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International Transit Studies Program Report on the Spring 1997 Mission Public-Private Partnerships and Innovative Transit Technologies in Scandinavia

This TCRP Digest summarizes the sixth mission performed under TCRP Project J-3, "International Transit Studies Program " The report 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 of the Eno Transportation Foundation, Inc, the contractor for 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 (TDC), 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 transport problems and issues.

The program arranges study missions in which teams of public transportation professionals visit exemplary transit operations in other countries. Each study mission focuses on a central theme that encompasses issues of concern in public transportation. Cities and transit systems to be visited are selected on the basis of their ability to demonstrate new ideas or unique approaches to handling public transportation challenges reflected in the study mission's theme. Each study team 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 to evaluate current and proposed transit improvements and can serve to identify potential public transportation research topics.

Study missions normally are conducted in the spring and fall of each year. Study teams consist of up to 15 individuals, including a senior official designated as the group's spokesperson. Transit agencies are contacted

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directly and asked to nominate candidates for participation. Nominees are screened by a committee of transit officials, and the TCRP Project J-3 Oversight Panel approves the selection.

Study mission participants are transit management personnel with substantial knowledge and experience in transit activities. Participants must demonstrate potential for advancement to higher levels of public transportation responsibilities. Other selection criteria include current responsibilities, career objectives, and the probable professional development value of the mission for the participant and sponsoring employer. Travel expenses for participants are paid through TCRP Project J-3 funding. For further information about the study missions, contact the TCRP (202/334-3089) or the Eno Transportation Foundation (202/879-4712).

About the Report

The following report is an overview of the sixth study mission. 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, TDC, APTA, FTA, or the Eno Transportation Foundation.

PUBLIC-PRIVATE PARTNERSHIPS AND INNOVATIVE TRANSIT TECHNOLOGIES IN SCANDINAVIA (MAY 23-JUNE 7, 1997)

Introduction

The three northern European countries (Finland, Sweden, and Denmark) visited by the study team have instituted public transit policy and operational reforms over the past decade. These reforms have been aimed at reducing costs and providing more efficient operations. The Scandinavian models are based on the contracting out of bus and commuter rail operations by the public sector to private providers with the retention of strict service standards and fare policy supervision.

Local authorities (in most cases, counties or comparable jurisdictions) have organized management companies responsible for policy, financing, marketing, tenders (i.e., bids) and contract supervision. Private, nationwide bus operators and public-private rail companies are in charge of operating bus services, urban rail, and commuter trains. The counties and local communities share in deficit financing under the Scandinavian models. The national governments no longer provide subsidies.

Farebox recovery has climbed in all three countries since competitive tendering (i.e., competitive bidding) was instituted in the late 1980s. There have been three successive waves of bidding in which public and private carriers have won tenders for bus and rail operation. Neither sector seems to have a definitive advantage.

In addition to visiting cities in Finland, Sweden, and Denmark, the group also took a 2-day visit to the World Congress of the International Union of Public Transport (UITP) in Stuttgart, Germany.

This report has two main sections. The first section provides an overview of the transportation services in each city studied by the team (i.e., Helsinki, Finland; Stockholm and Gothenburg, Sweden; Copenhagen, Denmark; and Stuttgart, Germany). The second section focuses on the main transit strategies and technologies observed by the mission participants and, where applicable, suggests application for use in the United States. Appendix A lists the names of the study mission participants and their titles and affiliations at the time of the mission.

TRANSPORTATION PROFILES

This section presents a brief discussion of the transportation services offered in each of the cities visited by the study mission team.

Helsinki, Finland

The Helsinki Metropolitan Area Council (YTV) is responsible for land-use planning, transit, waste management, and pollution control in the metropolitan region. This region has a population of about 1 million--one-fifth of the entire country--and includes the city of Helsinki and its suburbs, along with the cities of Espoo (pop. 183,000), Vantaa (pop. 161,000), and Kauniainen (pop. 8,000). YTV was created by an act of parliament, which specified the council's areawide responsibilities in service provision.

Two million trips are made every weekday in the YTV area. Roughly one-half of these trips are made by car, one-third by public transit, and the rest by bicycle or on foot. In the current modal split, private cars (46 percent) and buses (19 percent) are the leading modes. The rest are divided among trips on foot (15 percent), commuter rail (8 percent), bicycle (7 percent), and interurban trains (4 percent). Among the trips on public transit, 60 percent are made by bus, 17 percent by tram, 12 percent by commuter rail, and 11 percent by trains. Figure 1 shows the Helsinki train station.

Helsinki City Transport (HCT) is the largest transit provider in the metropolitan region. It accounts for about 330 buses, 105 light rail cars, and 42 metro coaches. HCT, one city-owned and five private bus companies, the state-run railway company, and a private ferry handle the balance of public transit within the region. There is full-fare integration throughout the region, which is divided into three fare zones. A multizone ticket or monthly pass costs about double the single-zone fare.

HCT employs about 5,000 people and obtains about 55 percent of its income from the farebox. The shortfall is paid by the member cities. The central government does not contribute to the operation or construction of public

transportation, except for the railway lines and the commuter rail extension.

Private bus companies, which provide service to cities and regions (e.g., YTV) and are closely monitored by them, form the backbone of the country's transit services.

Electronic fare collection is being introduced throughout the region. In some Finnish cities, contactless fare cards are already being used. Light rail is being expanded, and passenger information systems are being upgraded. Route and timetable information has been available to computer users since 1995, and real-time passenger information systems on main bus routes and terminals are in the planning stage.

Stockholm, Sweden

To make public transit funding, policy, and operations more responsive to the needs of users, a phased reform in Sweden, underway for more than a decade, has shifted responsibility entirely to the nation's 24 counties. In most cases, the counties have organized management companies responsible for policy, financing, marketing, tenders, and contract supervision. Private bus firms and public-private rail companies are in charge of operating local and commuter traffic.

Under this system, the counties and local communities share in deficit financing; the national government no longer provides subsidies. Farebox recovery climbed to about 44 percent in 1996 from less than 30 percent between 1988 and 1990. The counties are responsible for most of the public transit subsidies (on average around 35 percent), while the local communities absorb between 15 percent and 20 percent of the deficit funding. In Stockholm, the share of the county council comes to about 54 percent; local communities within the Stockholm region are not involved in meeting the shortfall.

Under the terms of the Dennis Agreement, worked out by the major political parties, the government and the Stockholm County Council are funding new transit infrastructure in the Stockholm region. This will amount to SEK 40 billion (U.S. $5.6 billion) in the 1992--2006 time frame, of which SEK 18 billion (U.S. $2.6 billion) will be invested in public transit. Additional costs for the projected Stockholm Ring and Outer Bypass Roads, designed to reduce traffic in the city, will be covered by road tolls. A dedicated trunk network for buses in the inner city and new light rail lines in the suburbs are expected to improve the street environment and cut transit times by more than one-third.

Responsibilities for carrying out the transit reforms mandated by the agreement are shared by Sweden's Road and Rail Administrations and Stockholm Transport (SL).

At the time of this mission, roughly three-fourths of the bus and metrorail lines were operated at major cost savings by the public and private carriers who submitted successful bids. In addition, the bus trunk network was under construction. When completed by the end of the century, the reserved lane trunk network, with intersection priority throughout, will drastically reduce transit time and traffic congestion in the inner city. Three-fourths, or 150 buses of the inner city fleet of 200, is already methanol-powered, and 6 electric articulated buses are in revenue service on a trial basis.

The metrorail system is being upgraded with 400 new ABB. railcars. Bus and train terminals have been modernized and equipped with convenient transfer and passenger information systems.

Gothenburg, Sweden

Trafik Kontoret, Gothenburg's traffic and public transportation authority, is responsible for transit and infrastructure (e.g., maintenance and roads in the city). Stadstrafiken, a department of Trafik Kontoret, is responsible for network planning, service standards, finance, and fare policy and acts as purchaser of transit services under the new competitive tender situation. The former public transit authority, converted in 1989 into a city-owned holding company, GS, is the main operator for Stadstrafiken. GS has won more than one-half of the tenders put out to bid to date; Linjebuss has won the remainder. Gothenburg had completed the contracting out of two-thirds of its bus routes by the time of this mission visit; this contracting process has been underway since 1993. In addition to its traditional city bus fleet, GS operates 29 Volvo natural gas buses.

The area also has a tram/light rail system that enjoys intersection priority (see Figure 2). A new, computerized traffic control system, including real-time passenger information, has been put into operation on the light rail route and in part of the bus network. Real-time light rail departures are also available to home computer users via the Internet, which is said to be a world's first (http://www.tkgb.se280/). The bus and light rail transit (LRT) systems together account for 85 million passenger trips a year.

Gothenburg recently instituted a hub-and-spoke bus line similar to German and Swiss city buses. Under this concept, all lines at a specific terminal leave at the same time in order to reduce transfer times between the lines. This results in simpler transfers and timetables and more transfer options for passengers.

Copenhagen, Denmark

Copenhagen Transport (HT) was set up in 1974 as a joint body comprising 12 public bus companies, three counties, and two cities. HT covers the metropolitan region, which includes 1.8 million inhabitants (about one-third of the country's population). Danish law stipulates that public transportation in the metropolitan region must function as a single, integrated system with complete fare integration.

Roughly 1,000 buses and 300 commuter railcars provide service in the metropolitan region with more than

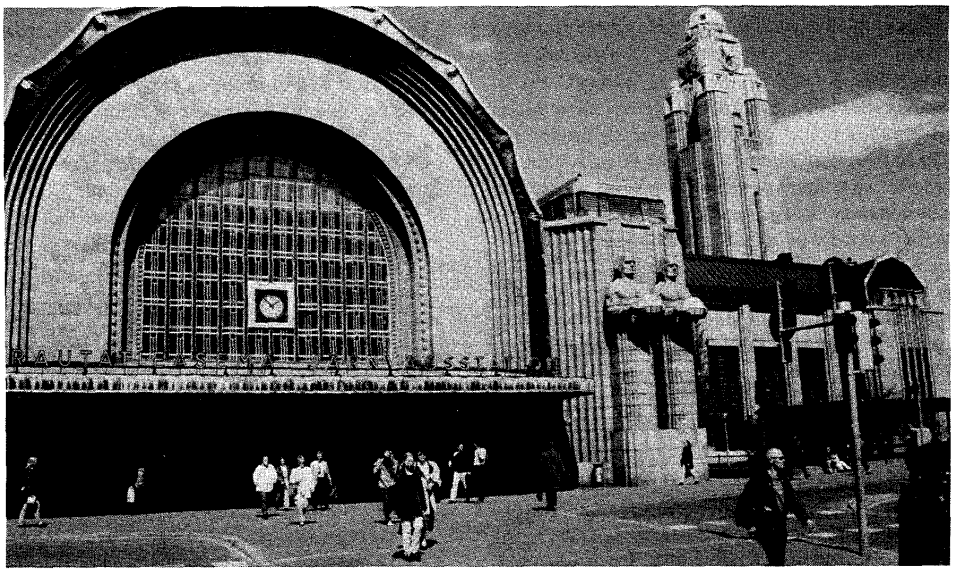


Figure 1. The train station in Helsinki, Finland, is an imposing Art Nouveau structure at the center of the city's public transport system.

