a regional shopping area, with a central transfer point one block from the center. The center provides customers with seating and other amenities. Trained staff sell passes and tickets, disseminate schedules, and handle passenger inquiries and complaints. Regional information is also provided.

The shelters, buses, customer service center, printed passenger information, and signage are all color coordinated, highly visible, and attractive. Schedules and route information are tastefully depicted on buses, shelters, and customer service centers.

Trip cards illustrate schedule and detailed route information. A route map listing all bus stops and the number of the line (i.e., route number) appears on one side of the card; a timetable appears on the other side.

The Bad Salzuflen system has achieved regional service coordination and fare integration and has reduced the number of cars in the city center by one-half by imposing a limited auto zone.

Muenster

Transit Profile

Located in the center of the Muenster region, this city of 280,000 is one of Germany's most livable and environment-conscious communities. The university and its students are a prominent factor in the city, and bicycle traffic constitutes about onethird of all vehicle trips.

Two remarkable statistics put into perspective the role of the Muenster transit fleet:

- In 1995, the 20-line system with its 113 buses, 51 of which are articulated, carried more than 30 million riders over its route length of 334 km (207 mi), almost double the 17 million carried in 1989.

- The modal split shows that 56 percent of Muenster residents walk (24 percent) or bike (32 percent) to work or school. Eleven percent take public transit.

Students who use the system's unique "semester pass" account for 16 percent (4.6 million) of the Muenster transit system's bus ridership. Use of the system by local residents has increased steadily in the 1990s. From 1994 to 1995, passenger numbers rose from 28.8 to 30.2 million or about 150 rides per resident per year. This increase is due in large part to successful public relations and market segmentation. Various kinds of flash passes for employees, students, seniors, and family groups are actively marketed.

Farebox coverage of operating costs reached 64 percent in 1994, the last year for which an annual report is available. The shortfall was covered by cross-subsidies from the municipal utility, a widely used German model.

What Could Be Applicable to the United States?

In Muenster, a relatively large city, several routes converge along certain corridors. Great care is exercised in scheduling these routes so that buses do not bunch either inbound or outbound. This increases the frequency on the segments of the street network served by more than one route.

Muenster has express and limited stop operations. This is important because local transit travel speeds are typically lower than in the United States. (Despite longer interstop distances, off-board fare collection, and decreased traffic congestion, routes are often on narrow streets and the high level of customer boardings tend to reduce travel speeds.) In Muenster, a few routes operate city-express service in which every other bus with shortheadway (10-min) routes skips a number of stops. These supplemental buses do not operate during the summer.

The study team viewed examples of preferential treatment for nonautomobile transportation modes, including dedicated lanes for buses, bicycles, and pedestrians. Muenster contains a very extensive system of preferential transportation treatments. Muenster's bicycle mode share is 32 percent-much higher than in other German cities. Its major system of bus lanes (which allow taxis), bike paths, and pedestrian trails is integrated with a very sophisticated traffic signal system, including priority left traffic lanes for buses. This signal system optimizes the continuity of bus lanes by allowing "protected" right turns by buses leaving a bus lane across adjacent mixed-flow traffic lanes. Traffic is stopped and the buses have the ability to move to the far right lane to board and alight passengers.

An issue Muenster is dealing with is the peaceful coexistence between buses and bicycles, avoiding traffic conflicts where bicycles use bus lanes, and, in one case seen by the study team, where buses use a wide bicycle lane.

New concepts are emerging in new suburban developments such as bus-only streets, which separate bus and automobile traffic to increase transit operating speeds.

Scheduled taxi routes operate during the day in low-density areas at the end of three of the routes. These operate hourly and pulse at the outer terminal of the routes they serve. The bus operator may call a taxi on behalf of customers so that they can complete their journey.

Muenster prints schedules that include information for city and regional buses as well as railroads and airlines.

In the "old town" center, parking fees have increased and major improvements in transit service have taken place. A concept under consideration is to close the central area completely to private automobiles.

In larger cities such as Muenster, the significant increase in transit service was largely driven by strict federal laws governing air quality and noise as well as traffic and congestion mitigation.

The transit system planned and developed a number of park-and-ride locations on the outskirts of the city. The areas were designed with a number of passenger amenities including bus shelters. What is particularly appealing about these shelters is the voluminous information pertaining not just to the transit system and its routes, but also to the city, events, restaurants, and taxi services. The shelter walls depict an array of information for the transit rider, which makes transit even more convenient and appealing.

BELGIUM

Liege

Transit Profile

Situated on the Meuse River near the rich coal fields of the Meuse Valley, the city of Liege is one of the chief manufacturing centers in Belgium.

A total of 16 transit providers form a public-private association, known as the TEC Group, which serves the city and surrounding region of 84 communities. Transit systems include fixed-route urban and intercity services, school buses, and paratransit for individuals with disabilities. The TEC Group operates 187 bus lines in the region, using a total of 705 buses, 54 of which are articulated.

Passenger totals amount to more than 80 million annually, operating costs are approximately $128 million, and farebox and other receipts total about $58 million. This leaves about $70 million in subsidies from the local, provincial, and national governments.

The TEC Group is very active in marketing and promotion and offers free rides during the "car-free Sunday"

campaign. Graffiti and vandalism are sizable problems that are being tackled by a variety of initiatives.

What Could Be Applicable to the United States?

Transit officials in Liege believe that there is not enough coordination between planning and transit service design and delivery. The officials believe that the central city is losing jobs and that markets and housing are spreading into the outskirts, which are difficult to get to by bus. They note that more commuter-focused transit service is needed, with more bus lanes and park-and-ride facilities, all fully integrated into the planning of new residential and commercial developments.

Liege officials are frustrated that the street network in new residential areas are labyrinths, very difficult to serve with transit, but where people want to live.

A massive project is in progress in the city's Central Plaza area, in which a new center to link CBD modes of transport at the Central Plaza will be established. The project, known as Place St. Lambert, is designed to (1) replace a motorway project; (2) elevate the bus transfer center to street level and move car traffic below grade; (3) add a 2,000-space underground parking garage; and (4) construct buildings over the adjacent railway station so that homes, shops, and offices return to the area to bring back to the CBD everything that makes a city come alive.

The facility is designed to be people-friendly and to protect the heritage and history of the site, which dates back to Roman occupation. The city believes that public transit, which will link pedestrian travel to automobile parking and tie bus routes to rail lines, can be a catalyst for economic development around the central city transit center.

Some observers are concerned that the project does not fully support public transportation policy objectives. Specifically, they are concerned that (1) splitting up bus transfer locations within the plaza will be less convenient to transit users;
(2) the intermodal connection between buses and trains will not be convenient enough; and (3) expanding parking capacity in the CBD will increase congestion. The project is a result of negotiation and political compromise, and it is hoped that it will enhance the quality of life in and economic vitality of Liege.

This industrial city is dealing with much pollution. The transit system operates a large diesel bus fleet with three experimental compressed natural gas (CNG) buses. CNG buses are much more expensive than diesel buses (five CNG buses cost the same as seven or eight diesel buses). Transit officials are seeking to measure the overall environmental benefit of operating more diesel buses, which have the potential to eliminate more cars, against operating fewer, cleaner-burning CNG buses, which will result in fewer bus service hours because of the buses' high cost.

The maintenance facility is open to the public on Sundays for tours. Transit officials believe this allows the public to better understand transit and raises the community's awareness of the system.

Brugge

Transit Profile

A city of 118,000, Brugge is located on the low coastal plain 55 mi northwest of Brussels and 8 mi from the North Sea.

De Lijn, a single regional system that serves the entire province, including Brugge as its center, is characterized by total fare integration among its urban and interurban bus and rail systems. Ridership has increased substantially since 1990 when the independent private transit providers serving the region merged to form a single transit association.

New services include dial-a-ride in the countryside and high-speed express buses for commuters to Brugge and other cities in the province. De Lijn, which has successively built a series of fringe lots on the outskirts of Brugge, has been actively promoting the parkand-ride concept since 1991. This initiative reportedly has resulted in a 40 percent increase in transit use by commuters, with resulting benefits for the fragile urban environment. The national government has contracted with De Lijn for pilot projects to deal with traffic congestion in CBDs through the use of intelligent transportation system (ITS) technologies, including improved communication, intersection priority, and realtime passenger information systems.

What Could Be Applicable to the United States?

A 1,600-space park-and-ride garage was constructed outside the central core area next to the train/bus station (a 20min walk or a 5-min bus ride to the core). For $3 a day, users can park their cars, and all occupants of a vehicle (up to 5) can ride free to and from the core area.

This facility, coupled with 2-min headway transit service to and from the core area, has made a major dent in relieving serious automobile congestion in the delicate medieval city center and commercial district. This strategy was complemented with other transit service improvements (10-min headways on main roads and 20-min headways in the outskirts) and very limited automobile access to the core area, including no automobile traffic allowed in the core itself. This dramatically reduced automobile traffic and parking in the CBD, leaving Brugge a vital, attractive, and livable urban center.

