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Transit Demonstration Projects that Made a Difference

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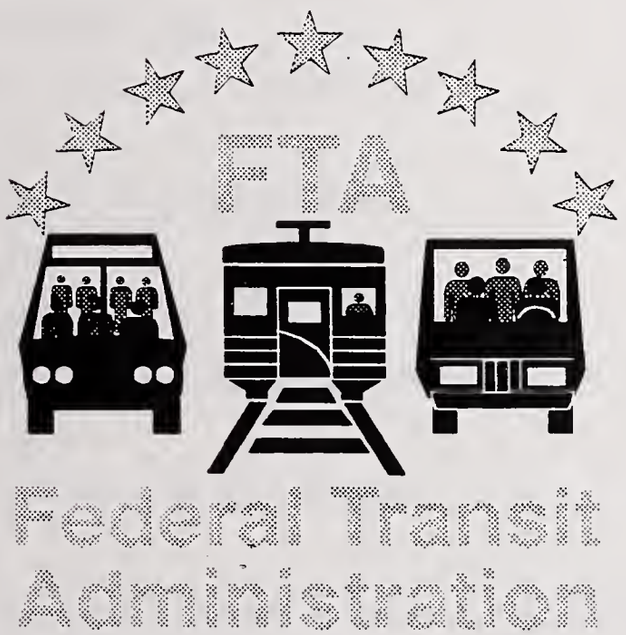

Office of Research, Demonstration and Innovation

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Transit Demonstration Projects that Made a Difference

Executive Summary

Thirty-five years ago, on June 30, 1961, President John F. Kennedy signed Public Law 87-70, the first legislation authorizing the Federal Government to conduct mass transportation demonstration projects. These demonstration projects showed how to implement innovative ideas about transit services, operations, management practices, institutional arrangements and technology in real-world applications to test their performance. Evaluation of experience with these demonstration projects was crucial to drawing conclusions about their technical and financial feasibility and their applicability to improving public transit throughout the nation.

This report describes selected examples of demonstration projects that have made a difference in the lives of those who use, operate, plan and finance public transportation. They show that governments at the Federal, state and local levels can collaborate successfully with the private sector in improving the welfare of those who use public transit. The nation owes a debt of gratitude to the people and organizations who were willing to serve as partners with the Federal Government in trying out these innovative concepts for the first time. Similarly deserving our recognition are the dedicated federal employees who worked creatively with them to plan and implement these demonstration projects and ensure that the results were made widely available.

shared-ride transportation in two travel corridors.

Transit Fleet Management and Control Systems

Transit fleet management and control systems permit transit operators to better control the schedule adherence of buses, thus promoting on-time service and greater passenger convenience. Control of bus schedules can reduce transit operating costs by minimizing the need for standby buses and operators to ensure scheduled service. Also, data required for schedule-making, planning and Section 15 reporting can be collected automatically, minimizing costs. FTA has been a key player in the development of transit fleet management systems since the late 1960's. Through support of RD&D projects in Chicago (1969), Philadelphia (early-mid 1970's), Cincinnati (early 1980's), and Los Angeles (early 1980's), FTA helped lay the foundation for fleet management systems being deployed today.

In places like Baltimore MD, Denver CO, Milwaukee WI, and Montgomery County MD, FTA has assisted in the installation of fleet management systems employing satellite technology to determine bus locations. These modern fleet management systems are providing significant benefits to transit operators. For instance, in Baltimore, the Maryland MTA system increased on-time performance on test buses by 23%, while Milwaukee's preliminary reports show increased on-time performance of around 90%.

Industry-Wide Bus Operator Training Program

In the late 1970s, FTA through a cooperative agreement with the AFL/CIO Appalachian Council, developed, tested and demonstrated the first Bus Operator Training Program. The program is currently in use in over 400 transit agencies world-wide. The program, including modules on passenger relations, emergency procedures and defensive driving, was designed to be taught in-house by transit instructors. It combined both classroom and behind-the-wheel instruction and replaced a variety of programs based on materials used by the trucking and auto industries. The program is still in wide use, with distribution handled through "train-the-trainer" workshops conducted by the Transportation Safety Institute.