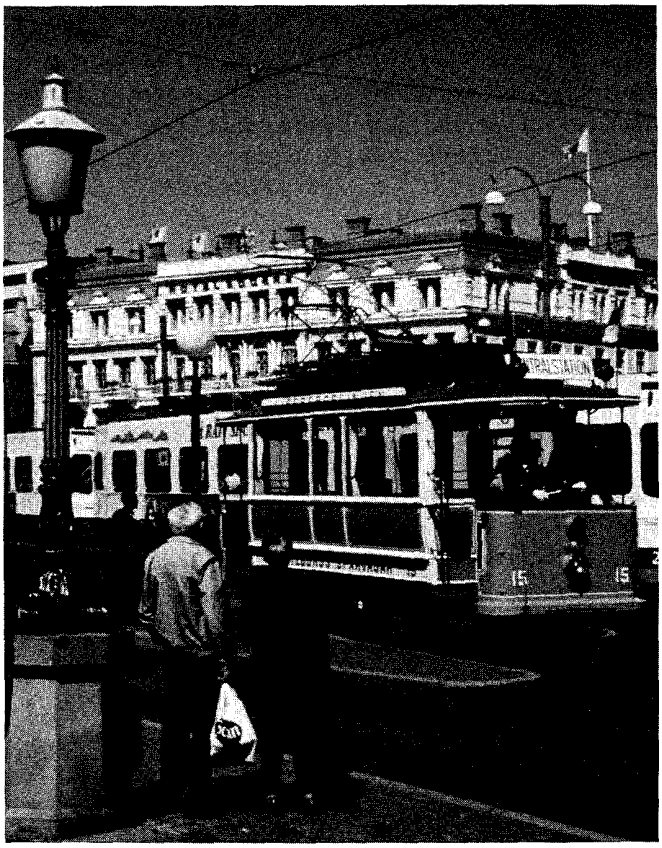


Figure 2. The extent and frequency of tram service in Gothenburg, Sweden, helps contribute to a vibrant central city environment. During the summer, vintage trams are run by the Ringlinien Tramway Society, a non-profit organization. Volunteers serve on the trams.

800,000 daily passenger journeys. An ambitious "Vision 2005" concept aims to double the number of passenger trips by public transit within the next 10 years. Farebox recovery of operating costs is slightly above 50 percent. Public subsidies (equivalent to $116 million annually) are required because of a public policy decision to operate around the clock and to serve sparsely populated parts of the region.

Two years ago, the bus division of HT became an independent company, known as Bus Danmark (BD), and was allowed to compete for contracts. At the same time, the Danish parliament passed a resolution stating that HT bus operations should be fully contracted out by 2002. Currently, about two-thirds of the bus routes are contracted out to roughly 12 providers. BD has won the largest share of contracts to date.

BD operates routes for which tenders have not yet been invited. Any company, private or public, Danish or foreign, can freely compete for HT bus operation contracts. HT continues to plan routes, prescribe service standards, fix fares, monitor contracts, and be responsible for marketing and public relations. All fare revenue is turned over to HT, which pays the contractors the contractual fee irrespective of the number of passengers using the route.

To reverse declining commuter trends, the S buses, a network of interconnected express bus routes, began in the early 1990s in the metropolitan region. Routes are linked with commuter rail stations and run through the center of Copenhagen (see Figure 3) and out to the suburbs (see Figure 4). High standards of speed, comfort, and intermodal conveniences have helped to halt and reverse the decline in commuters using public transit within the metropolitan region over the past several years.

In recent years, local authorities have opted for extra services for people who are elderly, people who have mobility impairments, and people with baby carriages. The routes and timetables for these low-floor service buses, which now run in five metropolitan area communities, are carefully laid out with help from citizens. The buses stop at such locations as housing projects, shopping plazas, downtown locations, homes for the elderly, and public buildings.

HT is responsible for operations; local authorities pay expenses. Anyone may use these buses with regular tickets and passes. Those with severe physical disabilities are served by a separate fleet of wheelchair-accessible, lift-equipped minibuses that provide door-to-door transportation. Ten thousand certified users are allotted 26 rides in a 3-month period.

The Danish State Railways (DSB) manages all rail services in the metropolitan region. The same farecards can be used on buses and trains. Plans are underway to expand light rail service in the Greater Copenhagen region. Alternative solutions being considered include expansion of the Orestad minimetro, light rail lines, and rail buses.

Copenhagen is encouraging the use of nonmotorized transportation through a novel bicycle program. This approach gives ecology-minded tourists a new reason to visit the city (see Figure 5). Bicycles are available at any one of the 120 bicycle stands within the historic inner city. To release a bicycle from its rack, one inserts a 20-kroner coin (U.S. $3.30) in the deposit lock, thereby releasing the locking clamp. The coin is refunded when the bicycle is returned to one of the stands and pushed into the locking position. Users must stay on public streets and can only use the bicycles within the historic inner city.

A city map with the location of the bicycle racks is available at the bicycle stands. A major source of funding for the project comes from the map's colorful, yet tasteful, advertisements for local products and services. The bicycles are virtually theft-proof because a tiny directional beeper is built into them for easy retrieval. Should a bicycle be abandoned on a city street, the 20-kroner refund is an incentive for a passerby to return it to the closest stand.

The project, which is managed by the Copenhagen Bike Foundation, was set up with support from the county council, several government ministries, the Copenhagen tourist promotion board, the country's leading daily paper, and a supermarket. The foundation operates the project with advertisement revenue, the sale of posters, sponsorships, and other sources.

Stuttgart, Germany

This city's exemplary state-of-the-art light rail system, supported by bus feeder lines operated by Stuttgarter Strassenbahnen (SSB), host of the UITP World Congress, is considered the paradigm of a modern, efficient local public transit company. SSB runs 150 miles of tracks through 330 square miles of urban and suburban neighborhoods (see Figure 6). The metropolitan area has a population of 900,000 and the 12 SSB light rail and tramway lines that serve this area are almost evenly split between modem, DUEWAG twin LRT units custom-designed for Stuttgart, and about 100 narrow-gauge articulated tramways of an earlier vintage. (The bus fleet of 255 is used in a support role on 55 coordinated feeder routes.)

The high-floor, eight-axle DUEWAG twin unit is 2.65 m wide and operates on the standard German rail gauge of 1.435 m. The 2.2-m-wide tramway operates on a narrow-gauge, 1-m-wide track. An innovative Stuttgart solution--a third set of tracks--allows the narrow-gauge tramway and the wider LRT to operate on the same route. The third rail is situated so that both types of equipment maintain the same distance to a common platform.

On lines used by the two types of vehicles, there are both high and low platforms at common stops. The high-level platforms, reached by ramps, allow faster and safer access to the interior of vehicles, thus reducing dwell time. SSB has reduced dwell times and increased average speeds from 15 to 25 km/h with signal preemption throughout the city.

Passenger totals have increased by as much as one-third since the start of the modernization program 20 years ago. Though Stuttgart is the home of several large

Figure 3. Copenhagen, Denmark, is a city of squares and marketplaces that together form a natural basis for the city 's outdoor lifestyle.

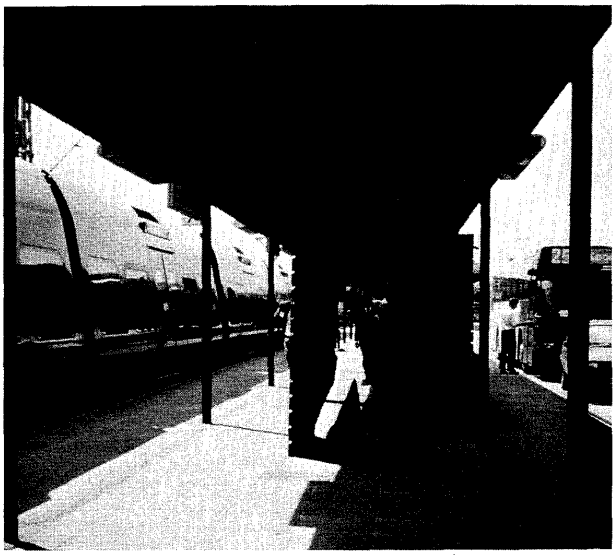


Figure 4. A network of interconnected express bus routes, known as S-buses, are linked with commuter rail station in Copenhagen, Denmark. Also featured is station art.

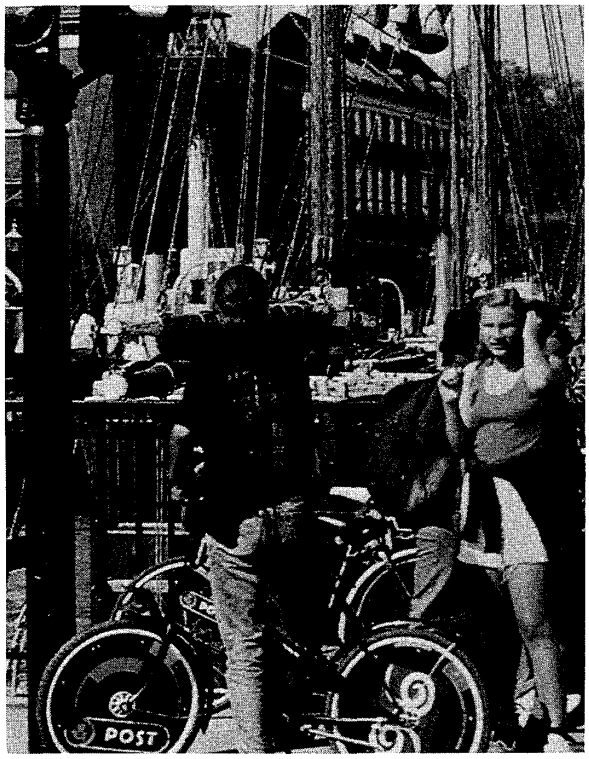


Figure 5. Copenhagen, Denmark, is known as the city of cyclists. The city bicycle program makes it easy to borrow a bicycle.

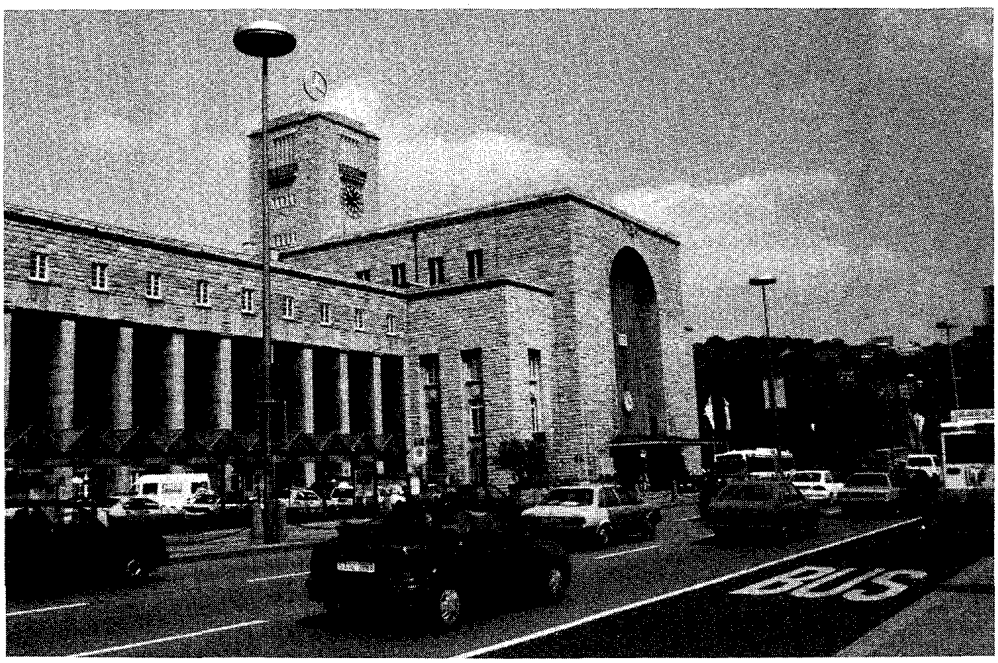


Figure 6. The downtown train station in Stuttgart, Germany. Beneath the street is a shop-lined pedestrian mall linking the station to subway and underground LRT stops and to the city's auto-free shopping district.

automobile manufacturers, private car use in the metropolitan area actually declined from 48 percent of the modal split to 43 percent, while public transit increased to 23 percent. The remainder of the public transportation share is split between walking (28 percent) and bicycling (6 percent). This development flies in the face of increasing car ownership, which has doubled over the past 20 years and now stands at nearly 500 per 1,000 residents, or more than 1 per household.