Headquartered in Brugge, De Lijn, one of three regional transit companies, is known for its innovative marketing strategies and customer information systems. One strategy that proved successful for this operation was the "Info Bus." Info Buses are located in many places downtown and are staffed

with a driver and customer service representative.

The bus offers customized trip information. The concept was developed by an in-house cross-functional employee team and promoted by mass mailings to individual households in the service area. Some of the information available on the Info Bus include a map of the regional transit network, a leaflet with bus stop and personalized trip information for districts, and regional transfer information.

Ten thousand people visited the Info Buses. Although success is not measured in terms of new ridership, the regional operator believes that a certain percentage of significant growth in ridership can be attributed to Info Buses. The transit company plans to extend this marketing strategy to other areas within the region.

The Info Bus concept might be beneficial to U.S. systems that are restructuring their service, expanding service, and/or undertaking target marketing campaigns to increase ridership and revenue.

The transit system's marketing campaign has featured free rides on a "shopping bus" on weekends in December and allowing senior citizens to ride free for 1 month on Wednesdays and Sundays. The officials' philosophy is to offer special promotions every year to keep ridership growing and make the town center more livable.

NETHERLANDS

Unique Transit Features

One of the most impressive passenger information systems was found in the Netherlands. The country has completely integrated train, bus, and tram transport systems information on a national level using a technology referred to as "the traveler's friend" or *de reiswizer*. The technology is accessible and easy to use.

Riders simply insert a phone card into a machine and choose in which language they prefer their trip information: Dutch or English. The rider follows a simple set of instructions as they appear on the display (e.g., to enter destination address and arrival time). If the departure point is not from the rider's current location, he or she can enter a different pick-up point.

Once the information is entered into the computer, the rider will see a display depicting all the details for his or her trip, including the travel mode (train, bus, or tram). The rider can accept or reject the trip option presented. If accepted, the set of instructions appearing on the screen can be printed for the rider to carry. A brochure (in English and Dutch) describing this technology is available at a number of locations throughout the country, including all train stations. A nominal fee is debited from the rider's phone card each time the trip planner is used.

A rider may also call a nationwide 800 number to obtain trip information from customer service staff who use de reiswizer to provide accurate information to riders who are calling from home and others who do not have direct access to the service.

This type of technology offers incredible convenience to riders. Although cost information was not readily available, any cost-benefit analysis undertaken would need to consider the cost savings in personnel who would normally process automated trip requests and cost savings resulting from the expediency of customer service personnel in handling calls on the nationwide 800 number.

The Netherlands has standardized the national transit fare structure using the *Strippenkaarten* (see Figure 7). The same ticket can be used anywhere in the country for any given number of zones. Strippenkaart vending machines are located in train stations, bus stations, and shopping districts. To redistribute fare revenue, a national survey is taken periodically to determine the share of revenue a particularly carrier is to receive.

The Netherlands has tied land development into the quality of transit service. In its land use planning processes, the country has codified a clear priority for approving developments with public transit access. The country is divided into three types of zones:

1. Zone Category A: Locations with excellent public transit service
2. Zone Category B: Locations with sufficient public transit services, but that can be reached by automobile
3. Zone Category C: Automobileoriented locations with virtually no transit

When developers want to build housing or nonresidential projects (i.e., retail, commercial, and industrial), governmental preference in granting approval is given to projects in categories A and B. This is part of the Netherlands national policy on integrating land development with public transportation service and infrastructure development.

Breda

Transit Profile

This border city of 102,000, next to the Belgian frontier, is known as a pleasant residential and light industry area with much cross-border traffic.

The publicly owned BBA is responsible for transit in Breda and regional transit in the province of Brabant, including the midsize city of Den Bosch. The BBA fleet consists of 460 buses; 130 operate in the city, and 330 operate in the region. Daily passenger totals are approximately 160,000.

In addition to fixed-route service, a subsidiary of BBA operates the express "Interliner," a luxurious higher rate regional commuter service, as well as a dial-a-ride service for individuals with disabilities. BBA also works with private taxi firms to provide after-hours door-to-door service.

What Could Be Applicable to the United States?

In Breda, the BBA bus system is a leader in operating liquified petroleum gas (LPG) buses. LPG is common in Holland. All new BBA buses are LPG powered; by the year 2000, all BBA city buses will burn LPG. Regional buses will still burn diesel fuel. BBA officials report that LPG buses are quieter, cleaner burning, and better smelling and provide improved acceleration. Concern for the environment is part of the BBA mission; however, the LPG focus is also driven by the desire to maintain an edge in the very competitive public transportation business environment in the Netherlands.

Breda transit officials face a dilemma. From an outside perspective, parking prices are high, but still too low relative to transit fares. From a local business perspective, if parking rates are too high, people will do business in towns that compete with Breda.

The transit system runs a "Phone Bus" service, which is operated by taxis under contract with the bus company. The system, which is initiated by riders who call, uses vans to transport riders who do not live on regular bus routes. These vans are less expensive to operate than fixed-route buses in low ridership areas. The system also provides a village bus using volunteer drivers in small villages. This bus is less expensive to operate than the Phone Bus in even lower ridership areas. The village bus does not operate in the same areas as the Phone Bus. The system sells advertising on its buses for revenue, uses propane in some buses, and provides visual and audio stop announcements on the buses.

The transit system has undertaken an aggressive campaign to eliminate graffiti on buses. A specialist was hired to investigate each incident of graffiti. Photographs are taken each time new graffiti is identified. Because vandals repeatedly use most of the graffiti symbols, the specialist can ride the bus and catch the individuals in the act.

Perpetrators are fined and forced to perform community service by cleaning buses. If the individual is a minor, the parents can also be fined. Second offenses are considered criminal in nature. Local lawmakers were very cooperative by passing legislation. Graffiti declined by 60 percent in the first year. This aggressive strategy has also improved the image of the transit system in the community.

Dordrecht

Transit Profile

Situated along the Maas River, Dordrecht has a population of 100,000.

The City Transit Company, which is tied into the regional network, operates a fleet of 45 midsize low-floor buses with a staff of 207. Midsize buses were selected to improve maneuverability around the narrow streets of the old town area. Fixed-route services are offered in the urban area, and the city promotes park-and-ride fringe lots outside the historic center to ease traffic congestion. Reduced fares and free transfers among bus lines are offered to drivers who park in the fringe lots.

Dordrecht also operates a complementary commuter and rural district service with low-floor buses that have room for passengers' hand luggage. The bus driver stops in the countryside on demand anywhere along the route, not only at designated stops.

What Could Be Applicable to the United States?

Although the Netherlands has strong transit laws and policies, many officials agree that the country needs to establish more examples of proactive public transit that is integrated with land use planning and development design. An example of this is a new residential development outside Dordrecht in a semirural area. New bus lanes were built and transit service has been provided into the city since the development opened. The idea was to get new residents into the "transit habit" right away--before they developed the "automobile habit."

The bicycle and pedestrian culture of the European communities visited was very evident. Biking and walking are major modes of transportation. Some creative solutions in Dordrecht to further reduce private automobile travel include factories that provide bicycles to employees if they live within 3 km of the work site.

Maastricht

Transit Profile

Maastricht, the capital of the Netherlands province of Limburg, has a population of 85,000.

The Maastricht City Bus service, which was privatized in January 1994, is unique in that it offers transborder service between Maastricht in the Netherlands and Hasselt in Belgium. The fleet comprises 63 buses; staff members total 225.

City Bus offers a variety of services, including paratransit and dial-a-ride vans, which used to be offered only to persons with disabilities, but recently have been made available to all residents willing to pay a premium fare for door-to-door service.

The goal of the City Bus system is to fully integrate bus and collective taxi services, which are operated by the same private company. Company officials state that since privatization, cost savings of more than 40 percent have been attained.

Among the Stadtbus marketing initiatives partly responsible for improving financial performance are (1) the weekend "2-for-1" pass, (2) a promotion offered in conjunction with local department stores, (3) job tickets marketed to employers, (4) a tie-in with the cultural center to offer combined tickets and bus passes for each performance, and (5) night taxis for carnival revelers.

City Bus also operates a luxury, high-speed, limited-stop express service for commuters. Because the express bus benefits from intersection priority, the

bus gets commuters to their destinations more quickly than a private car does.

What Could Be Applicable to the United States?

In 1994, Stadtbus Maastricht, a public operator for 75 years, was established as a public corporation, with 100 percent of its shares held by the city of Maastricht. Some had anticipated that Stadtbus Maastricht and the regional operator, also a public corporation whose shares are held by the region, would be the only participants in the demonstration project-the competitive offering of the regional bus service. However, a new firm, Vancom Netherlands, was awarded the contract for service. Vancom began providing service in June 1995 as a joint venture with Stadtbus Maastricht.

Characteristics of the privatesector contractors include the following:

- Lower labor costs and greater flexibility in labor practices (i.e., mechanics who drive during peak-hour runs and bus operators who get only one relief period in a full shift); and

- Generation of necessary capital and streamlined purchasing procedures.

European Union directives will open competition among providers Europewide. Municipal and regional governments are becoming more the procurers of services and less the providers of services.