Urban Transportation Planning System Software

Beginning in 1972, FTA developed, tested and disseminated computer-based planning tools for multimodal transportation planning, adding the ability to plan transit systems to software used in highway planning, and adapting the software for use on small computers. The Urban Transportation Planning System met the need for long-range planning tools allowing quick, inexpensive and comprehensive evaluation of different multimodal transportation strategies. The UTPS also improved local capabilities to discover and assess low-cost methods of optimizing the person-movement, convenience and capability of existing transportation systems and integrated these new tools into a joint FTA-FHWA urban transportation planning procedure which exploited advances in computer capabilities. This work resulted in the manual known as Characteristics of Urban Transportation Systems (CUTS), which has been updated and remains a basic multimodal planning reference.

Transit Demand Management Modeling

FTA developed a microcomputer program to enable employers, developers and local governments to collect and analyze data on

Transit Demonstration Projects that Made a Difference

Public Law 87-70, signed by President John F Kennedy on June 30, 1961, amended the Housing Act of 1949 and authorized the Federal Government to conduct mass transportation demonstration projects. The purpose of these demonstration projects is to assist in carrying out urban transportation plans and research, including development of information of general applicability on the reduction of urban transportation needs, the improvement of mass transportation service and the contribution of such service toward meeting total urban transportation needs at minimum cost.

The following are examples of selected demonstration projects that have made a difference in the lives of those who use, operate, plan and finance public transportation. The 1961 law predates the Departments of Transportation and Housing and Urban Development. For simplicity, the agency responsible for conceiving and conducting these demonstrations, whether the Federal Transit Administration (FTA) or its predecessors the Urban Mass Transportation Administration and the Urban Transportation Administration, is referred to throughout as FTA.

Demand-Responsive Paratransit Service

Before the FTA demonstration program, there was no mode of publicly operated transportation service between fixed-route transit and private taxi service. As various ridesharing models were proposed and demonstrated, the concept of paratransit emerged, articulated in an FTA-sponsored Urban Institute report entitled *Para-Transit*. Part of the repertory of paratransit concepts was real-time matching of rider needs and vehicle operations. FTA played an major rôle in transforming demand-responsive transit from an attractive theoretical concept into a working reality. The first demonstration of the demand-responsive concept took place in Peoria, Illinois from 1964 until 1966. The Peoria Premium Special bus provided door-to-door service for work trips on a subscription basis. Routes were modified weekly to accomodate new subscribers. The demonstration of real-time dispatching of Dial-a-Ride service using manual techniques in Haddonfield, New Jersey attracted increased patronage with every increase in service area. Later demonstrations in Rochester, New York and elsewhere showed that despite favorable public response the cost per ride was too high for Dial-A-Ride to be used as primary public transportation service but confirmed its value in meeting the need for specialized service for the elderly and disabled. FTA sponsored research that made computerized dispatching possible and conducted the first major pilot experiment in Orange County, California in 1980. These demonstrations of the feasibility of demand-responsive paratransit enabled the transit industry to meet the requirements of the Americans With Disabilities Act to provide equivalent service those unable to use fixed route transit.

Improved Passenger Information Systems

FTA has sponsored demonstrations of computerized passenger information systems that make it easier for passengers to learn of transit services and schedules, making them more likely to ride transit. This can lead to higher transit ridership and increased revenues for transit operators, as well as reduced highway congestion and air pollution. Prototype systems are being installed in Los Angeles, Denver, and Bellevue, WA. Houston Metro's Smart Traveler project is expected to shift approximately 5% of single-occupant vehicle drivers to some form of

applying advanced communication technologies for transit and ridesharing.