The LRT/bus network carries roughly 170 million passengers a year and takes in more than $140 million, resulting in a farebox recovery of about 80 percent of total costs, including debt service. The figures demonstrate that residents of Stuttgart are solidly supportive of their public transit system.

Public budgets cover the shortfall. A mix of federal, state, and local appropriations cover investments in new rolling stock and infrastructure.

INNOVATIVE TRANSIT STRATEGIES AND TECHNOLOGIES

This section focuses on the main strategies and technologies observed by study mission team members. Topics examined include

- Competitive tendering,
- Services for persons with physical disabilities,
- Alternative fuels programs,
- Marketing and public information techniques,
- Smart cards,
- Rail resurgence, and
- Fare integration.

Competitive Tendering

All the Scandinavian countries studied have undertaken national public transportation policy reforms over the last decade. One of the main thrusts of the reforms has been to reduce unit operating costs of services by tendering (i.e., contracting out) services to the most competitive bidder.

The results in all three countries appear to be consistent:

- Lower unit operating costs,
- Improved quality of the bus fleet, and
- Improved customer satisfaction.

The three Scandinavian countries have approached contracting out of operations in a deliberate, closely managed manner. The Scandinavian model is like franchising services in the United States (e.g., trash collection). Standards are employed in the tendering process to consider quality and age of buses, driver performance, reliability of service, and bidder's managerial competence.

Transit authorities are being transformed under the tendering policy into two distinct entities: one as an operator of services and the other as a purchaser of services that is also responsible for planning, fare policy, service standards, and marketing. As a purchaser of services, the management company prepares tenders, selects the most competitive bidders, and supervises and evaluates the contractors' performances under the terms of the agreements.

The Scandinavian systems studied seem to have had better success in contracting out transit services than their U.S. counterparts. Although the U.S. systems have also achieved cost savings, service quality has not increased as consistently as it has in Scandinavia. The United States should consider the Scandinavian approach to explicitly emphasize quality in the selection of the most competitive bidder. The thorough evaluation of contractors' performances through customer surveys may be a useful aid to U.S. practices.

The United States should also be appreciative of the resilience of the Scandinavian transit systems in adapting to the dramatic policy changes over the last decade. All of the systems observed appeared to be growing and making major improvements in service quality. They face challenges similar to many U.S. systems in retaining and attracting more passenger trips in an increasingly competitive environment. They seem well able to accept and meet these challenges.

Finland

Bus services have been progressively privatized throughout Finland since 1994. The nation's public-private model for privatization of public transit services confirms that transit can be operated cost-effectively by private carriers. Much of the savings is attributed to lower labor costs--not through wage reduction, but through elimination of unproductive bus lines, reduction of administrative and management personnel, and deployment of intelligent transportation systems (ITS) technology. Higher standards of service can be achieved without raising costs by the deployment of service strategies that emphasize simplicity and innovation.

Although the City of Helsinki still owns and operates its bus and light rail fleet, it has outsourced 20 percent of its bus service to date. Transit ridership declined in the early 1990s. As the standard of living improved throughout the country, more people had a choice between driving and using public transit. In response, Finland, and especially Helsinki, instituted policies that favored public transit. As a result, public transit carries more than 70 percent of all trips during rush hour in central Helsinki, and 60 percent of all off-peak trips. A total of 25 percent of the region's trips are made by public transit.

The initiation of tendering has attracted two of Sweden's largest bus companies--Linjebuss and Swebus. These companies purchased the municipal operations of the

Helsinki area cities of Espoo and Vantaa. As a result, most transit services outside the Helsinki region are privately operated. The contracts are turnkey operations with private operators providing labor, equipment, and facilities for service operation. The contracts are fixed price and are based on revenue hours and miles of service. The tendering approach allows public and private operators to bid on service contracts.

Operating costs have dropped by one-third and service delivery has improved. In some cases, service has increased while costs have been reduced. Strict service performance standards have been implemented and are closely monitored by Helsinki City Transport (HCT) and the Helsinki Metropolitan Area Council (YTV), the regional council of government responsible for public transit. Important performance standards include on-time performance, customer satisfaction, vehicle cleanliness, and safety.

The YTV and HCT monitor service through onboard and direct phone surveys to riders. The surveys measure the level of customer satisfaction with the service. These surveys regularly indicate strong support for the service quality provided by the private operators. The provision of bid specifications requiring newer vehicles, expansion of service routes, and increased service frequency has enhanced service quality. As a result, ridership has increased.

In 1995, HCT, in conjunction with local municipal authorities, finalized a comprehensive regional transportation plan that provides for no less than 60 percent of funding to be dedicated to public transit. Rail receives priority with the funding.

Helsinki is scheduled to begin offering its tram fleet for public-private tendering. This fleet represents one-fourth of all public transit trips generated in Helsinki. The success of privatization with trams will solidify Finland as a leader in public-private partnerships and may serve as a model for other transit agencies to follow.

Sweden

Farebox recovery has climbed in Sweden since competitive tendering was instituted, and competitive tenders for bus and rail operations have been won by both public and private carriers.

Sweden, one of the most egalitarian societies in the world, has a strong capitalist economy (see Figure 7), yet the Swedes enjoy one of the shortest workweeks in the industrialized world. Therefore, competitive tendering offers advantages and disadvantages. Advantages include savings resulting from a clear organizational focus on cost efficiency and savings generated from the sale of capital resources as public transport is outsourced. However, a possible disadvantage is that the competitive tendering has increased the standard workweek for transport workers (which accounts for some of the cost reductions). Another possible disadvantage is that, in Sweden, major operators tend to grow and expand (e.g., Swebus and Linjebuss), while smaller operators, including several public transport operators, have been absorbed or gone out of business.

In the short run, passengers and taxpayers have benefited from higher quality transport at lower costs. Whether this advantage can be sustained is not clear. Also to be determined is whether publicly owned companies will continue to dominate the Swedish market for rail and bus transport.

Stockholm. In Stockholm, the Stockholm Transport (SL) exists as a limited company, wholly owned by the county council. SL is charged with "offering customers a fully developed transport system--easy to use, reliable, pleasant, and affordable, with reasonable journey times."

The organizational structure of SL shows a clear division of responsibility between the planning, procurement, and marketing arm of the organization and its operational subsidiaries. Nine independent subsidiaries supply transport services according to market conditions and in competition with other suppliers. The subsidiaries include Metro (the subway system), local and suburban railways, airport services, buses, and special services.

Since 1993, SL has procured public transport services in open competition. Since then, 71 percent of the bus operation and a significant portion of the fixed-track service have been competitively tendered. Under the current agreement with Swedish State Railways, commuter rail will not be competitively bid until the year 2000.

Operations on SL's three Metro lines have been competitively tendered one time. SL Metro was successful in that tender. Plans are now underway to offer the Metro lines for tender a second time.

Approximately 35 percent of the local and suburban train and tram service has been competitively tendered. Four different train and tram systems exist in Stockholm County. Competition among SL subsidiaries has resulted in bid awards to both the rail subsidiary and to SL Metro. Linjebuss has recently won a rail tender and will be adding a rail component to its Swedish operations.

Virtually all bus operations are now being competitively tendered. Two major international private bus companies--Swebus, recently bought by Stagecoach Holdings of the United Kingdom, and Linjebuss--have won an increasing number of the tenders. Swebus now accounts for 31 percent and Linjebuss for 19 percent of the urban bus lines that have been put out to tender. SL Bus has also won several tenders and provides a significant portion of the bus service. When a new operator wins a tender, that organization, by law, must accept the employees of the former organization and continue their salary and benefits at their existing level for at least 1 year.

Competitively tendered contracts are typically signed for a 5- to 10-year period, with a limited option for extension. Timelines vary by type of service. The procurement covers overall responsibility for provision of quality service (as defined by SL) and for operation and rail

Figure 7. The shopping district in downtown Stockholm, Sweden.

traffic control, including staffing and technical maintenance of rolling stock. SL owns the tracks and installations, and rail stock is normally leased from SL. SL sets the fares for all parts of the system.

From 1989 through 1996, the competitive tendering process has resulted in a cost reduction of nearly 20 percent, a decrease of more than one billion Swedish knoner a year. Many think open competition is the major reason for the cost reduction. During the 1990s, the volume of transport services offered to customers has increased by 13 percent, with the same or higher levels of quality. The total public subsidy for transport has also fallen during this time, from 70 percent in 1989 to 55 percent in 1996. This has resulted in annual savings of about $145 million in the region's annual transit budget of $750 million.

Gothenburg. At the time of this mission visit, Gothenburg had just tendered another one-third of its 35 bus routes. The city-owned bus company now also competes for tenders on a regional basis. This means that, instead of always facing the possibility of losing tenders, it now may win new service lines.

Gothenburg's tendering process was inaugurated in 1992, with one-third of the bus service being put out for tender. Another one-third was tendered in the autumn of 1996, and in 1997 the remaining third will have been competitively tendered. Contracts are written for 5 years with an optional extension of up to 2 years.

Regional bus lines have also been tendered. One-third of these lines was tendered in 1996 as part of the tender for city bus operation. Another third will be tendered during each of the next 2 years.

The first tender, in 1992, resulted in considerable cost reductions and higher quality service. The 1996 tender saw a further cost reduction of 5 percent for local service. In 1996, Swebus won 74 percent of the tender for local service. The city-owned company and the private operator, Linjebuss, each received 13 percent. For regional service, Swebus, in a consortium with some 50 smaller bus companies, successfully competed for most of the service.

Nine tram system routes, with 200 trams, constitute an important part of Gothenburg's public transport system. Collectively, the bus and tram systems provide 85 million passenger trips per year, with a farebox recovery rate of 56 percent. Gothenburg was the only one of the systems studied that uses a partial net contract under which operators keep 25 percent of passenger fares.

Denmark

Denmark's experiences with privatization of services is of interest because of the following factors:

- The multimodal approaches,
- The involvement of customers in monitoring services, and
- Integrated planning and traffic management.

In the Scandinavian countries, the transportation systems include pedestrian travel, taxis, road networks, traffic management, and rail and air systems, as well as the traditional inner-city bus and rail systems. This intermodality characterizes Denmark, particularly Copenhagen, the capital city.

The Danish model for transportation service delivery has changed dramatically over the past 20 years. Prior to 1975, Copenhagen, for example had a large bus system operated by more than 30 public and private companies that held concessions to those routes. Each company had its own fare system and time schedules that, only in limited degree, were coordinated with the other companies. Copenhagen Transport (HT) was established by merging the 12 public companies. HT made contracts with 19 private bus companies in the region. In 1975, a common fare system and coordinated schedules were introduced.

Although public transit has always been important in Copenhagen, ridership began to fall during the 1980s, and Denmark's parliament initiated several important policy changes.

Tendering has established the need for clearer and more public performance measures for each mode. The goal of allowing many private operators to compete has not been entirely successful. For example, after the first round of tenders, there were 14 operators; for the second round, 10 small operators dropped out completely, and 4 operators combined to create a stronger bid. Copenhagen offers small units to attract very small companies with 4 to 15 buses. In some cases, the units are for a single line or even just for some of the buses on a line.

Given the basic requirements of achieving quality for the customers, offering fair competition among operators wanting to provide services, and simplicity for the customers to use, the tendering system in Denmark is a success. The goal of reducing costs to the government is a success as well--services have expanded greatly and the level of subsidy from each jurisdiction has not had to increase in order to obtain those improvements.