In Maastricht many routes converge on a segment of the main street between the rail station and downtown. Schedules are coordinated so that frequencies along the "main axis" are comparable to subways--every 2 to 3 min.

LESSONS LEARNED

To decrease automobile congestion, American cities and transit systems can consider the following actions.

Automobile Restriction

- Use pedestrian zones or automobile-restricted areas in congested areas.
- Enact more stringent local and regional policies that restrict automobile use and increase public transit services, which would make a bus trip more competitive regionwide.
- Establish automobile-free or automobile-limited zones, particularly in local areas with very poor air quality, in conjunction with highfrequency transit service to and from park-and-ride lots.

Integrated Pricing

- Increase parking rates incrementally in the short term, but work toward "market-rate" levels in the long term.
- Improve transit service levels in conjunction with raising parking rates, initiating some cross-subsidy funding.
- Establish a system in which the city's "customers" or "clients" pay reduced short-term parking rates and people who work in the city and others who park for significant lengths of time pay full market rates.

Marketing and Customer Information

- Use automated transit pass dispensers and chip, prepaid, and zone cards to simplify the purchase of monthly transit passes.
- Market transit passes to local universities as part of general student fees. In return, the university can advertise on the fare cards.
- Direct customer service representatives at transit systems to provide the schedules and telephone numbers of other transportation modes (e.g., Greyhound and other intercity bus lines, Amtrak, airport limousines, and taxis).
- Communicate with representatives from other modes to identify schedule and route adjustments that would enhance service to mutual customers.
- Mail transit schedules to all residents on a frequent basis.
- Communicate on an ongoing basis with representatives from all modes to optimize system integration; identify structural changes in routes and schedules that will improve customer convenience and make a complete trip more competitive with automobile travel.

Planning

- Establish close working relationships among public transit providers; city, county, and regional planning departments; and local developers and architects. This will facilitate opportunities to learn about land use planning and development design attributes that complement and support public transit and other critical services. Collectively identify potential changes in laws and ordinances that would help public transportation meet broader urban and regional objectives.
- Routinely review plans and designs for new residential, retail, and commercial developments. Provide comments regarding the project's compatibility with the delivery of public transportation services. Transit providers can get involved in comprehensive land use and transportation planning on the city, county, and regional levels and provide input as early (and often) in the process as possible.
- Build a long-term constituency (based on the initial efforts described previously) to engage planning departments, developers, and architects in integrating the vital links among public transportation service delivery, land use planning, and development design. This will go a long way toward achieving the larger community goals of economic vitality, quality of life, and long-term sustainability. Engage and involve elected officials and planning commissioners in this long-term

Figure 1.Stadtbus bus stop sign on an automobile-free street in Frauenfeld, Switzerland, emphasizes community pride.

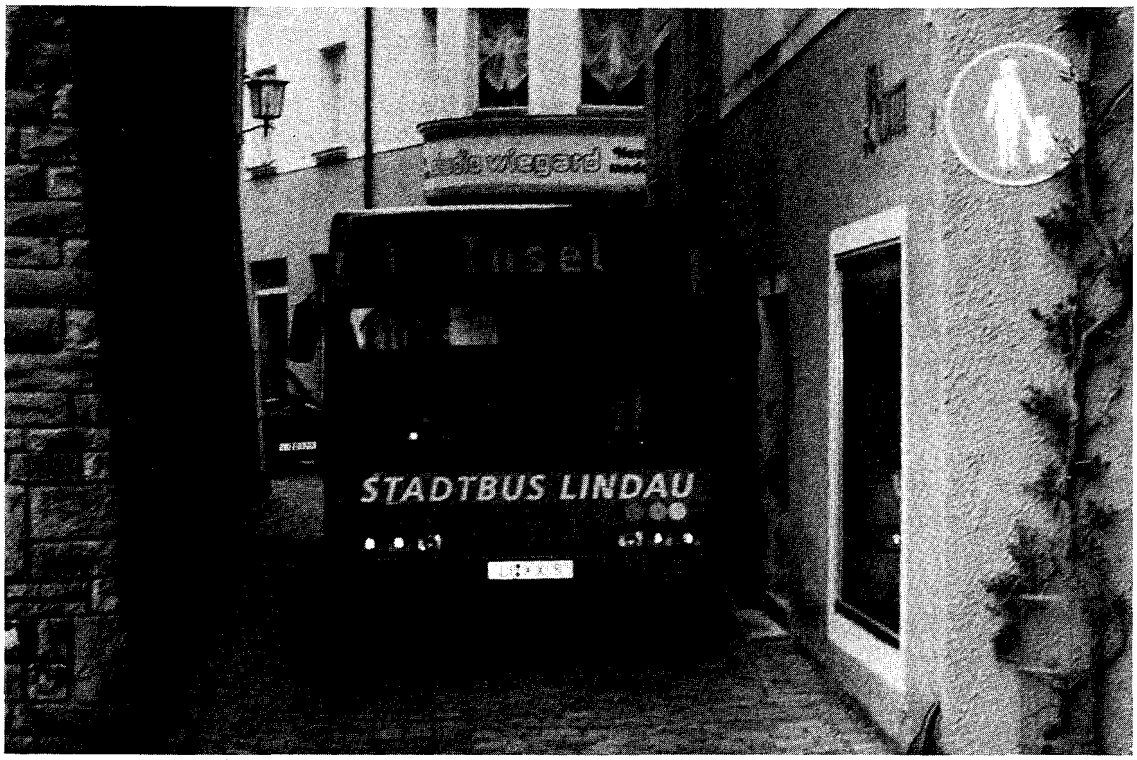

Figure 2. Low-floor "midibus "passing through the narrow streets of Lindau, Germany

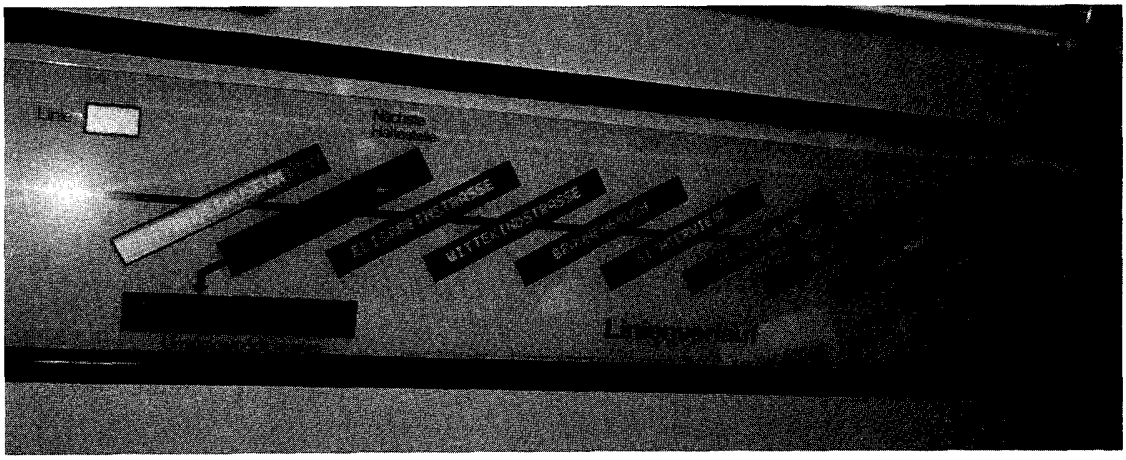

Figure 3. Onboard electronic next-stop information display.

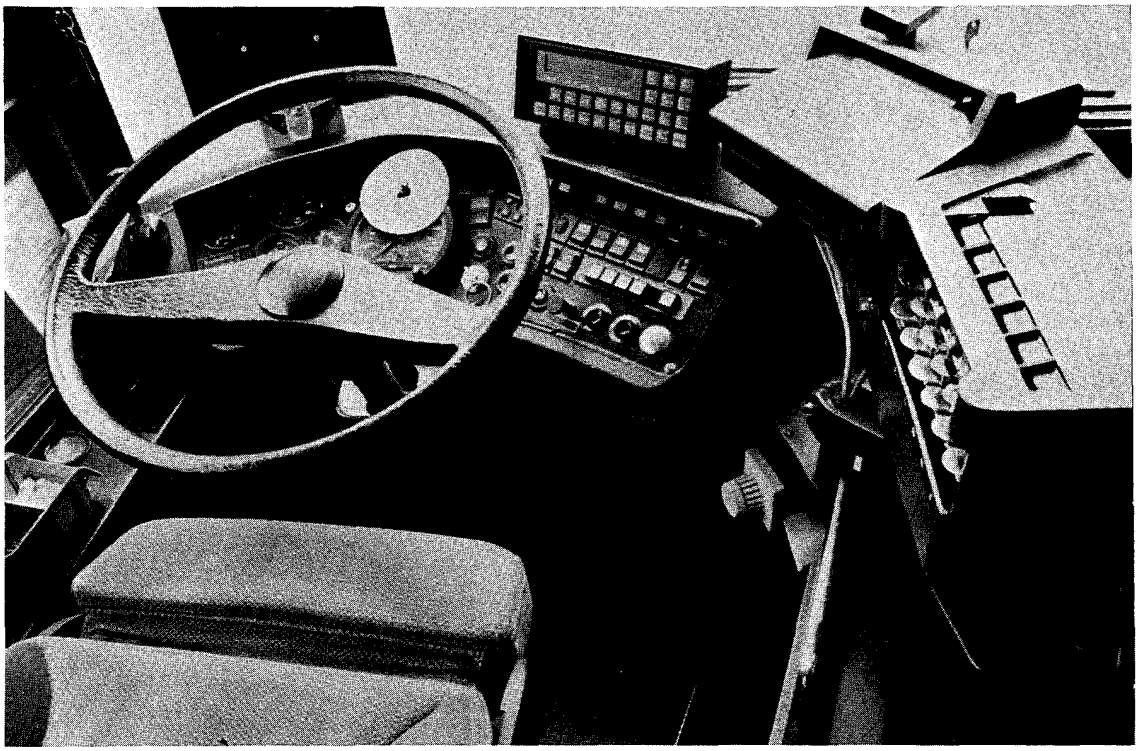

Figure 4. Operator compartment, with onboard electronics, on bus in Radolfzell, Germany.