National Transit Geographic Information System (GIS)

FTA developed and demonstrated a National Transit Geographic Information System (GIS) providing, in map-based graphical and statistical form, handy information about a representative inventory of the nation's public transit assets. Initially, the nation's fixed guideway infrastructure was represented in the Transit GIS, now augmented by a national database of 583 fixed bus route networks. Transit planners and service providers will have access to information about their local service areas that will improve their ability to utilize resources and make informed decisions on planning, policy and operations. As part of an FTA demonstration project, the Capital District Transit Authority in Albany, New York is using GIS for route monitoring, management of bus stop signs, and in computer-assisted dispatching and scheduling. Creation of this national system is an ongoing and collaborative effort on the part of many in the transportation industry. The Bureau of Transportation Statistics distributed the first version of the infrastructure database on compact disc as part of the National Transportation Atlas, and Bridgewater State College in Massachusetts is establishing an Internet Home Page for access to the Transit GIS. The National Transit Institute will offer an introductory training course on transit geographic information systems that will provide transit professionals an opportunity to compare various GIS software platforms for use within their organizations.

Automatic Fare Collection

FTA pioneered automatic fare collection technologies starting in 1964 with a one-year experiment conducted by the Long Island Rail Road and at its Kew Gardens and Forest Hills Stations. Magnetically striped cards with an encoded monetary value were used by passengers to enter and exit the stations. Automatic passenger counts were obtained. In 1969, the new Lindenwold Line which operates between Philadelphia and Lindenwold, New Jersey adopted the magnetically encoded fare card with a simplified zone system. In the early 1970s, the first completely new rapid transit system in the post-war era, the San Francisco Bay Area Rapid Transit System (BART), installed an automatic fare collection system using a more advanced magnetic stripe card, which deducted the exact fare based on distance traveled. The "distance traveled fare" was major advance in transit fare collection. Other rapid systems such as Washington, Atlanta, Chicago, Philadelphia and New York (now being phased in) use the same concept with some site specific variations. The magnetically encoded fare card is now the basis for many types of US and foreign transit system fare collection systems.

The most recent advance in fare card technology is called the *proximity card*, successfully tested through FTA support by Washington Metro, Los Angeles DOT, and the City of Torrance, CA. The proximity card has no magnetic stripe; instead, it works through radio waves that communicate between the turnstile (or on buses, the farebox) and a computer chip embedded in the card. The passenger simply passes the card within an inch or two of the target on the turnstile, and the fare is deducted. The total absence of moving parts makes the proximity card system suitable for harsh environments like transit buses and parking lots, where magnetic stripe cards have been unsuccessful. In addition, the computer chip increases data capacity over the older magnetic stripe, so the proximity card can be used for multiple applications--one card for buses, subways and parking lots--even allowing several transit providers to easily

transportation demand management (TDM) programs and a modeling technique for analyzing the interactions of TDM strategies and land use development scenarios, along with a manual of implementation guidelines. These techniques will help local communities to better address ways to improve local mobility, reduce traffic congestion and increase transit ridership.

Multi-Operator Negotiable Transit Subsidy Vouchers

FTA sponsored demonstrations of transit vouchers that encourage employees to ride transit to work in the New York City, Philadelphia, Los Angeles and Washington metropolitan areas. Thousands of transit vouchers are now sold monthly in each area, contributing to increased transit ridership.

Background

Transit Subsidy Vouchers, also known by their copyrighted name of TransitCheks, were developed under a 1986 cooperative agreement between FTA and the New York Transit Center (NYTC). The NYTC is a group of public and private transit providers and employers in the New York region. The NYTC's interest in this project was to develop a framework and procedures to take advantage of the then recently enacted Deficit Reduction Act of 1984 that allowed employees to receive a noncash tax free transit fringe benefit of $15 per month from their employers. Subsequent legislation has increased the monthly tax free transit benefit amount to $65.