Over the long term, the cost savings experienced in the first 5 years of tendering will probably not be sustained. The savings related to consolidation of planning, scheduling, and marketing have probably been reached. Reductions in price from $70 an hour to $53 will probably stabilize at $55 over the next few years while operators begin to collaborate and form joint partnerships.

Copenhagen maintains control of the services offered by constantly measuring the performance of the operators and using that information to evaluate and establish incentives for the operators. This ongoing monitoring and public measuring of results will help HT continue to provide excellent transportation services.

Services for Persons with Disabilities

Providing transportation services for persons with disabilities is recognized as both a legal and a social responsibility in Scandinavia. While legislation mandating accessible transportation in these countries is not as comprehensive nor as prescriptive as the 1990 Americans with Disabilities Act (ADA), all three countries have a tradition of providing social service and, in some cases, accessible fixed-route transportation that predates the ADA. Within these countries, transportation for persons with disabilities is primarily provided by paratransit, which tends to be viewed as a social service rather than a transportation program. Recent efforts have been aimed at making fixed-route services, especially rail, accessible and usable by persons with disabilities.

Unlike U.S. policies resulting from passage of the ADA, Scandinavian countries have not established national or even regional standards for how access may occur or is defined. Among the cities visited in Scandinavia, differences were observed both in how accessibility is provided and in the level of financial support for these services. Given that only major cities were visited, one can assume that variations in service are even greater in rural areas.

Another significant difference between Scandinavian and U.S. public transit programs is in the level of public participation guiding the planning process. While the ADA requires and expects extensive participation and consultation with members of the public, there is no such requirement in Scandinavia. In the countries visited, transit officials are not required, for example, to conduct public hearings when instituting major service changes or increasing fares. Transit personnel in several cities indicated that they consult with staff of social service agencies, who presumably are effective advocates for their clientele. Otherwise, however, the presence or influence of organized disability advocacy groups was not observed nor even mentioned at any of the sites visited.

Rail Accessibility

Interestingly (because one could argue that the largest challenge faced by transit operators in the United States as a result of the ADA is making older rail systems accessible), Scandinavian heavy rail systems are more accessible than other modes, such as bus or light rail. Helsinki, Stockholm, and Copenhagen (Stuttgart as well) have elevators serving nearly all rail stations, tactile warning strips for those with visual impairments, either low-floor or ramped access to rail cars, and other accommodations for those with visual and mobility impairments. Stuttgart also provides these features (see Figure 8).

An excellent example of the level of accessibility that can be achieved on a major rail system was observed in Stockholm. Stockholm's Metro system, among the largest in the world, was originally build in the 1940s. Plans for greater accessibility were adopted in connection with the second major expansion of the system, which was completed during the 1960s. During that time, elevators and escalators were put in most stations, and other improvements have been made since then. One such innovation is an automatic announcement system, triggered by a sensor when a person steps in front of it on the platform. A pre-taped message announces when the next train is coming. In the future, elevators will also be equipped with audible signals to help travelers with visual impairments better navigate the station.

In Stockholm, subway elevators have been installed next to escalators at a slant (parallel to the escalators), similar to a funicular. Because the elevators have glass walls and are directly adjacent to the escalators, persons using them can easily signal for assistance should it malfunction. Furthermore, the glass walls deter vandalism, a chronic problem in U.S. subway systems.

U.S. architects and transit planners should take notice of some of the innovative design features observed in Scandinavia. Many of these are aesthetically pleasing and have practical application to assist travelers. In Copenhagen, for example, design of the new S-Train took into consideration the desire of passengers to see the length of train. Throughout the train, cars are connected with glass doors that can literally be opened by a touch of the hand. This results in a spacious, open atmosphere for travelers that makes them feel less vulnerable, a fear which sometimes prevents the elderly or those with mobility impairments from using public transit.

The design of the floor in the Copenhagen rail station is not only attractive, but also serves to assist travelers with visual impairments. The raised markings on the tile are arranged in distinct directional patterns so that persons with canes can better navigate the busy and complicated station.

Bus Accessibility

As in the United States, the trend in Scandinavian countries is to provide access with low-floor buses, rather than lifts, which in the past have been unreliable and the cause of increased maintenance costs. In Helsinki, 15 percent of the current bus fleet has low-floor vehicles to allow for easier access for persons who need it (see Figure 9). As the fleet is replaced, low-floor buses will be purchased. New light rail cars about to be put into service will also have low floors and will be able to accommodate three wheelchairs.

An impressive urban planning feature observed in Helsinki was the tendency to locate parking meters and bus stop signs away from curbs and directly adjacent to buildings. The lack of such barriers on the sidewalk helps persons with visual or mobility impairments better navigate

Figure 8. *A tactile map for those with visual impairments at the main station in Stuttgart, Germany.*

Figure 9. *A low-floor bus in Helsinki, Finland.*

the path to a bus stop or rail station, thus encouraging their use of public transportation.

In Stockholm and Copenhagen, all inner-city buses have low floors. Of the cities visited, Stuttgart had the least accessible buses--of 69 bus routes, only 1 operates with low-floor buses and there are no plans to acquire more.

In Scandinavia, most buses are equipped with very simple mechanisms (e.g., a metal ring bolted to the floor) for securing wheelchairs in the vehicle. Some buses and virtually all the rail cars had no securement system at all, although spaces were designated for wheelchair users.

Scandinavian planners were quick to point out the benefits of low-floor buses for other passengers, especially people with children in strollers. In both Helsinki and Stockholm, a person with a baby in a stroller can ride for free. Bus schedules indicate which vehicles have low floors. The same space designated for wheelchair users is also made available for strollers and, in some cases, special securement devices for strollers have been installed.

Marketing the use of low-floor buses for groups other than those with disabilities is an interesting strategy that probably would produce mixed results in the United States. "mainstreaming" (i.e., including persons with disabilities in the same services and programs as those available to the general public) is a basic premise of ADA. While encouraging the use of low-floor buses could result in a wider constituency group and a higher level of support for accessible vehicles as well as promoting mainstreaming, it could also cause problems if these groups competed for limited space and attention from the vehicle driver.

Unlike in the United States where efforts are made to encourage persons in wheelchairs to use fixed-route accessible buses, little such effort is being made in Scandinavia. Because such a high level of paratransit service is available, the use of this mode is promoted, even though fixed-route service allows for more independence for the traveler having disabilities and is far more cost-effective for the transit operator to provide.

Paratransit Services

In Scandinavia, paratransit tends to be managed and/or financially supported by social service agencies.

The paratransit program in Helsinki is managed by the Ministry of Social Affairs, a department of the city separate from the transportation program. Nearly 30 percent of the agency's budget is dedicated to paratransit. Federal legislation in Finland requires that qualified individuals be provided a minimum of 18 trips per month, a standard of service that is somewhat consistent throughout the three countries visited. Most paratransit trips in Helsinki are provided by taxi. To accommodate wheelchairs, 2,000 of 9,000 taxis are ramped, an unusually high rate compared with other countries.

The paratransit program in Stockholm is governed by a board within the Stockholm City Council. Its annual budget is approximately $111 million. About 5 percent of the city's population is entitled to receive paratransit services, which is primarily provided by taxi. Service is provided door-to-door with some personal assistance from the driver. A national subsidy reimburses up to 35 percent of the city's cost in providing the service, and about 20 percent is recovered through fares.

In 1991, the Gothenburg Transit Authority Special Transport became an independent agency, which currently employees 100 persons to serve 26,000 customers. Its paratransit program is extraordinarily well funded, providing 6,500 trips per day (or 2.1 million trips per year) with an annual budget of $30 million. All trips are dispatched from a central office, and customers can reserve trips up to 2 weeks ahead. Immediate demand-response trips are available as well. Planners report that costs have been reduced as a result of competitive bidding; of their budget, 50 percent is recovered from government sources, 25 percent from fares, and 25 percent from social service agencies.

Paratransit services in Copenhagen have been publicly funded since 1979. The program directly employs 20 administrative staff members, 3 drivers, and 1 traffic manager. All other personnel needed to operate the service are contract employees. Service is provided with 200 contract vehicles (minivans) and is door-to-door, including stair assist. Service is 24 hours a day, 7 days a week, and eligible persons are allowed up to 26 trips per quarter (104 trips per year), although extra trips can be arranged at a premium cost. No medically related trips are provided through this program. Fifty percent of the users are in wheelchairs, and the user's average age is 75.5 years old. Unlike Helsinki and Stockholm, only 2 percent of the trips in Copenhagen are provided by taxi; most are provided by minivans. The average cost per trip is $30.75.

Copenhagen's long-term program goals include improving efficiencies through advanced technology, competitive bidding, and the installation of a new telephone system. The application of related technology, such as automated vehicle locators and geographic information systems, is also being considered. Extensive use of advanced technology related to paratransit operations was not observed in any of the other cities visited.

Unlike its Scandinavian counterparts, Germany has no federal requirement for providing paratransit. Limited services are available through social service agencies, such as the Red Cross, or other agencies serving a particular clientele.

Table 1 shows the level of funding available for paratransit in the various cities visited, as compared with a few U.S. cities providing ADA-related complementary paratransit service.

Service Routes

In addition to providing some accessible fixed-route services and a very comprehensive level of paratransit, the Scandinavian countries are also using "service routes," a

hybrid of fixed route and paratransit. Originally developed in Sweden, service routes are now in use throughout that country, as well as in the cities of Helsinki and Copenhagen. Service routes operate with small, low-floor vehicles on a designated route and schedule. The routes have been developed specifically to serve a particular clientele, usually senior citizens, and tend to be neighborhood-oriented. In many cases, the vehicle can be flagged down along the route if the rider has difficulty getting to the nearest stop, and extra assistance is provided by the driver.

In Stockholm, 15 service routes operate between 9:00 A.M. and 3:00 P.M., a frequency of every half-hour to every hour. The routes have been planned with input from various constituency groups. Gothenburg has two service routes; Helsinki and Copenhagen operate several as well. As with other aspects of transit observed in these countries, the operation of service routes is competitively bid.

Service routes could be adapted for use in the United States. To date, transit operator efforts have been focused on providing a complementary paratransit program that meets standards established in the legislation (e.g., no capacity constraints). Although almost all transit operators are in compliance with the law, they are struggling to maintain compliance as demand continues to escalate. Many are using technology or seeking other strategies to help them provide paratransit services more cost-effectively.

Some operators (most notably Madison, Wisconsin) have been experimenting with alternative service delivery methods such as service routes, but few have had an opportunity or developed the expertise to do so. In many communities, service routes could be targeted for persons who are conditionally ADA-eligible or who could use fixed-route services if they were more "user-friendly."

Alternative Fuels Programs

The United States seems to be gradually reducing bus emissions, while the Scandinavian cities visited are looking at the pollution problem with long-term solutions in mind. The Scandinavian countries are not especially concerned with converting all buses to a low-emission alternative fuel. Rather, these countries are pursuing development of a totally nonpolluting bus engine. Planners in Stuttgart said that their ideal version of a powerplant and drivetrain emitted no pollutants.

In Helsinki, emissions from clean diesel buses were quite low, and the city is not actively seeking alternative fuels. Helsinki is a member of Zero Emission Vehicles in Urban Society (ZEUS). The eight European cities that make up ZEUS are integrated test sites for reduced emission transportation.

In 1981, Stockholm rebuilt an electric bus to be a Volvo-hybrid-electric. By 1993, the city had purchased its first Scania hybrid. In 1994, Stockholm put seven DAB hybrids on trial runs; they were introduced into regular service in 1996.