Figure 5. (Top and Bottom) Color-coded bus stop sign posts in Dornbirn, Austria.

Figure 6. Mid-size low-floor bus in Bad Salzuflen, Germany.

Figure 7. Strippenkaarten vending machine in th Netherlands.

process, working toward changes in attitudes, laws, and practices.

- Consider inclusion of bus and HOV lanes and bicycle paths in all new roadway and roadway expansion projects.
- Develop a constituency for automobile-free zones that are for transit and pedestrian use only. Educate citizens and the business community on the benefits of these zones to the community and commerce.
- Link complementary modes when siting and designing new or expanded transportation facilities.

Route Design and Operations

- For small transit systems, draw from the central terminal concept where all trips originate and end.
- Establish signal preemption systems, providing intersection priority to buses at critical bottlenecks. Start small and build on successes, expanding the system in the long term to include more intersections and integration with transit-only HOV lanes.
- Where rights-of-way exist, establish bicycle lanes on major arterials, providing bicycle-friendly amenities such as racks, lockers, and showers in close proximity to major destinations.
- Develop high-frequency transit corridors, linked with a system of peripheral park-and-ride lots serving areas of high congestion; coordinate pricing with "market" pricing of public parking; and expand cross-subsidy between parking revenues and transit service costs.
- Shut down bus engines for layovers longer than 5 min.

Technology

- Purchase products and vehicles that feature European-style technology and vehicle design. Pertinent European styles include perfected low-floor buses, convenient vehicle-door locations, automatic passenger counting systems, improved bus operator driving areas with computerized digital panels and moveable steering columns, and overnight battery-operated heating systems.
- Use signal preemption technology for bus priority.

CANADIAN URBAN AND REGIONAL TRANSIT INNOVATIONS: MISSION 5, OCTOBER 14-27, 1996

INTRODUCTION

Canadian transit historically has had a well-deserved reputation for efficiency and effectiveness. Some transit factors are unique to Canadian society and governance, but many ideas can be used in the United States. Many lessons learned from the Canadian transit system experience appear to be useful for enhancing the quality of the U.S. environment and U.S. transit services. Canadian agencies are proactive to development, view development associated with transit investments in the long term, and have kept their transit systems simple.

While many transit strategies were familiar, it was the commitment to make strategies work, the pursuit of several strategies concurrently, and the overall community desire to meet the area's transportation needs principally through transit that seem to make Canadian transit efforts very effective.

The fifth study mission under the ITSP focused on model Canadian metropolitan and commuter rail, urban bus, infrastructure, and transit/land use developments. The team visited major operations, production, and maintenance facilities throughout Canada and brought back service improvement and productivity ideas relevant to U.S. public transit.

Transit systems in Quebec, Montreal, Ottawa, Toronto, Calgary, Vancouver, and Victoria and two production facilities were visited during this 2-week, coast-to-coast study.

QUEBEC

Transit Profile

Quebec, the capital of the Canadian province of Quebec, has a population of 168,000; the metropolitan area has 646,000 residents.

Transit service in the city and most of its surrounding region is provided by the Societe de transport de la communaute urbaine de Quebec (STCUQ), which serves a population of 448,000 in a service area of 478 sq km. In 1994, 322 million passengers were carried by STCUQ's fleet of 488 buses.

The system features two Metrobus routes, which provide frequent and rapid service along two major corridors through the city. Metrobus routes are on regular streets, often in reserved, segregated bus lanes, and Metrobuses make only limited stops.

STCUQ features the largest single transit depot of its kind in North America. The depot includes bus storage and maintenance facilities for the entire fleet as well as administration and management offices. Quebec City has many transit priority measures in place, including reserved lanes and intersection signal priority for STCUQ buses.

What Could Be Applicable to the United States?

The structure of STCUQ is similar to that of many regional transit authorities in the United States. The various municipalities within the service area are represented, and a portion of property tax revenues are dedicated to transit.

Although provincial policy decisions have an important bearing on local transit service, STCUQ staff indicate that the province has little influence on projects and does not attach requirements to funding. But the fact that funding is discretionary rather than formula based indicates that STCUQ has a significant influence on

project selection and design. The substantial capital support for the reserved bus lanes and bus procurement debt service signifies a provincial interest in the accomplishment of certain local and regional objectives.

In addition to funding reserved bus lanes, granting approval to establish and promote these lanes is an important step taken by the province. Removing existing lanes from general use for restricted HOV or bus use is extremely difficult in the United States; this is sometimes difficult even when new traffic lanes are being constructed. The STCUQ concept behind the successful campaign to reserve these lanes was that one-third of the traffic was being moved by buses; therefore, one-third of road capacity should be dedicated to buses.

Keys to the success of the Quebec system appear to be the ancillary mechanisms established to enhance transit services. In the case of reserved traffic lanes, the implementation of transit priority signalization provides a clear and distinct advantage for transit over general traffic. Further, the province requires that general traffic yield to buses exiting pull-out bays. Many U.S. transit systems are hesitant to build or use pull-out bays because of the difficulty operators can have in reentering the traffic flow.

The STCUQ vision of its core purpose is evident in how it deals with financial cuts. Services that retain the highest priority for funding are those that focus on high ridership, a high revenue-cost ratio, and peak-hour work-trip services, thus resulting in higher levels of financial efficiency for the system.

The restructuring of service in Quebec reflects selective applications of priority corridor treatments and bus priority technology to build highfrequency transit routes, resembling those on a light rail line. Transit priority (diamond lanes) were implemented primarily through taking an existing traffic lane. To minimize dissension, the lanes were created during a holiday period so that traffic would not be severely affected immediately.

Quebec implemented limited use of transit signal preemption. Preemption is provided only at a few strategic intersections where buses must move from a curb lane to a left-turn lane; a separate signal phase is provided for the bus to permit the turn. At transit centers, entrances are gated. The entrances open after buses are detected through a height-reading detector near the gate.

Although all systems visited in Canada offer extensive conventional fixed-route bus services, a number of them provide innovative transit services that address the needs of the lower density markets in their service areas. STCUQ operates a Taxibus operation along several routes on the periphery of its service area. This service is operated under contract by private operators, which run reservation-based fixed routes with taxicabs. These routes extend further into low-density areas and feed to the terminus stops of the regularly scheduled conventional fixedroute bus operations.

STCUQ is working with small stores, shopping centers, and churches to establish small park-and-ride lots throughout its service area. The agency enters into a cooperative agreement with property owners to allow parking for transit users at no cost to the transit agency. About 45 park-and-ride lots have been established. In general, the cooperating business owners and churches see the benefit of bringing potential customers and churchgoers, respectively, to their parking lots. The transit agency benefits by providing a means for potential riders to access the transit system. This is particularly important in some of the outlying areas where local circulator routes have been eliminated in favor of more frequent express buses on major corridors using reserved bus lanes (the Metrobus system).

MONTREAL

Transit Profile

Sometimes called the "Paris of the New World," Montreal is a cosmopolitan city with just over 1 million inhabitants in the city proper and 3 million in the region. It is the second largest metropolitan area in Canada, one of the world's largest inland seaports, a leading financial and manufacturing center, and one of Canada's oldest cities.

The Montreal metropolitan region is served by three independent carriers coordinated by a new regional agency, the Agence metropolitaine de transport (AMT). The Societe de transport de la communaute urbaine de Montreal (STCUM) is the largest of the three carriers. The two others are the Societe de transport de la Rive-sud de Montreal (STRSM), serving the South Shore, and the Societe de transport de la Ville de Laval (STL), which serves the city of Laval, just north of Montreal.

STCUM operates 1,626 buses and 759 Metrorail (subway) cars, serving a population of 1.8 million. In 1994, the system carried almost 340 million passengers. Features include the Metrorail, patterned after the Metro in Paris, and a number of priority measures for buses, including the "R Bus" routes that use either reserved or counterflow (or contraflow) lanes (see Figure 8). STCUM is the first Canadian operator whose fleet consists entirely of low-floor buses.