NYTC developed the procedures and the negotiable financial instruments known as TransitCheks. Such a negotiable instrument is key to the simple and practical administration by employers of the tax-free transit benefit program in a multi-operator region such as New York. Without TransitChek, employers would have to be responsible for multiple passes and other instruments created by separate operators. TransitCheks are sold in bulk by the NYTC to employers in the New York region who in turn distribute them to their employees. The employees redeem the TransitCheks at the transit provider of the employees' choice. The transit provider deposits the TransitCheks in any bank. Through the Federal banking system, NYTC's bank clears the TransitCheks and transfers funds to the transit providers' bank accounts The TransitChek has a number of security features to guard against counterfeiting, theft and fraud. NYTC is able to administer the TransitChek program entirely from small sales fees and the interest on the float of unredeemed TransitCheks.

The New York TransitChek Program presently involves over 6,000 employers and over 110,000 employees and generates sales of over $40,000,000 per year. The TransitChek Program enables employers approximately to double the value of employees' fringe benefits through the leveraging effect of the tax code. The success of the New York TransitChek Program has led to the creation of similar programs in a score of other U.S. cities, including Washington, DC.

Cellular Phones to Promote Ridesharing

FTA supported a successful test of cellular phones, voice-mail and computerized real-time information in carpool and vanpools in Bellevue, WA. The use of cellular phones was successful in improving public perceptions of ridesharing. Forty-two percent of drive-alone commuters expressed strong interest in the idea. Many transit agencies are investigating various means of supplying real-time information to the traveling public. FTA's report describing Phase I of the Bellevue Smart Traveler project, issued in May 1993, will guide agencies in making sound decisions in

technology and performance, lowering operating cost, reducing pollution, and adding passenger amenities to stimulate ridership Experimental Transbus prototypes built by General Motors, Rohr, and AM General were extensively tested and operated in revenue service Although no Transbus production orders were ever placed, the bus manufacturers adopted the basic bus designs and many features pioneered by the Transbus Program. The Advanced Design Buses of the late 1970s-early 1980s were a direct result of this program. In addition, aspects of the bus procurement process were changed because of Transbus, such as the use of negotiated procurements. The "White Book" standardized bus specification, widely used for two decades in purchasing transit buses, was an outgrowth of Transbus; FTA and the American Public Transit Association are now collaborating in updating it. Finally, the evolution of wheelchair accessibility by lifts was an outgrowth of lowering the bus floor and later adding a kneeling feature.

Fire-Safe Materials for Transit Vehicles

In October 1993, FTA published recommended fire-safety practices for transit bus and van materials. These guidelines are similar to those developed by FTA and published several years earlier for rail transit, used worldwide by transportation authorities. There have been no fires involving rail transit car materials in the U.S. since the rail transit fire-safety guidelines were published and widely adopted in selecting materials for rail cars. The guidelines will be considered for non-transit applications by a recently formed Interagency Working Group on Fire and Materials, representing many Federal Government agencies.

Electronic Interface Standard for a Vehicle Area Network

FTA sponsored development by the Society of Automotive Engineers of Standard J-1708T for a variety of electronic capabilities, including eiectronic fare systems, communication systems, automatic vehicle location systems, passenger information systems, passenger and counters. This is the first officially recognized standard for ITS. The standard defines recommended practices and open architecture for interfacing interchangeable transit vehicle components. Designs employing this standard can reduce the number of wires in a bus, thereby decreasing weight, maintenance complexity, and installation costs. Prior to this standard, it was very difficult to interchange transit communications equipment because of manufacturers' proprietary designs. Use of the standard will open up follow-on procurements, expand competition and minimize the cost of electronic transit components and systems.

Alternative Fuel Transit Vehicles

Capital grants are being used to purchase alternatively fueled transit vehicles (primarily buses and vans), fueling systems and garages, while research dollars are being used to evaluate these vehicles and fuels in order to determine which are more efficient and cost-effective. Efforts in this program are coordinated with the Environmental Protection Agency and the Department of Energy. FTA has assisted in the purchase of over 2,500 alternatively fueled vehicles of a number of different types. FTA research has:

- studied what modifications are necessary so existing bus garages can handle alternative fuels safely;
- collected data on operational and cost impacts of alternatively fueled buses;
- conducted industrial hygiene surveys in three sites that use methanol buses to

share the same card Tests of the proximity card have been so successful that Washington Metro, the City of Torrance CA, and Ventura County CA, have all begun full system implementations, all thanks to FTA RD&D projects.