Five percent of Stockholm's industrial pollutants come from buses. The city is actively seeking ways to further reduce this percentage. Of the 1,600 buses that Stockholm runs, 7 are hybrid buses, 600 are clean-diesel-equipped with catalytic converters, and 130 run on ethanol. The ethanol is made from surplus Italian red wine.

Stockholm has compared the nitrous oxide (NO_x) exhaust emissions of the hybrid-electric and ethanol buses with those that are equipped with standard diesel engines. An ethanol engine produces only 20 percent of the NO_x emissions of a 12-year-old bus, and only 50 percent of the emissions of a new, clean-diesel bus. A hybrid-electric, however, produces only 2 percent of the NO_x emissions of a 12-year-old bus and only 17 percent of the emissions of a new, clean-diesel bus.

The program has had to address several problems since it began using ethanol as a fuel. First, ethanol required an engine with a much higher compression ratio in order to burn the fuel cleanly, so the engines needed to be modified. This modification also produced a higher level of vibration from the engines. Corresponding with the red wine base of the ethanol, the exhaust of the buses emitted a strong vinegar smell. Today, there is a slight vinegar smell from passing buses. In response to customer complaints that ethanol buses make more engine noise than diesel buses, service providers have put more noise insulation in the engine compartments.

As always with alternative fuels, there are tradeoffs. The fuel consumption of ethanol-powered buses is approximately 60 percent to 70 percent lower (more miles per gallon), but they have operating costs about 8 percent higher than standard diesel buses. This increase in operating costs, however, is made up by government subsidies.

Twenty-nine natural gas minibuses are used in Gothenburg's paratransit service. The city recently ordered compressed natural gas (CNG)-powered buses. Copenhagen manages a fleet of more than 1,000 buses. The city's tendering specifications require bidders to operate buses consuming low-emission fuels, such as ultralight diesel. The specifications do not indicate that any fuel other than diesel must be used, but the Danish Inland Revenue Department demands that the bus exhaust satisfy its low emission standards.

Stuttgart is working on a preferred option for its new buses. The city is encouraged by test results with hybrid diesel/electric hub-wheel, motor-powered buses (see Figure 10). Stuttgart is looking into buses powered by fuel cells and electric hub-wheel motors. These buses have no

TABLE 1 Level of funding for paratransit services

City	Population	Annual Budget	Trips/Year	Cost/Trip
Helsinki, Finland	1,000,000	$25,740,000	1,342,000	$19.18
Stockholm, Sweden	1,500,000	$110,000,000	4,000,000	$27.50
Gothenburg, Sweden	800,000	$30,000,000	2,100,000	$14.28
Copenhagen, Denmark	1,800,000	$12,300,000	367,000	$33.51
San Francisco,CA	750,000	$11,300,000	1,044,680	$10.82
San Francisco Bay Area, CA	6,000,000	$48,000,000	3,000,000	$16.00
Portland, OR	1,285,000	$9,217,000	613,775	$15.02
Madison, WI	240,000	$3,600,000	243,897	$14.76

Figure 10. One of Stuttgart's 17 new low-floor, articulated buses with hybrid diesel engine/electric hub motors. The buses are used on Model Route 42, which has dedicated bus lanes, real-time passenger information displays, traffic signal priority, and passenger amenities at bus stops. Current ridership is 31,000 per day.

transmissions and produce no emissions--they will hopefully reduce long-term maintenance costs.

Marketing and Public Information Techniques

Helsinki, Finland

Marketing functions employed by Helsinki City Transport (HCT) include advertising at station areas, print advertising, mailing of schedules to all households in Helsinki, and publishing transit schedules on the Internet.

HCT plans to provide passenger data through real-time information at bus stops and park-and-ride lots for bus and train movements. Electronic display boards will be located at major bus stops to show passengers the waiting time for the next bus to arrive. Using a GPS, buses will be equipped with devices to help drivers determine if they are running on schedule. These data will be used for arrival and waiting time information at bus stations.

Sweden

The Swedish Public Transport Association (SLTF), comparable to APTA, undertakes the advocacy efforts for the public transit authorities in each county--the "buyers" of public transit in Sweden. In addition to advocating additional public transit funding, the SLTF develops regional technologies, sponsors surveys, and communicates route changes after a new service contract or service revision is instituted.

The SLTF has advocated increased funding at the national level in order to expand services. Research shows that there is an opportunity for public transit's market share to double, and actions are being taken to pursue this opportunity. A corporate image campaign was undertaken by SLTF to promote the advantages of public transportation. A 3-month campaign, which included clever, high-quality TV advertisements, print ads, T-shirts, posters, holiday cards, golfballs, and other items, was based on the theme that traveling together is a "genius thing to do" (see Figure 11).

The campaign was well received by the public and plans are underway for a 3-year, $3 million marketing effort. Although not all the public transit authorities contributed to the first campaign, participation will be mandatory for the next one.

Stockholm. In the Stockholm metropolitan area, Stockholm Transport (SL) maintains a good public image. SL has experienced increases in ridership and in service levels and maintained service quality--all without corresponding cost increases--as a result of the following:

- Efficiencies created by competitive tendering,
- A stable financial contribution by the county council (more than 50 percent of costs), and
- Major funding for new transit infrastructure.

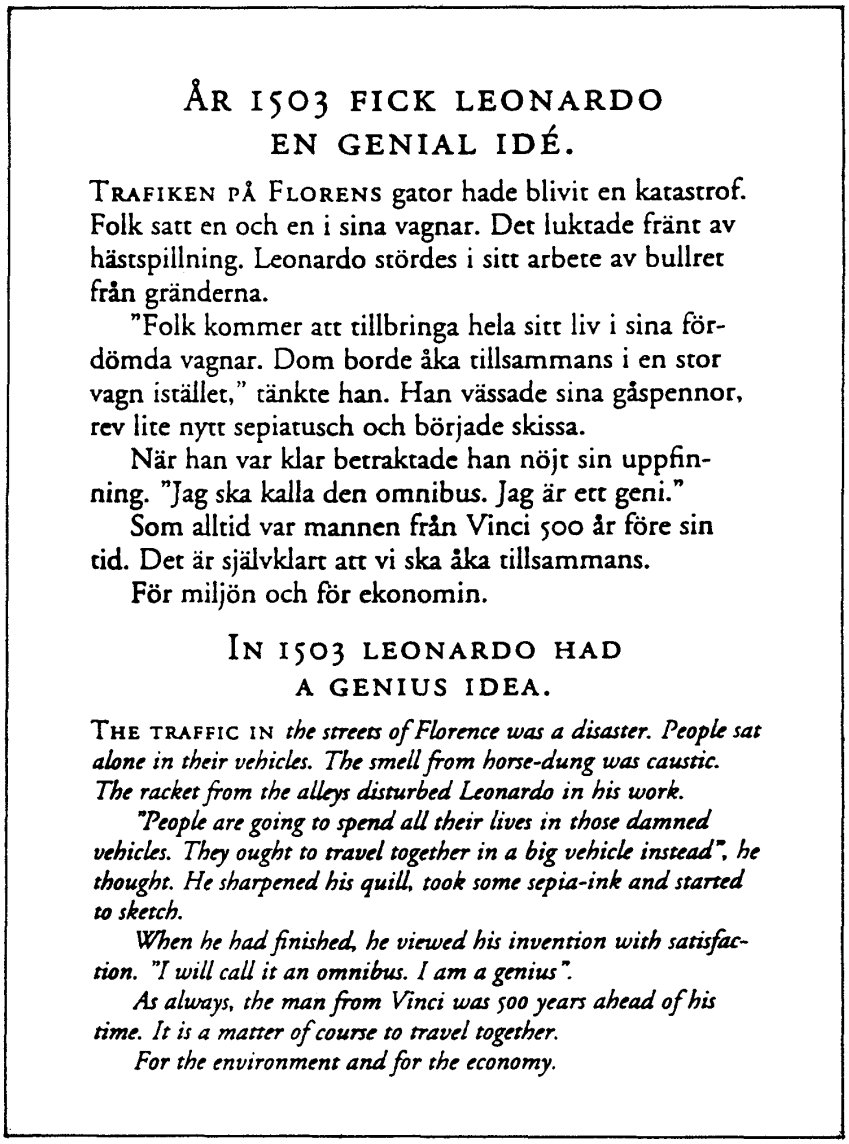
Guiding SL's success is the "SL90 model" business plan. The plan separates political responsibility (i.e., to optimize the benefits to society--" to do the right things") and business responsibility (i.e., "to do things right") in public transportation. In practice, this has led to politically governed planning, procurement, and operational functions that reflect sound business principles and that are subject to marketplace competition. A further example of a positive result is the reduction in the public subsidy for public transit--from 70 percent to 55 percent.

SL's overall goal is to encourage more travelers to make more trips with its services and thus increase the market share of total travel within the county. SL, a competent and environment-friendly company, is striving to build on its forward-looking reputation. The thrust of its marketing communications program centers on four tenets:

1. Be a highly visible part of city life and make the system simple to use.
2. Improve customer information. Travel information is disseminated by electronic message signs and public address systems in the underground and at bus stops. Passengers can plan their public transit trip on SL via the Internet.
3. Create new ways to communicate with the customers.
4. Intensify and strengthen the quality of internal information among SL staff in order to offer good customer service.

Quality management, the key component of customer service, focuses on these main elements:

- *Knowledge about what the customer wants.* SL performs extensive research on passenger characteristics, travel habits, and measurements of attitude and knowledge. Information from this research shapes company goals and service planning.
- *Product development.* Service development is based on customers' needs and reflected in contractors' service agreements. Other areas considered are passenger environment and technical systems, personal service, network of services and operations, sales, and communication (information and marketing).
- *Contractor role.* The level of quality experienced by the customer is based on the interaction between the customer and the contractor. Therefore, it is critical that specific requirements be placed on the contractor. Service agreements emphasize punctuality, information about service delays, coordination between trains and buses, vehicle on-time performance, staff behavior, and safety. There is continuous adaptation of services to reflect passenger requirements and needs. To ensure these requirements are met, incentives are included in some service agreements. In one county, for example, a quality handbook linked to a bonus system forms part of the service contract. This quality control system,



ÅR 1503 FICK LEONARDO EN GENIAL IDÉ.

TRAFIKEN PÅ FLORENS gator hade blivit en katastrof. Folk satt en och en i sina vagnar. Det luktade fränt av hästspillning. Leonardo störtes i sitt arbete av bullret från gränderna.

"Folk kommer att tillbringa hela sitt liv i sina fördömda vagnar. Dom borde åka tillsammans i en stor vagn istället," tänkte han. Han vässade sina gåspennor, rev lite nytt sepiatusch och började skissa.

När han var klar betraktade han nöjt sin uppfinning. "Jag ska kalla den omnibus. Jag är ett geni."

Som alltid var mannen från Vinci 500 år före sin tid. Det är självklart att vi ska åka tillsammans.

För miljön och för ekonomin.

IN 1503 LEONARDO HAD A GENIUS IDEA.

THE TRAFFIC IN *the streets of Florence was a disaster. People sat alone in their vehicles. The smell from horse-dung was caustic. The racket from the alleys disturbed Leonardo in his work.*

"People are going to spend all their lives in those damned vehicles. They ought to travel together in a big vehicle instead", he thought. He sharpened his quill, took some sepia-ink and started to sketch.

When he had finished, he viewed his invention with satisfaction. "I will call it an omnibus. I am a genius".

As always, the man from Vinci was 500 years ahead of his time. It is a matter of course to travel together.

For the environment and for the economy.

Figure 11. "In 1503, Leonardo had a genius idea"--print advertisement from SLTF's campaign in Sweden.

which is based on passenger surveys conducted four times a year, assesses vehicle cleanliness, driver courtesy, service delays, and information availability. Passenger responses provide a basis for the allocation of bonus payments.