STRSM operates 335 buses along the urbanized South Shore of the St. Lawrence River. The service area includes 346,500 people. In 1995, the system carried more than 26 million passengers. Highlights include a major downtown Montreal commuter terminal and the use of European articulated buses.

STL operates 220 buses in an area centered around the city of Laval. The system serves about 330,000 people and carried 16.3 million passengers in 1994.

Its major transfer terminal is located at the Henri Bourassa Metro station on the extreme north of Montreal.

Commuter rail links in the region are coordinated by ATM and operated by CN Rail and CP Rail on a contractual basis. The Deux-Montagnes electric service, which operates from the Central Station, has been fully rebuilt and equipped with new Bombardier rolling stock.

What Could Be Applicable to the United States?

STCUM operates a full array of bus services throughout its service area and Metrorail service in the more densely developed areas. The two principal suburban transit operators, STRSM and STL, maintain extensive suburban bus systems. These operators coordinate their activities with STCUM by operating major commuter transfer terminals in Montreal.

STCUM's focus is on retaining existing ridership levels. With limited revenue, little population growth, and increasing suburban sprawl, the agency is using innovation, service efficiencies, and customer service to maintain its levels of service and ridership. Surveys conducted by the agency indicate that there is 12 percent loss of existing riders and a corresponding 12 percent gain of new riders each year.

In Montreal, transit is of great value to the public. STCUM is very aware of the public's perception and as a whole is moving forward. They especially took great care of their subway cars and stations. Montreal exhibits a true passion for customer service. It has changed from a projectoriented to a customer-oriented agency. One creative approach to getting close to the customer is an automated survey of people who have called STCUM for information. STCUM receives 700 to 880 inquiries daily.

STCUM further focuses on customers by making listening a high priority management skill. Listening to customer complaints and ensuring appropriate staff response has been emphasized through creation of an internal committee that reviews all complaints and responses.

One service that could have great application in U.S. suburban transit systems is Montreal's Between Two Stops Program. After 9:00 p.m., passengers concerned about safety can request to be let off anywhere along the regular route instead of at designated stops only.

Another element of this customer service orientation is the new moneyback guarantee policy proposed for implementation in the fall of 1997. The policy states, "We will be on time, guaranteed. If we are late, you don't pay." Other examples of innovations and efficiencies include the designation of exclusive bus lanes, which results in a quality service advantage as well as operational cost savings. STCUM recently renegotiated labor contracts, resulting in no salary increases for 2 years. It appears that both management and labor recognize the gravity of the current funding situation.

STCUM has been most aggressive in the area of public-private partnerships to raise revenue. STCUM is trying to significantly expand the portion of its budget generated by rental income and advertising. Besides the usual bus wraps, bus and train advertising panels, and subway station advertisements, STCUM has used hub cap ads, bus handstraps shaped like soft drink bottles, and even wrapped subway trains. Two ad campaigns using entire trains have been created to date, each generating more than $1.5 million per year for the transit agency.

STCUM is exploring the feasibility of commercializing entire subway stations. Transit officials have been meeting with representatives of the top 25 companies in Montreal to determine the level of interest in the concept. Subway train wraps are considered a communication device that signals the coming of the station commercialization program. The concept would be to turn an entire station over to a company, which could then paint the entire station in its company colors and logo, add stores, demonstrate new products, and distribute information. A demographic profile of the users of each subway station has been developed for this program. With 65 stations and more than 700,000 daily subway riders, STCUM has received substantial interest in this program and hopes to find a commercial partner for each of its stations, the largest of which serve more than 1 million users each month.

OTTAWA

Transit Profile

Ottawa, Canada's capital, ranks fourth among the metropolitan areas in the country with a population of more than 900,000. The city itself has about 340,000 inhabitants.

There are two major transit systems in the national capital region. The Ottawa-Carleton Regional Transit Commission, operating as OC Transpo, is the larger of the two, with 820 buses serving a population of 626,000. OC Transpo is the public transit operating arm of the regional municipality responsible for planning and operating transit services throughout the region.

The second system is the Societe de transport de l'Outaouais (STO), which serves the Quebec portion of the region. STO operates 186 buses, serving seven municipalities and 228,500 people. Its commuter lines reach downtown Ottawa.

The OC Transpo fleet moves more passengers to their destinations than any other comparable system in North America. In 1994, ridership totaled 73.4 million. The system is best known for its exclusive and extensive Transitway (or Busway)--a network of bus-only arterials that provide frequent and rapid service. During peak hours, 200 buses carry 10,000 passengers along the Transitway in each direction (see Figure 9). This is a considerably larger number of commuters than the number who use the Queensway, the region's major freeway, to get to their destinations. OC Transpo's concern for the environment has been demonstrated by green-space improvements

along all sections of the Transitway. An extensive tree and shrub planting program is underway. Previous eyesores, such as abandoned railway lines and trash dumps, have been transformed into linear parks.

Transecure, an innovative neighborhood watch program on wheels operated by OC Transpo drivers, summons emergency help for people in trouble or calls the police when suspicious or illegal activities are observed along their routes. Launched in 1989, Transecure is successful in assisting people in obvious distress, summoning medical help, stopping burglars in the act, and allowing people to use buses as shelters and safe havens until help arrives on the scene. Drivers are instructed to allow passengers to alight between regular stops after 9:00 p.m. if this brings them closer to their destinations and they feel nervous about their safety.

With its 148 articulated buses, OC Transpo has become Canada's largest user of articulated buses. OC Transpo also operates a number of communityoriented bus routes in the city's urban neighborhoods. The farebox coverage of the system was 58 percent in 1994 and the total number of full-time personnel was 2,143, all but 159 of whom were drivers and mechanics.

What Could Be Applicable to the United States?

The growth and development of Ottawa demonstrate a strong commitment by the community to quality-of-life issues. Examples include protecting the expansive green way, preserving historic structures, and operating an annual municipal program to maintain the Rideau River as the world's longest skating rink.

Another example of this commitment is the official "transitfirst" policy regarding Ottawa's transportation planning. Many resources available for transportation purposes are invested in public transportation, even though highway congestion does not appear to be a significant issue. Even during peak hours in downtown areas of Ottawa, long traffic delays are rare.

By observing Ottawa, U.S. cities can learn that there are several common fallacies in the transportation industry. One is that a large population, incredibly high densities, and a transitcaptive workforce are needed to generate significant transit usage. The population of the Ottawa metropolitan area is only 900,000, and the downtown workforce numbers 280,000. Approximately 88,000 of these workers are employed by the federal government; these workers are normally associated with white-collar, "choice" ridership. Parking downtown is $7 per day, and traffic congestion is not severe. Yet the system carries 74 million passengers yearly. Another fallacy is that severe congestion and heavy fare subsidies are needed to influence modal choice. The one-way fare on OC Transpo is $1.85 ($2.90 for express service), with monthly passes costing $72.50 (including express service); therefore, clearly there are no huge fare subsidies.

Another frequently cited impediment to transit usage is the need for trip chaining. Trips are rarely exclusively to work and back home. More often, they involve trips to shops and other services. The Transitway addresses these trip-chaining requirements in several ways. First, stations along the facility are well integrated with existing and new development, including several major shopping centers. Second, frequencies are such that passengers can get off the bus at a station and then catch another bus without incurring substantial delay. Approximately 70 percent of passengers on the system use monthly passes, allowing them to get off and on the system without having to pay additional fares.

Finally, many in the United States believe that choice riders will choose rail but will avoid buses at all cost. OC Transpo demonstrates that it is not necessarily the technology that attracts riders, it is whether the system works for the customer. People will use the system if it is convenient, affordable, and makes more sense than driving.

There is a strong regional focus in Ottawa. When the regional municipality was created, functions common to all member municipalities were transferred from local to regional control. These functions include planning, debt financing, sewage treatment, traffic control, public transportation, and social services. This consolidation provides greater coordination of public services. Another factor that aids Ottawa in its regional approach is that the transit commission is elected from the regional council, not directly from the municipalities.

The Communibus program is example of partnership at the community level. In response to funding reductions, OC Transpo evaluated routes in its service area and identified several poor-performing routes for elimination to help balance the budget. For some routes, the Communibus program provided an opportunity for a community to save its route. "Use it or lose it" type notices were placed in local newspapers to notify the community that the route was in jeopardy. A time limit was given for the route to be brought up to acceptable performance standards. In several instances, the community organized support though coordinated efforts of local merchants, service organizations, and community leaders, which boosted ridership.

OC Transpo's regional focus also is evident in its Transecure program, which has a number of communityoriented features. Employees serve this community watch program on wheels by using two-way radios in vehicles to summon help and to provide information on emergencies and other incidents. As mentioned previously, the program offers transit vehicles as a safe haven for people in distress. Similar to the Between Two Stops Program in Montreal, the Transecure Night Stop service allows passengers traveling after 9:00 p.m. to be let off at a location closer to their destination instead of at a regular stop.

TORONTO

Transit Profile

Toronto, the capital of the province of Ontario, is the most populated metropolitan area in Canada, with a population of 1 million.

The ridership of the Toronto Transit Commission (TTC), which is operated by the metropolitan government, is second only to New York City in North America. This results in part from the residential density of the city proper, which is nearly 20,000 persons per square mile. Highways and commuter trains and buses augment the transit system. Although Toronto's streets are congested with traffic, the city has resisted building major expressways. More than a dozen transit systems serve the Greater Toronto Area. The largest of these is operated by TTC, which provides service in the Toronto metropolitan area (about 400 sq mi), serving 2.3 million people. The system operates 1,539 buses (including 90 artics), 295 light rail vehicles, and 622 subway cars. In 1994, the system, known for its high degree of integration between rapid transit and surface routes, carried more than 388 million riders. Much urban development has taken place around many of the subway stations.

The Scarborough suburban rail line, also operated by TTC, uses linear induction technology (the same that is used by the SkyTrain in Vancouver). TTC is building a new surface light rail line, which is partially in operation along the waterfront.

The other major regional transportation provider, Government of Ontario Transit (GO Transit) is operated by an agency of the provincial government. GO Transit serves an area of 3,000 sq mi and sets the current North American standard for commuter rail with its fleet of 331 bilevel passenger cars and 49 locomotives. The system runs 139 trains and provides 1,000 bus trips daily, carrying 120,000 passengers on an average weekday (see Figure 10). The bus component includes 184 buses on suburban feeder routes, transporting 29,000 passengers daily. In 1994, GO Transit's ridership totaled 34.5 million.

What Could Be Applicable to the United States?

Toronto is a textbook example of coordinating land use policies with transit system development. At the regional level, the Municipality of Metropolitan Toronto (Metro) has provided a long-range plan for greater Toronto, with a strong emphasis on integrating transit and land use. The plan focused on developing compact corridors along Toronto's subway system, with high-density office, commercial, and residential development directed around subway stations. As growth continued, development was channeled into corridors extending along streets perpendicular to the subway lines and served by surface streetcar lines or highlevel bus services.

In addition to the compact corridor development strategy, two other land use planning approaches have been successfully used in Toronto. One is the development of urban centers, a concept also being implemented in Vancouver and Calgary. This approach is designed to promote better balance between the location of employment and residential areas and to encourage reverse commuting by focusing new development into "mini-downtown" or "satellite downtown" areas-to balance peak demands on the transit and road systems.

The other approach is the development of the underground Path system. During the past 25 years, a network of 21 km (nearly 13 mi) of tunnels and bridges has been developed to connect downtown subway stations to adjacent shopping centers and office buildings. The concept, which was incorporated into the area's land use plans in the late 1960s, has been incrementally developed primarily though private-sector initiatives.

GO Transit is a significant mover of people. Canadian officials have invested substantial financial resources in the country's commuter rail. They have also opted not to build freeways where commuter rail lines operate. This fact is probably the single most important lesson learned. Transit authorities in Canada have a real voice in what is built in their jurisdictions. Metropolitan planning decisions to implement commuter rail have saved the cost of building more than five freeway facilities.

GO Transit is not considered as commuter rail but as transportation for commuters. Service delivery affords other opportunities for creativity. For instance, during periods of light demand, GO Transit stops train service but operates buses along its commuter rail alignment. This brings costs in line with ridership without eliminating service. In addition, local buses which pulse at the GO Transit commuter rail station, operate flexible routes rather than fixed routes. In the evening, when demand lessens, the service area in Oakville (a suburb of Toronto with a commuter rail stop) is divided into four quadrants, with one bus operating within each quadrant. Still later in the evening, Oakville bus service quadrants are consolidated into two zones. This reduces the total expense of operation, while providing customers total area coverage that is more like a door-to-door cab service.

The TTC provides a designated waiting area on all subway platforms to ensure customer safety and security. These areas have brighter lights, an intercom, a closed-circuit television camera, and a public telephone.

CALGARY

Transit Profile

Calgary, with a population of 738,000, is the largest city in the province of Alberta. Transit is provided by a city-run system whose ridership in 1994 was 52.6 million. Calgary Transit operates 550 vehicles, 51 of which are

articulated and 85 of which are light rail.

The system is known for its "C Train" light rail service, which operates on two lines and serves the central, northwestern, northeastern, and southern parts of the city. The C Train operates on transit-only streets in the central city and on reserved rights-of way outside the core area. Altogether there are five light rail transit (LRT) lines in the city, with a total length of 18.2 mi and which are boarded on a weekday average (1995) by 112,700 passengers. More than 90 of the system's buses are of low-floor design. By percentage, this represents one of the largest fleets of low-floor buses in the country. Employees total 1,585, 113 of whom are employed in management and administration. Farebox coverage in 1994 was 51 percent.

What Could Be Applicable to the United States?

Using Calgary as an example, newly developing urban areas, similar to those in the Sunbelt and western United States, can grow in a manner that is conducive to high levels of transit use and service. Investment in the transportation infrastructure in Calgary is the result of a great deal of public outreach and involvement, and the investment decisions reflect community priorities. Both highway and transit systems are planned to complement each other, where appropriate, and to satisfy existing or planned growth as dictated by the adopted land use plans.

Transit accommodation exists in the form of an extensive network of facilities: a light rail line, extensive park-and-ride lot system, major highfrequency transit corridors, bus-only lanes, major cross-town high-frequency bus routes, and express service to employment areas.

Services are provided where they are most in demand. Transit is viewed not as a social service, but as an integral component of the transportation system. Many U.S. cities in high-growth areas might find Calgary's model relevant to examine.

Calgary provides the most impressive examples of progressive urban policy development. It has created a new government corporation that is responsible for administering a broad range of public services, including water, sewer, transit, and planning. With declining resources for roads and other public services, there is a greater focus on moving people and goods in a coordinated manner. To ensure that the corporation makes good investments, an annual census is taken, and every 3 to 5 years, a comprehensive origin/destination study is completed. Information from the census and the study helps the planning staff make proper projections, thereby aiding in the final decisions affecting delivery of public services.

Calgary's "Go" plan is an impressive example of a partnership between citizens, staff, and elected officials. The plan grew out of the concerns expressed by citizens in 1991 about what Calgary would look like as a result of its growth. These concerns prompted the city council to reconsider its existing transportation plan. The issues of community and environmental quality, along with mobility and costs, guided the overall approach in designing the new transportation plan. These four concerns surfaced as a result of significant discussion and broad-based public input. The vision of how Calgary will look in 30 years achieved wide acceptance as citizens became more involved and informed. The Calgary planning model is an excellent example of creating public ownership in the process, vision, and outcome.

Financial restrictions led to the development of business-based planning approaches for introducing and assessing bus routes. Both Ottawa and Calgary make service decisions based on the potential ridership benefits per unit of service cost. This clearly reflects an underlying value: Serve more people for less money.

Calgary also responded with a unique approach to funding paratransit door-to-door service, which is more expensive per passenger trip than fixedroute transit. Calgary obtains private donations for the purchase of the paratransit fleet. Individual vehicles are marked to honor people who make donations. One staff position is dedicated to obtaining private funding, which in turn frees up more dollars for service delivery.

Calgary has also developed a partnership with local providers of school bus service. Calgary Transit schedules school bus service and provides field supervision. The school system continues to purchase, operate, and maintain vehicles, but has been able to eliminate supervisory staff. The public benefits through this arrangement, which eliminates duplicated functions between two publicly financed institutions.

VANCOUVER

Transit Profile

Located just north of the U.S.Canada border, Vancouver is the industrial, commercial, and financial center of British Columbia. Greater Vancouver is Canada's third largest metropolitan area, after Toronto and Montreal. Vancouver is 140 mi north of Seattle, Washington. Extending over an area of 44 sq mi, metropolitan Vancouver, with more than 1.6 million people, contains almost half of British Columbia's population; the city proper has a little over 470,000 inhabitants.

The city is characterized by a strong downtown, surrounded by highdensity neighborhoods, which encourage walking and high transit usage. Although suburban areas have a lower density, many regional subcenters have begun to develop as a result of regional planning and rapid transit investment. The city itself remains one of the few in North America without a freeway.

Vancouver is one of the fastest growing metropolitan regions in North America, with a net annual population gain of more than 40,000.

BC Transit is a Crown (public) corporation of the province of British

Columbia. Its 17-member board of directors, appointed by the responsible minister, is made up of elected and appointed officials from the communities served by the system. The board is responsible for transit policy making and coordination, including the planning and funding of transit systems in the province. All transit assets, including fleet, facilities, and guideways, are owned by the corporation.

The chair of BC Transit is appointed by the provincial cabinet. The day-to-day business of the corporation is conducted by a president and chief executive officer, assisted by six corporate support units: finance, technical services, corporate services, security, human resources, and strategic planning. Customer services are delivered through four business units: Vancouver Bus, BC Rapid Transit Company (BCRT), West Coast Express (WCE), and Victoria/Municipal Systems (VMS).