- *Customer experiences.* A "quality barometer" is performed twice a year to determine what existing and potential customers think about SL. More specific onboard surveys are used to gauge general opinion of the service and its quality. The barometer places high emphasis on sufficient levels of service, value for the money, and customer information. Many users see SL as beneficial to society and 9 out of 10 view the system as good for the environment. In 1996 a system was devised to compare county public transportation companies using a scale of 1 to 5, with 1 being the best and 5 being the worst. The county of Stockholm received a grading of 1.4, the highest in the survey.

Good access to and visibility of public transportation services is the key to success at Stockholm's city terminal. The terminal is one of the world's most modern and attractive bus stations. It is in the same structure as the World Trade Center, which has hotel, restaurant, conference, and international exhibition facilities and employs approximately 2,000 people. Other services offered at the terminal include ticket sales, traveler information, baggage storage, newsstands, and restaurants. Nine million passengers take advantage of services at the terminal each year.

The terminal is in the center of Stockholm and has access to two major thoroughfares. There is also indoor access to Central Station, the underground system and the suburban train service. Bus connections to the airport and all major urban centers and cities are available. Approximately 750 buses arrive and depart each day. The terminal is a cooperative venture between the landowner, the Swedish State Railways, the city of Stockholm, and building and real estate companies.

"Operation Safety" was designed to create a safer environment in the SL system. Its goal is to reduce violence and vandalism through close cooperation with the police. SL has doubled its security force in the underground and an alarm and surveillance system has been added in one station. Stockholm's "Peace in the Streets" project is a cooperative venture between SL; the city's Real Estate, Streets and Traffic Department; the schools; the police; the city council; and others to increase the safety of SL passengers. In many instances, young people serve as hosts at stations when there is risk of a disturbance. They also provide information services for schools and youth recreation centers. Results from the project show fewer incidents in stations where hosts are working.

Several methods to improve the cleanliness of the stations have been tested. The method chosen is that the station is cleaned continuously from afternoon until midnight every day of the week. Workers wear uniforms for visibility and also answer questions from passengers. This service has resulted in a positive public image.

Art plays an important role in the establishment of a secure and pleasant atmosphere. The SL Art Board maintains and creates artwork throughout the SL system. During 1996, major artistic renovations were completed and new artistic decoration was provided at two main stations. One station features an exhibition of student artwork from art schools in Stockholm. In 1996, the SL Orchestra celebrated its 19th year of community involvement. The orchestra has recorded two compact discs and performs several concerts a year. In keeping with the theme of transportation, performers dress like of turn-of-the-century tramway conductors.

Gothenburg. A campaign to reduce costs through the competitive bid process has reduced costs by 30 percent in Gothenburg. Revenues have increased and, even though fares were increased by over 40 percent in 4 years, there was no decrease in ridership. High fare evasion (15 percent) was experienced, but actions were taken in 1993 to counter that situation. Ticket inspectors were added, especially on the special midnight service where fares are double the base price. Before the inspectors were present, passengers did not pay the fares; now the service makes a profit. In addition, all tickets and transfers are validated on the bus for proof of payment (see Figure 12). A marketing campaign was launched with the slogan "Everyone profits when you pay your fares." As a result of these efforts, fare evasion dropped 5 percent to 6 percent and the farebox recovery ratio is now 56 percent.

Gothenburg also uses mobile fare outlets. These provide another method for riders to obtain fare media more conveniently (see Figure 13).

Cleanliness is a high priority for passengers in terms of vehicle condition and bus waiting areas. Improvements in lighting, public information, and shelters are underway. A private contractor purchases the shelter for the public transit authority, places the advertisement, and maintains the shelter. These areas are kept very clean and thus graffiti has been reduced.

Market research is provided by university students who survey passengers about the system and its ease of use. Aside from this research, there is little public participation in the planning process although there is coordinated planning with other regional authorities.

Since 1984, the development of the KOMFRAM system has been underway to provide real-time information from the computer system database to public transportation passengers. Computers are on board all light rail vehicles and most buses to transmit data to bus stops, terminals, and homes. In 1995, the system was connected to the Internet; this is believed to be the only example in the world where you can read the real-time departures from all stops on the light rail system on the Internet.

The KOMFRAM system was developed within the framework of GoTiC, the Gothenburg Traffic Information

Figure 12. On-board ticket validation machine in Gothenburg, Sweden.

Figure 13. A mobile fare outlet in Gothenburg, Sweden.

Center. This research, development, and demonstration project is a cooperative venture between the traffic and transport authority and several departments at the Chalmers University of Technology in Gothenburg. The goal is to bring together researchers, manufacturers, and users to improve public transit information. The technology includes a loop system in the road that will send and receive data on the number of vehicles passing the loop and real-time information about bus operations (see Figure 14). It reports delays on certain portions of the routes and provides historical information to analyze what situations occurred and why. Specific components of the program include:

- *Signs at bus shelters and bus stop posts.* Electronic displays show bus routes serving the station, bus destinations, and the number of minutes until the next departure. Messages are also displayed concerning service interruptions at the affected stops.
- *Monitors.* Real-time information displayed via monitors is being tested at major bus stops. Arrival and departure information is displayed as well as a larger view of the route system. Passenger input is being sought before additional units are purchased.
- *Signs in the vehicles.* Information on board the vehicle (i.e., real-time information on the bus route, destinations, and names of the two nearest stops) reassures passengers that they have selected the correct route and disembark at the correct station.
- *Telephones, cellular telephones, and pagers.* Two projects are underway to gauge the usefulness of providing real-time information through various telephone services. A series of responses given by the caller produces text or audio information on appropriate bus routes and arrival/departure times and destinations.

Copenhagen, Denmark

Copenhagen Transport (HT) has embarked on a comprehensive plan to modernize public transit facilities and increase ridership. The plan, known as "Vision 2005," focuses on improving mobility in the city through increased public transit service, not more automobiles.

In response to the government's environmental goals that require reduced carbon dioxide emissions, no increase in the market share of automobile traffic in the cities, and improved conditions for public transportation, HT is stepping up efforts to increase public transit ridership 50 percent by the year 2005 to address the expected surge in traffic. The agency plans to achieve this by improving and offering new public transit service and making the cost of fuel and the cost to ride transit more equitable to balance the competitive edge automobile driving has experienced in the past.

Making transit attractive to the public is key. HT is replacing old equipment, expanding the express bus service, using a global positioning system (GPS) to provide accurate passenger information related to bus arrivals, departures, and delays, and allowing for signal priority and reserved lanes for buses. Customer information will be provided at the bus stop showing delays and in-vehicle displays will inform passengers of the next stop and connecting buses and trains. This will help those who are unfamiliar with the system feel comfortable about using the service (see Figure 15).

Improvements, such as better lighting, pedestrian access, windscreens, and passenger information displays, are underway in bus terminals and stops. A recent public opinion poll showed that 84 percent of respondents disapprove of increased car traffic, 82 percent support more funds for expanded public transportation, and 68 percent prefer light rail to bus. In response, expansion of the light rail system in Copenhagen is being explored.

Customer Service/Quality Assurance. HT conducts passenger surveys every year to assess the current service and to understand customer priorities. Some of the areas surveyed are condition of the vehicle, driver knowledge of the network, and bus schedule adherence. The results are applied to service contracts in the competitive bidding process. HT sets goals for each criterion to determine contract performance. Contractors meeting the standards share a quality pool of 1 percent of the contract sum. HT makes a corresponding offset from its payment to those not meeting the standards. In addition, the contractor must prepare an action plan to ensure future fulfillment of the performance standard under the contract. Examples of situations where these financial sanctions are applied include early and late departure from a terminal, not collecting fares, failure to replace defective equipment, incorrect signage, missing announcements of bus stops, and operation of a vehicle type different from contract requirements.

Additional customer input is received through a special telephone line that handles 800,000 inquiries each year. At Town Hall Square, a major transfer and information station, passengers receive bus arrival and departure information on a large electronic message screen displayed outside the building (see Figure 16). Other customer information techniques include having messages regarding bus and rail service on the radio 5 min before every hour and half-hour. This time is used for marketing purposes as well. In addition, text television is used to send out customer information. HT plans to provide geographic-information-system-based trip planning for customers based on real-time information and to eventually have voice recognition available for this service. Plans are also underway to establish a home page on the Internet.

Marketing Strategies. HT is developing a new marketing strategy to focus on "customers" not "passengers." Most current trips are work related. Thirty-five percent are by automobile and responses to surveys

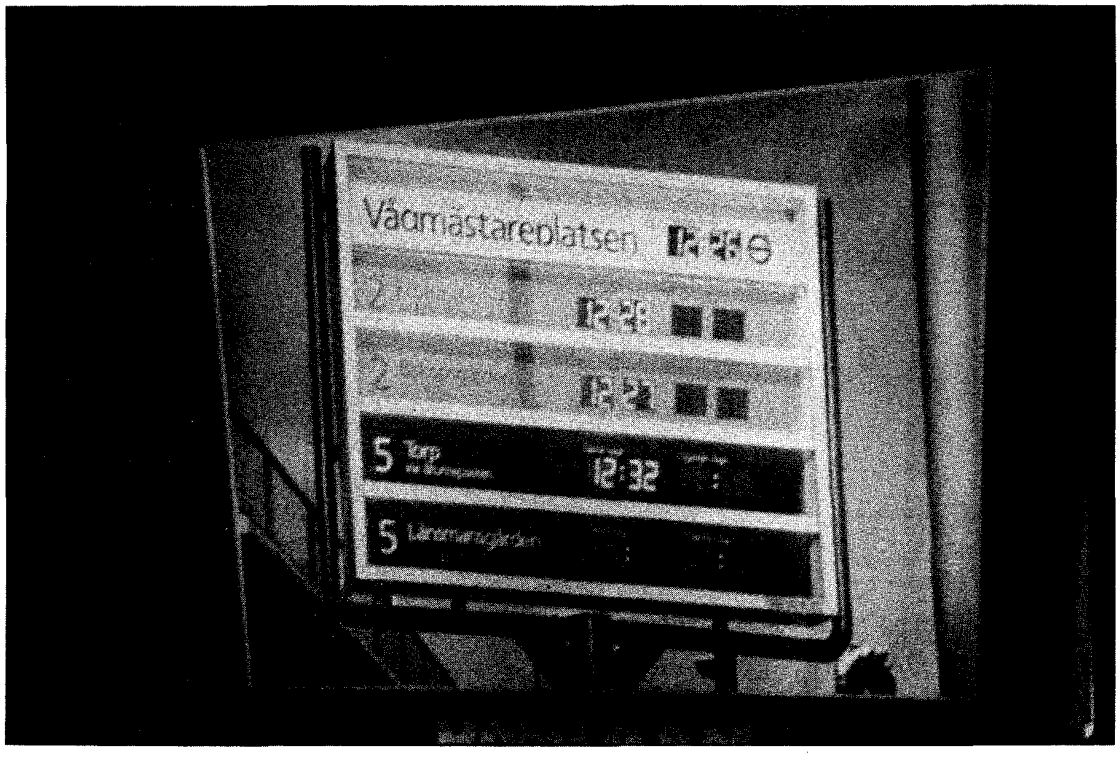


Figure 14. Real-time bus schedules in Gothenburg, Sweden.