Transit oversight services in British Columbia are provided in partnership with local governments and regional transit commissions. In the Vancouver region, a commission represents the 17 municipalities, the electoral districts, and three villages constituting the Vancouver Regional Transit System (VRTS). Commission members are the local mayors, city councilors, and electoral district representatives, some of whom also sit on the board of directors. Representation is geographically based, with one commissioner representing a specific group of municipalities.

Under the province's BC Transit Act, regional transit commissions are responsible for the following:

- Determining routes, service levels, and performance standards;
- Reviewing and recommending annual operating and capital budgets to the BC Transit board; and
- Raising the local share of the transit deficit through local taxation.

VRTS serves a population of 1.7 million with an integrated network of services including diesel, CNG and electric trolley buses, passenger ferries (SeaBus), automated light rail transit (SkyTrain), and commuter rail (West Coast Express) (see Figure 11). Covering an area of 1,125 sq mi, VRTS represents the largest urban transit service area in Canada. With more than 115 million revenue passengers per year (215 million unlinked trips), VRTS ranks third in overall ridership, after Toronto and Montreal. Although a downturn was experienced during the recession in the mid-1980s, system growth has been very strong during the past 5 years. Since 1987, transit service has expanded by 37 percent, ridership by 28 percent, and the fleet by 74 percent.

The main components of the system are urban buses and trolley buses, SeaBus, SkyTrain, and the West Coast Express.

Urban Buses and Trolley Buses

The fleet consists of 675 diesel and 25 CNG buses, plus 244 electric trolley buses, for a total of 944 vehicles. Buses come in a variety of sizes. All bus services in the metropolitan region are operated by BC Transit, except for in West Vancouver, where the municipal authorities run bus services under contract to BC Transit. Wheelchair lifts and low floors are used throughout.

SeaBus

This service consists of two double-ended catamaran ferries with a capacity of 400 passengers each. Opened in 1977, SeaBus travels 1.75 nautical miles across Burrard Inlet between downtown Vancouver and Lonsdale Quay in North Vancouver. The *Burrard Beaver* and the *Burrard Otter* depart every 15 min and carry about 11,000 passengers daily. SeaBus is operated by Vancouver Bus.

SkyTrain

A completely automated, driverless system, SkyTrain connects downtown Vancouver with suburban New Westminster and Surrey, serving 20 stations along its 28-km (17.4-mi) route (see Figure 12). Opened 10 years ago, SkyTrain uses state-of-the-art linear induction and moving block technology. Most of the route is elevated, but in downtown Vancouver, the line operates underground. Office and commercial developments built within walking distance of SkyTrain stations are currently valued at more than C $5 billion (approximately $3.8 billion). The line now carries approximately 115,000 passengers each workday, and passenger totals have more than doubled since the line first opened. SkyTrain is operated by BCRT, the wholly owned BC Transit subsidiary.

West Coast Express

A new 40-mi commuter line connecting some of the eastern suburbs with downtown Vancouver, West Coast Express (WCE) commenced service in November 1995 and operates bilevel cars similar to those used by GO Transit in Toronto (see Figure 13). The service also features "cappuccino cars" for its commuter clientele. Currently it consists of five trains westbound in the morning and five eastbound during evening rush hours. The WCE fleet consists of 5 locomotives and 28 bilevel cars; ridership is increasing and now stands at 5,500 per day.

What Could Be Applicable to the United States?

Though geographically separated by the Strait of Georgia, both the cities of Vancouver and Victoria provide transit services through BC Transit.

BC Transit operates a full array of transit services throughout its service area, including conventional fixed-route bus, trolley bus on heavier fixed routes, the SkyTrain system, the unique SeaBus, and the WCE commuter rail service. BC Transit is planning to expand its family of services in the lower density and suburban sections of its service area. Minibus-based

operation of regional center circulators, community-oriented feeder services, and suburban demand-responsive basic mobility services as well as shared-ride taxi services are actively being devised.

A key to Vancouver's success in planning for and implementing its extensive network of transit facilities and services is its general policy of constrained roadway building. No new expressways or freeways are being built; in fact, none exist in the metropolitan area. There is emphasis on the use of public transportation as the means to serve intraurban mobility needs and to accomplish land use and city-shaping objectives. The funding of transit projects, therefore, is not seen as a diversion from traditional highway funding sources, but simply the result of a conscious decision on the part of the community to address mobility needs.

Following are some outstanding features of transit service in Vancouver:

- Coordination among various transit modes, which is evident through nearly seamless transfer connections;
- Strong linkage between land use planning and development; and
- SkyTrain, which is viewed as a tool to shape urban growth.

VICTORIA

Transit Profile

One of the oldest communities in the province of British Columbia and the provincial capital, Victoria has a population of 72,000 and a metropolitan area population estimated at 317,000.

Victoria/Municipal Systems (VMS), an integral component of BC Transit, currently operates a fleet of 190 buses in Victoria and carries 17 million passengers annually. The paratransit system has 31 vehicles that carry 190,000 passengers annually. Accessible conventional transit service was introduced 5 years ago using low-floor buses that offer easier boarding for all passengers and full accessibility for people in wheelchairs. The system provides attractive levels of service on major corridors, focusing on downtown. In the important commuter market, the percentage of transit to downtown approaches 15 percent of all travel on a 24-hr basis. A recent survey revealed that more than 60 percent of the region's residents boarded a transit bus in the past year.

By concentrating recent expansion in the peak hours, the transit system is developing a strong regional commuter focus, with 15-min frequencies during peak hours from the outer reaches of the transit service area about 20 mi from the central business district to downtown. Total operating revenue covers roughly 50 percent of the total direct operating expense; municipal and provincial subsidies cover the balance. During the past decade, Victoria's transit system has consistently maintained one of the lowest accident rates in North America, for which it has received numerous awards. VMS has a total workforce of 480 employees, 67 of whom are employed in management and administration.

On-Street Management System

A notable, recent VMS innovation has been its on-street management system, which eliminates central control and combines new radio and computer technology with a simplified organizational structure. The system enhances service reliability, improves safety, and decreases costs. Direct radio links with police, fire, and ambulance services also provide spin-off benefits to the community.

Victoria's on-street management program allows the transit service to be managed from the road supervisor's vans, eliminating the need for central control and saving C $328,000 ($252,000).

What Could Be Applicable to the United States?

Like many of the other cities studied, Victoria's transit system is characterized by a strong customer focus. Its marketing focus has been on specific age groups, where the network's increase in ridership has been.

Strong concern for the environment is evidenced by the Victoria region's Task Group on Atmospheric Change, which encourages increased public transit, and the provincial Greenhouse Gas Action Plan, which recommends reducing vehicle trips through mass transit, carpooling, and other measures.

Victoria's Busline project is a prototype, computerized telephone information system. The system provides customers with the following information: (1) bus departure times and when the next bus will arrive; (2) instructions on how to get the bus; (3) general transit information; and (4) connections to other modes. Before this project, about 29 operator hours were available to answer 770 calls for information per day, with 36 percent of the callers experiencing busy signals and 18 percent put on hold. The project increased calls to 940 and improved service, without adding additional operators. The project cost $590,860, and projected savings over 10 years is estimated at $1.5 million, for a net value of $447,000.

Transit service is an important component of the public service in Victoria, and the Victoria Regional Transit System has obtained a strong commitment to public transit with high levels of service and use. The successful image of a high-quality, safe and dependable service played an important role for entry into several partnerships. Partnerships have been established with 45 municipalities to improve the traffic flow.

The university has raised tuition cost to help subsidize the student bus pass program. This program benefits the community because it reduces heavy automobile traffic.

LESSONS LEARNED

Several conclusions can be drawn from the transit experiences in Canadian cities in terms of applying

successful transit service techniques to U.S. cities. But first, a caution is necessary. In almost every case examined in this study, transit has been a major component of the transportation system for a long time.

For example, the tremendous ridership levels in Ottawa are not the result of implementing the innovative Transitway. These levels existed before the Transitway was developed. The Transitway made transit service more efficient and effective, but was not necessary to induce people to choose transit. Similarly, high transit ridership in the larger cities of Montreal and Toronto is a continuation of longestablished patterns. Transit can be extremely successful and relevant. But in the United States, it is likely that potential customers will first have to be convinced to leave their cars at home. What makes transit in Canada such an important and relied on component of city infrastructure? Unlike the United States, why is "transit first" common policy in Canadian metropolitan areas? Rather than dismantle existing transit systems in the early part of this century, Canadian cities chose to invest and develop them. At the same time, U.S. cities were heavily investing in highway development.

As a result, existing transit systems in the United States deteriorated because of lack of adequate public funding, while Canadian transit continued to grow and play a major role in urban development and sustainability. The view that the public will continue to rely on public transportation in Canadian cities continues to affect land use planning and long-term development of metropolitan areas. As a result, transit is servicing existing developments, and new developments are planned to support existing transit facilities.