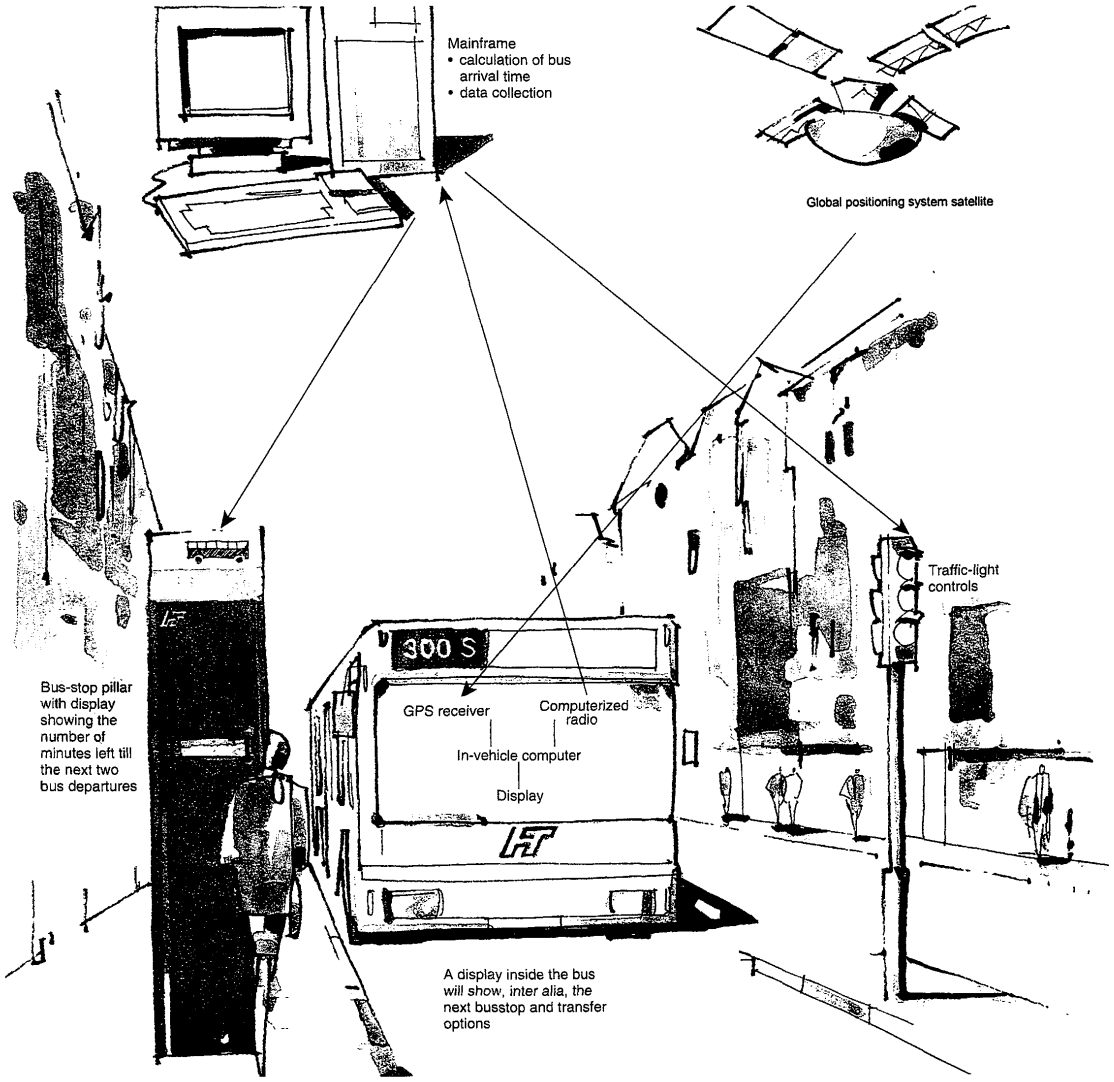


Figure 15. Integrated customer information and transit priority using a global positioning system.

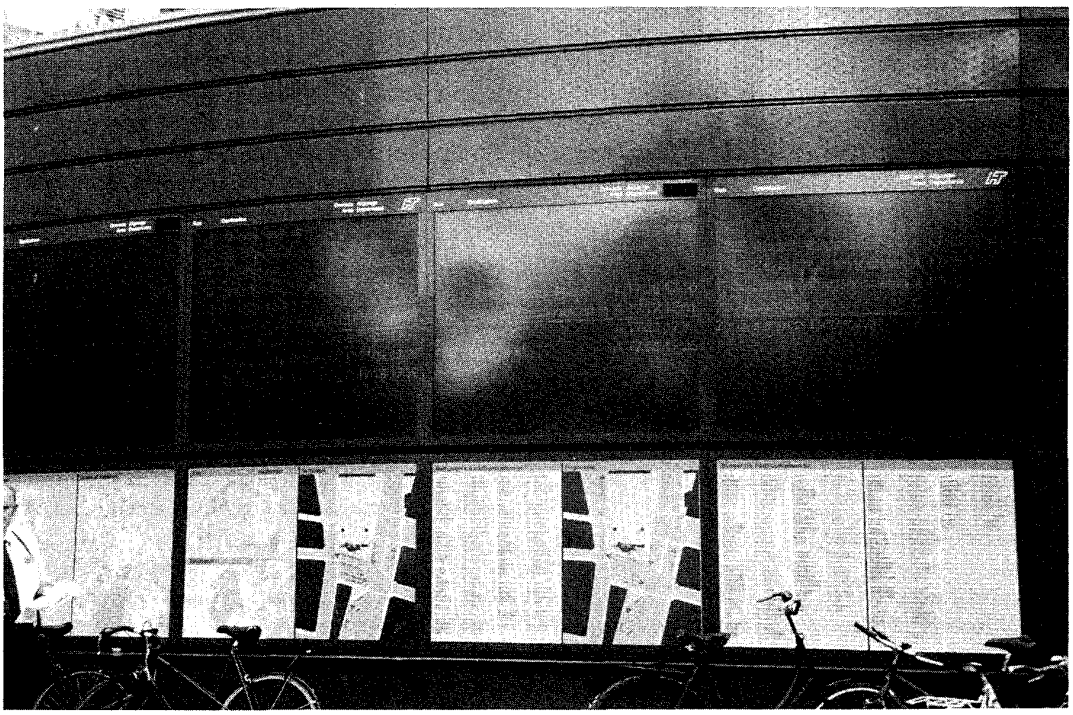


Figure 16. Real-time bus information at Copenhagen Transit Center.

indicated that 87 percent would not change their mode of travel. Unfortunately, of those who use the service for work trips (18 percent of mode share), 34 percent said they would switch modes if a car was available to them. This percentage represents a large share of HT's ridership and is critical to retain. Although, the system is perceived as difficult and complicated to use, those surveyed indicated they would use it more if it were made easier. In addition, the cost to a family of four to use the public transit service is higher than the price of gas for the same trip.

To keep the frequent service user loyal, HT sends special supplements to patrons when route changes are made so they will not have to buy a new schedule book. Plans to work with the rental car companies for a car/bus package for tourists is also being pursued.

The image of public bus service is relatively low, however, rail service enjoys a much higher public acceptance. HT has recognized the importance of marketing the bus service and is now financing these efforts at about $2.5 million per year. The main objectives are as follows:

- Become more customer-oriented and be seen less as a government organization,
- Set a goal of increasing ridership by 20 percent by the year 2000,
- Market new products such as a leisure package,
- Communicate the improvements being made to the public,
- Develop travel planning for employers and offer discount programs, and
- Have tourists pay the cash fare.

Up to this point, marketing activities have focused on products, not customers. Better information coordination between the bus system and rail service is needed. Direct marketing has been used with trial tickets, and a 13 percent increase in ridership was experienced. HT intends to set up a separate public relations department strictly to deal with the media.

Danish State Railways S-Trains. The Danish State Railways (DSB) has 93 million boardings each year and will replace all of its trainsets by the year 2005. A well-developed, clever campaign has been launched to obtain public input on train design and to entice new customers to ride the service. Problems with the system included insufficient capacity during rush hours, delays, and passengers feeling unsafe at station sites. The new train construction could address these issues, and surveys were performed to learn about the public's concerns and gather input before the new trains were ordered. Greater comfort, lower noise levels, low energy consumption, and the desire to use recycled materials were some of the comments. Graffiti had been a problem, so a special lacquer was applied to the trains; this would allow graffiti removal using water and a high-pressure washer. Some of the trip lengths varied from 45 min to as little as 10 min; therefore, the trainsets incorporated separate compartments with varying seating arrangements that more comfortably accommodate longer trips. To address safety concerns, full view through the entire trainset is provided by glass panels, wheelchair and stroller access is available in particular areas, and there are certain compartments where smoking is allowed.

To accompany the new train delivery and to meet the goal of increased rail ridership, a marketing campaign was launched. The campaign was aimed at having the riders and general public identify with the trains and those who ride on the them. The idea was to "sell the feeling" of the train and the people on board in a humorous fashion. To accomplish this, DSB rented 200 videocameras and then loaned them to passengers for 1 day to tape their own "commercials" about what they experience on the train during a typical trip. In addition, 600 to 700 personal stories were submitted by passengers. As a result, three 30-sec television commercials were developed from the submissions. The commercials showed the differences in trips taken on the train versus the car (i.e., the great variety and number of friendly people aboard that one meets).

Stuttgart, Germany

Transportation planners in Stuttgart are striving to keep the city center vibrant and are focusing on public transportation as a key component. Environmental concerns regarding emissions have gained attention and a Clean Air Plan was implemented in 1990.

The Stuttgarter Strassenbahnen (SSB) and German Rail (DB) have formed a regional public transit authority, Stuttgart Transport and Fare Association (VVS), to coordinate fares and services, oversee marketing and public information, and allocate revenues to the surrounding districts for public transit service. A master plan is in effect to increase public transit ridership, improve air quality, reduce roadway congestion, and increase productivity and efficiency in the public transit system. The goal of fare integration and simplification has been a recent focus and increased ridership is partly attributed to this activity.

To ensure that travel times are reduced and reliability improved, a program of joint activities is underway with the municipality to test and implement advanced information technology. This project, the Stuttgart Transport Operation by Regional Management (STORM), involves the monitoring of six key areas:

- Travel information and booking,
- Dynamic park-and-ride information,
- Travel link information for bus and rail,
- Individual route guidance,
- Freight and fleet management, and
- Emergency calls from vehicles.

STORM is designed to integrate various data sources and information systems and to give accurate real-time information on traffic flows, parking availability, and public transit operations. This system, coupled with the growth in congestion and improved public transit is expected to encourage a gradual switch of travel to public transit. Parking has been reduced in the city, and the price has risen. There is also an advanced parking guidance system that informs travelers via roadside signage of the number of spaces left at a particular lot in advance of the entrance so that drivers will know to select another parking area.

Smart Cards

Smart cards are being introduced in some of the cities visited on this mission. The smart card is as smart as the community chooses to make it. The card can be limited in application at first and expanded as people develop ways to use it.

Coordination with other vendors to share this technology and allow communities to issue purses on these cards has created a new use for the cards in which all kinds of services can be purchased on them. The cards can be used by one person to access many services (e.g., transportation) without carrying multiple payment instruments (credit cards, checkbooks, and cash).

Smart cards look like credit cards and contain a chip inside that is programmable. The chip carries credit/debit card information. The cards can operate without touching a reader, which records, for example, that a person has boarded or disembarked from a vehicle. They also can be inserted into a contact-card reader and used along with a password to gain access to banking services where the transit purse can be increased or decreased as needed by the user.

In the transit industry, information about travelers is very difficult to obtain. Currently, data are collected by hand by counting passengers and at the farebox by the transit operator. Farebox data can tell the operator the number of riders, but not origins and destinations. Rider profiles can be performed by observations or by assumptions from interviews of travelers. If information could be collected efficiently about the trip as well as about the location and time of day, transit operators could use the data to plan better service. Smart cards are uniquely qualified to collect these data because they can record the location of disembarkation. And, with the use of computers, the data collected can be assembled quickly and analyzed efficiently.

Smart cards are also convenient for passengers who do not want to carry cash. If a community could reduce the need for cash--and thus make riders less prone to robbery and threat of injury--it might increase the mobility of its residents and thereby improve their quality of life.

With the advent of contactless readers, the potential for fast-loading transit vehicles has emerged. This technology also offers tremendous benefits for the transit operator, including reducing crime related to handling fares. The benefit to the seller is that cash is immediately transferred. The benefit to the buyer is that cash is not being carried at all, but the transaction is now possible.

Smart card technology is operating in European communities where telephone charge cards can be used for other services besides phone calls. In Finland, for example, the smart card is being used outside Helsinki for bus, taxi, and van travel. The goal is to make travel on public transportation simpler by combining different types of tickets into one card. The smart card will also provide special offers for card-holding passengers. Finland is currently using a contact card, but is developing the contactless smart card for Helsinki where fast-boarding of transit vehicles is a high priority. In addition to the ease of using public transit with the smart card, this technology will help improve transit's image as a unified system and create a level of confidence among passengers because of the visible use of new technology.

Cards cost about $5 to $10 to manufacture. They are sold to the user, and if lost, they can be repurchased. A smart card system would cost a transit system about $3 million. Development costs would be borne by the partners in the project who would benefit the most by eliminating or reducing tellers and related security costs. It takes roughly 2 to 3 years to fully initiate a smart card system. Development should be coordinated with other information systems in the area in order to achieve the greatest benefits.

Potential communities for this kind of technology are those that can establish guidelines for developing specifications and that can demonstrate an evolved ability to work across sector lines (e.g., banks and city services, transit and taxis, toll booths on highways, parking lots, buses and trains, libraries, and hospitals.) Businesses and service providers can benefit from combining forces to achieve better cash collection and market information.

A smart card approach for payment of transit fares and for cash purses requires the establishment of public-private partnerships that do not currently exist in the United States. Although smart card goals are common in the Scandinavian countries visited and are actually in use in several cities there, potential smart card relationships are only now being formed in the United States.

Rail Resurgence

Scandinavia and Germany are witnessing a resurgence in rail transportation owing, in part, to vehicle innovations. Rail services range from the dense urban core to long-distance regional corridors. New vehicle design has focused on providing

- Maximum passenger capacity;
- Better aesthetics (design and passenger amenities);
- Optimum door and stairway positioning;

- Ease of boarding and deboarding with low-level platform doors;
- Improved propulsion, braking, and steering systems;
- Greater operating efficiencies with electronic guidance, vehicle location, and passenger information systems;
- Higher ergonomic standards for comfort and safety;
- Lightweight aluminum car bodies for greater energy savings; and
- Finishes that minimize maintenance costs.

Improvements to the attractiveness of rail transit have also resulted in enhanced system performance. Regional services, for instance, have seen advances in vehicle design to allow maximum use of existing tracks. Advances in design and technology have reduced travel time and improved passenger comfort.

Tilting mechanisms, for example, enable trains to handle curves at up to 40 percent higher speeds. Electronic sensors measure the curve on approach to determine the appropriate degree of tilt. Other design and technology improvements that have enhanced speed and provided greater flexibility in service design and delivery include greater underframe clearance; lightweight material; bullet-shaped design; powerful, yet optimal energy consumption; and modular design (both inside and out).

The ability to adapt vehicles to environmental challenges and integrate service for a more seamless, customer-convenient transport system requires vision. Stuttgart provides an excellent model of a land-use and transportation vision, which allows for greater integration of rail services, spawning the advance of innovative vehicle designs. The simple, yet definitive tenants of the Stuttgart plan respond to the trends occurring in many U.S. and European cities. The plan is based on the premise that good public transport is the key to success. The Stuttgart plan calls for

- Improving the environment (including air quality and noise reduction) in residential areas, Reducing commuter parking in the city center to support transit use,
- Using land-use controls as an instrument of transport policy,
- Focusing development along rail corridors to support greater transit use, and
- Preserving and enhancing city-center vitality because it is a necessary component of a strong transportation system.

This plan also recognizes the challenges of creating a successful marriage of land-use and transportation policy by establishing clear limits on the development of the transport system. Stuttgart is following the measures outlined below to keep capital and operating costs in check and to allow the focus of expenditures to be on service:

- As a cost-saving measure, tunnels should be restricted to the central business district (CBD) and then only if required by topography. Outside the CBD, existing road rights-of-way should be used and rail service should be run within or next to general-purpose traffic.
- Fully actuated train signal priority should be provided for all train service to enhance speed and reliability. Giving priority to transit vehicles throughout the system is a significant step in support of creating a viable transit system and is a much-needed step for U.S. cities.
- In order to switch from narrow-gauge (i.e., l-m wide) to standard-gauge vehicles over a large part of the network, a three-rail, mixed-gauge track has to be provided. This is a commitment to a capital improvement that greatly enhances service flexibility by allowing the use of trams and trains in the same corridor.

Commuter rail supported by bus or light rail circulator systems is needed to expand the reach of the commuter rail system beyond the immediate vicinity of the stations. Presumably, the ability to fund these feeder services is enhanced by this policy statement.

Fare Integration

In all the five cities visited, fare policies are regionally coordinated even though there are often multiple operators. Most fare systems are relatively simple, are the same for all modes (excluding paratransit services), and are somewhat expensive ($60 per month or more). Fares generally cover more than 50 percent of operating costs.

Mode splits are exceptionally high (more than 30 percent) compared with U.S. standards. No bus systems use registering fareboxes and all rail systems are barrier free. Bus operators often handled cash, but single cash fares were priced at a premium.

Finland

The Helsinki Metropolitan Area Council (YTV) prepares the regional public transportation plan, decides routes and schedules, arranges competitive bidding among operators, approves fares, and issues regional fare tickets. Locally, each municipality owns and operates a transit system and establishes fares. There is full-fare integration throughout the region, which is divided into two zones.

On a national basis, the Ministry of Transport and Communications establishes maximum pricing for intercity bus travel, all of which is provided by private carriers. The Finnish Bus and Coach Association (FBCA) is composed of nearly 400 private bus companies. Matkahuolto, a subsidiary of FBCA, offers a unified ticketing system through 500 stations in the country, thus offering a level of fare integration nationally.

Matkahuolto, YTV, and Helsinki City Transport are working jointly on an integrated fare media program through a national travel system, using smart card and swipe card technology.

Sweden

In most countries, the legal responsibility for public transportation is shared by the county councils and the municipalities through the formation of public transport authorities. These authorities decide on the level of services, the planning of services and timetables, and both local and regional fares. These responsibilities encompass all modes of public transportation, including rail and ferry.

In Stockholm, Stockholm Transport (SL) is the transportation authority of Sweden's largest metropolitan region. The system operates extensive bus and rail services across five fare zones. A flat fare per zone has been established, regardless of the mode of travel. Although the fare structure is standardized and relatively simple within the SL system, there appears to be little coordination of fares between counties.

In Gothenburg, Stadstrafiken, a department of Trafik Kontoret, is responsible for fare policy, network planning, service standards, and finance. As in Stockholm, a single fare structure governs the entire Gothenburg metropolitan area.

Denmark

Under national law, public transportation throughout the region must function as a single system with complete fare integration. Copenhagen Transport's (HT) responsibilities include establishing fares, planning routes, prescribing service standards, monitoring service contracts, and providing marketing and public relations support. Through HT, a common ticketing and tariff system is in place for the entire region (see Figure 17). Although the Danish State Railways now manages all rail services in the region, the same farecards can be used on both buses and trains. Customers are free to transfer between bus and rail, and there are joining timetables for the entire region. As in Finland and Sweden, fares are well integrated regionally..

Germany

Stuttgarter Strassenbahnen (SSB) operates a modern light rail and bus feeder system, while German Rail (DB) operates regional commuter rail service. In 1978, these two agencies formed the regional public transport authority (Stuttgart Transport and Fare Association [VVS]) to coordinate fares and services and establish public policy for Stuttgart and the surrounding transportation districts. The common regional fare system also encompasses more than 40 private bus operators who have become partners in VVS. The fare structure is zonal and applies uniformly to bus, light rail, and commuter rail modes.

LESSONS FOR U.S. CITIES

An observation throughout this mission was the resurgence in the use of public transport despite an increase in private automobile ownership and a decentralization of urban area population. Key reasons for this resurgence include the following:

- Well-coordinated regional, urban, and suburban services inspire commuters to choose public transportation over private automobiles.
- Systems provide high-quality service for suburban and regional travelers and improved comfort, speed, and reliability for urban travelers.
- Land-use controls are in place in advance of transportation improvements to protect the financial commitments made to enhance service and capital facilities and vehicle acquisition.
- An integrated approach (including a coordinated fare structure) bridges the gap between all rail services and local bus services.
- Visible results are provided at an early stage to maintain the momentum and support to make the improvements--this is especially important given the long lead time necessary for full implementation of a viable, comprehensive transport system.

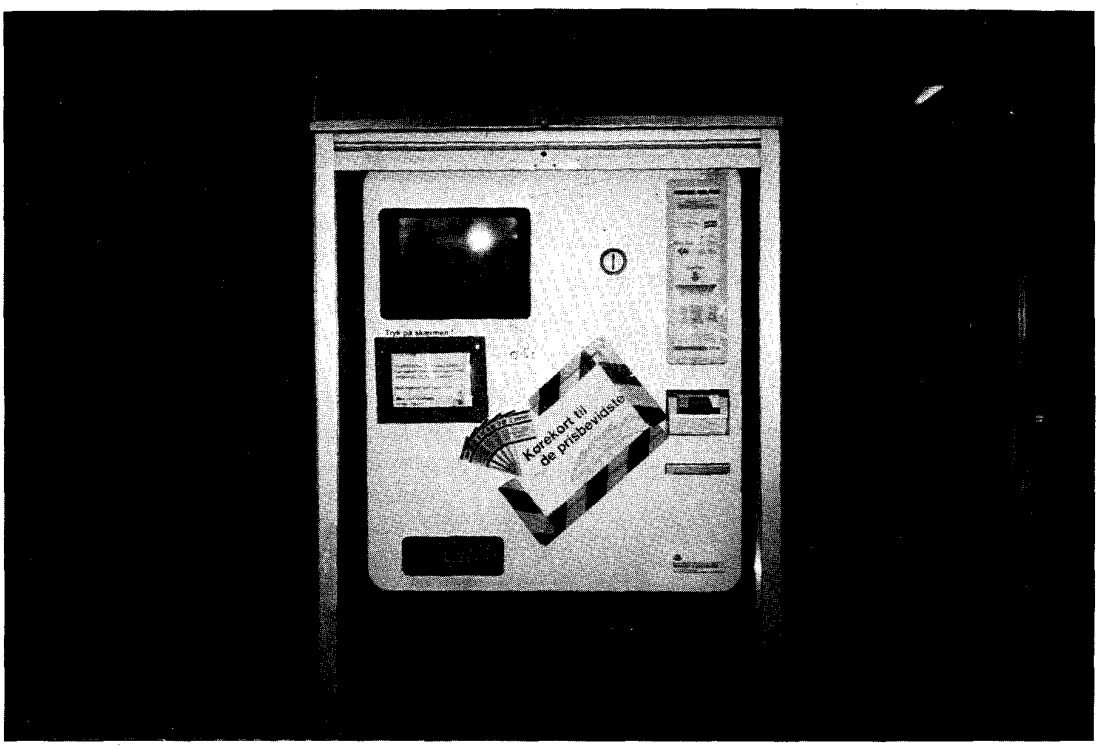


Figure 17. Danish ticket vending machine.

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

Mission 6--May 23-June 7, 1997: Public/Private Partnerships and Innovative Transit Technologies in Scandinavia (Helsinki, Stockholm, Gothenburg, Copenhagen, and Stuttgart)

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