Some might conclude that transit is popular in Canada simply because it is part of the culture and Canadians are used to using it. But what makes transit effective, as demonstrated in every site visited during this mission study, is transit's competitiveness with other modes of travel in terms of time. In every city, most peak-hour trips to the downtown area are faster and less expensive than comparable trips by automobile. Extremely high service frequencies during peak hours, combined with exclusive transit facilities in each city, make transit more appealing. Whether these exclusive facilities are light rail, dedicated transit lanes on existing highways, or exclusive transit ways, each operates independent of the flow of traffic.

Operating transit services is tricky, with many impediments to success. Although there are definite differences in society, form of governance, provision of public services, labor relations, and community outlook between Canada and the United States, a number of lessons learned from this review of Canadian transit experience appear to be relevant for possible U.S. application.

- Being proactive rather than reactive is important to transit development.
- It is important to understand the cyclical nature of the transit business and to view transit investments and the development that will follow in the long term.
- Numerous markets require customized and innovative, not necessarily large-scale, services.
- Passengers are customers, and customers need a range of services and well-presented information to ensure that they remain consumers.
- Transit systems should be kept simple.
- Transit operators have to go beyond their usual role of operating buses and trains efficiently and must become involved in infrastructure activities to ensure that the operating environment is transit-friendly.

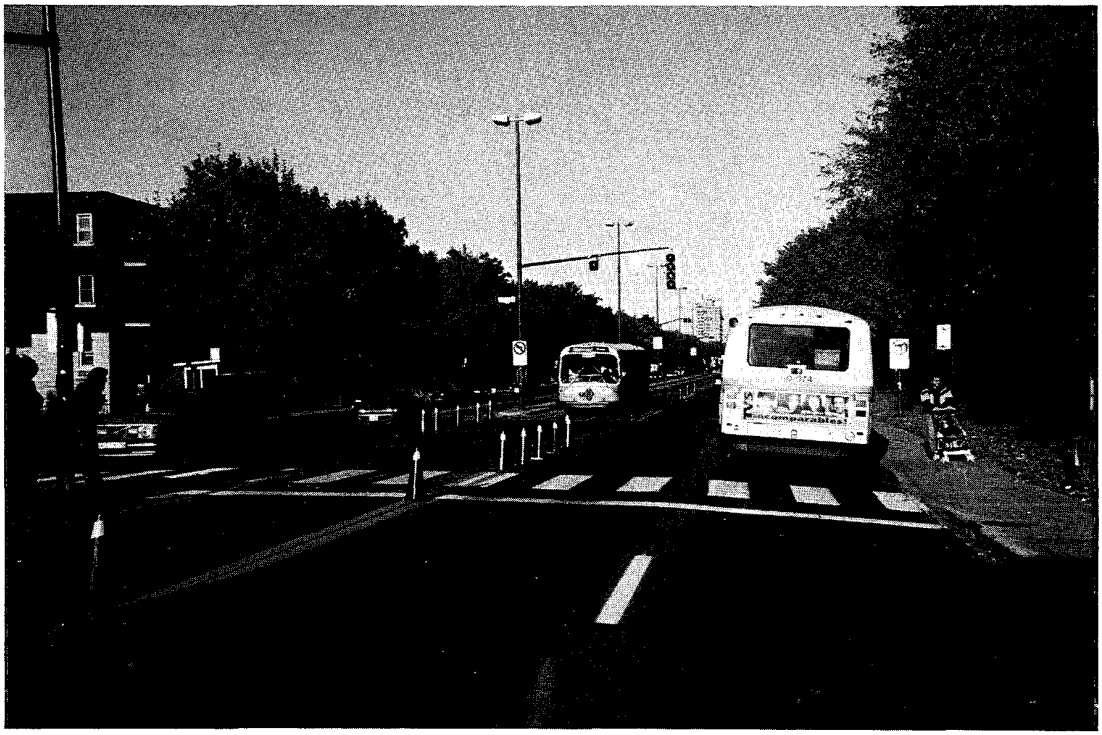

Figure 8. Contraflow bus in Montreal.

Figure 9. Busway in Ottawa.

Figure 10. GO Transit bilevel commuter rail wrap in Toronto generates $10, 000 per carper month in revenue.

Figure 11. Sign in Vancouver at the intermodal Waterfront Station displaying directions to SkyTrain, West Coast Express commuter rail, and SeaBus.

Figure 12. The driverless SkyTrain in Vancouver is accessible to high-rise development.

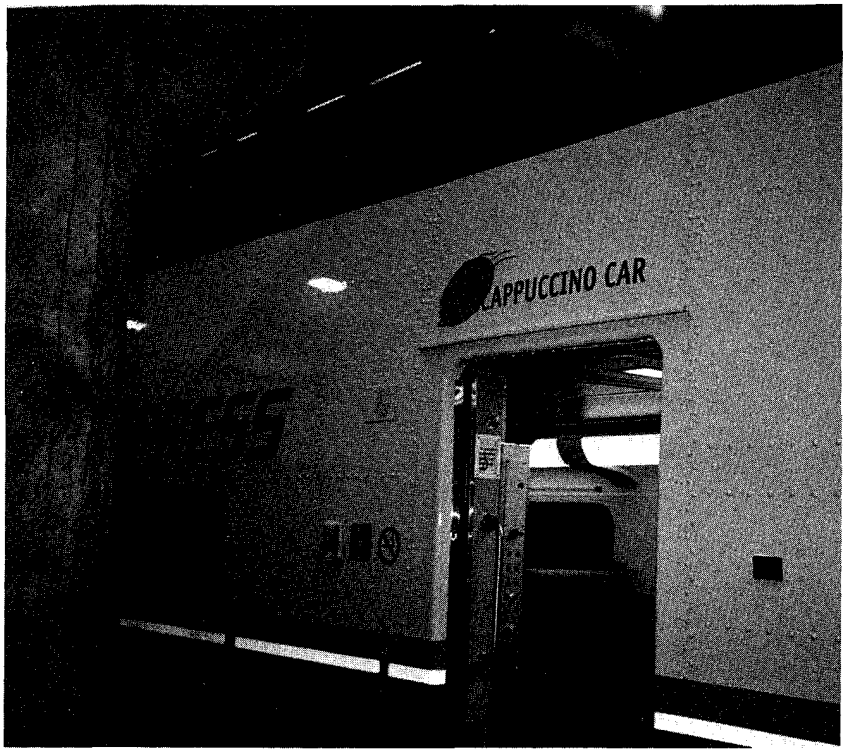

Figure 13. Cappuccino car on West Coast Express commuter rail in Vancouver.

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APPENDIX A

MISSION PARTICIPANTS AND THEIR TITLES AND AFFILIATIONS AT THE TIME OF THE MISSION

Mission 4--May 9-26, 1996: Urban and Regional Bus Operations in Smaller European Cities (Zurich, Schaffhausen, and Frauenfeld, Switzerland; Dornbirn, Austria; Lindau, Radolfzell, Ravensburg,Detmold, Lemgo, Bad Salzuflen, and Muenster, Germany; Antwerp, Liege, and Brugge, Belgium; Breda, Dordrecht, Maastricht, and Amsterdam, Netherlands)

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APPENDIX B

European Hosts Perspectives of "What They Do Best"

City	Outstanding System Features
Zurich, Switzerland	• Signal preemption for intersection priority for buses • Interconnections of trams, buses, and trains • Fare integration and honor system
Schaffhausen, Switzerland	• 10-min headways • Signal preemption at intersections • Schedule mailed to each household
Frauenfeld, Switzerland	• Good passenger amenities at bus stops • Honor fare system for quick loading and unloading • 15-min peak and 30-min off-peak headways
Dornbirn, Austria	• Strong advertising • Simple schedule with timed-transfer point in the city center • Privately contracted service that saves money
Lindau, Germany	• Good image, good appearance of buses, and friendly personnel • 3-min headways • Good passenger information with color maps and schedules
Radolfzell, Germany	• 3- to 4-min walk for customers from a bus stop • Convenient fares and boarding • Good image and logo and preemptive signals at intersections
Ravensburg, Germany	• Lean management • Color-coded image for marketing campaign • Center-city transfer facility with amenities
Detmold, Germany	• Increased bus frequency • Emphasis on good marketing campaigns • Easy-to-understand schedule
Lemgo, Germany	• More direct routes • Improved passenger shelters • Increased service to 30-min headways
Bad Salzuflen, Germany	• Comfortable service • Easy-to-understand schedule • Low price
Muenster, Germany	• Improved service to 10-min headways • Student pass system • City policies that increased parking fees
Liege, Belgium	• Rebuilding of the city center with a transfer center • Regional coordination • Exclusive bus lanes with signal preemption at intersections
Brugge, Belgium	• New route system with a 10-min headway • Automobile-free historic downtown • Info Bus program
Breda, Netherlands	• Employee motto is "customer first" • Well-defined quality standards to which employees adhere • Phone bus for door-to-door service
Dordrecht, Netherlands	• Recognition that the system cannot serve all customers in the same way (i.e., distinguish between senior citizens and commuters) • Increased headway of buses in the city center with smaller buses • Friendly drivers
Maastricht, Netherlands	• National phone number for information • Private contract • Efficient and frequent service