High Occupancy Vehicle (HOV) Priority Facilities

For a period of about ten years, from the early 1970s to the early 1980s, FTA developed, demonstrated and evaluated more than ten High Occupancy Vehicle (HOV) priority facilities in various urban areas. Among the earliest demonstrations were exclusive lanes along Shirley Highway (I-95) in Northern Virginia and the El Monte Busway in Los Angeles. The success of these demonstrations, which showed that during peak periods each HOV lane carried two to three times as many people as an adjacent mixed traffic lane at substantially higher speeds, has led to HOV lanes being implemented nation-wide.

Background

HOV priority facilities are highway facilities constructed or modified to provide priority to vehicles carrying more than a defined number of passengers. HOVs can be buses, vanpools, or carpools carrying 2 or more (or 3 or more) passengers. HOV priority facilities are located on freeways, arterials, city streets or entirely separate rights-of-way. HOV priority facilities include a family of techniques such as reserved lanes on freeways, arterials or city streets, reversible roadways within freeway rights-of-way, wholly reserved freeways during peak periods, exclusive busways on separate rights-of-way, priority admission of HOVs to metered freeways, transit malls, downtown auto-restricted zones, etc. These projects together with other non-FTA-funded HOV projects served to demonstrate the technical, institutional and political feasibility of HOV priority facilities.

The repeated demonstration of HOV facilities of various types and in different locations together with independent, objective and comprehensive evaluations provided a base of knowledge and a sense of confidence to local and state highway and transit officials to undertake independent and routine implementation of HOV facilities using Federal, state and local highway and transit funding. HOV priority facilities are now well accepted and their implementation has proliferated in many urban areas. It is estimated that HOV priority facilities have saved the general public billions of dollars in reduced travel time and in the avoidance of the construction of more costly highway facilities to provide the necessary peak period person-carrying capacity. HOV priority facilities also provide a time-saving incentive to shift from single occupancy vehicles to HOVs and thus have served to reduce the consumption of fossil fuels and the emission of air pollutants.

Bus Design and Technology

In the mid-1960s the "New Systems Study" suggested many potential transit innovations and documented industry needs. In addition, a 1968 National Academy of Engineering study strongly urged major improvements in bus design and technology. Among the most prominent features needed for a new design bus were a lower floor and other passenger amenities. The "New Look Bus" was designed in 1959, and was the only model being built by the 3 manufacturers building buses in the late 1960s-early 1970s. The bus was growing heavier because of air conditioning, energy absorbing bumpers, etc.

The Transbus Program, launched in 1971, was a successful attempt at advancing bus design,

Angeles use this method of lining tunnels. It is now an industry standard.

Subway Environmental Simulation Computer Program and Handbook

The number and location of ventilation shafts is a significant cost of building a transit tunnel. Developed in the late 1970's for about $4 million, the computer model was designed to optimize air flow and temperature control in subway tunnels and stations. The model is used world-wide for every major transit or rail tunnel designed and built since the mid-1970's. The computer program was used in the design of the Baltimore, Washington, Los Angeles and Atlanta rapid transit systems, new Dallas light rail system and the 3-mile tunnel extension of the Portland light rail system. The original computer program was expanded to include a fire model to address elimination of heat and smoke in the event of a major tunnel fire. This portion has not been validated. However, based on testing just completed by FHWA at an abandoned tunnel in West Virginia, the validation will be completed by 1997. The software is maintained by the Department's Volpe Center, and it continues to be supplied on request to subway designers world-wide.

Advanced Signal and Control Technologies

FTA sponsored studies of these technologies over 15 years ago, and the concepts are now the basis for major signal and train control replacement programs at BART and NYCTA. FTA transferred the documentation on these technologies to the signal supply industry and the transit operators. This technology is now moving forward without major R&D funding from FTA.

Electromagnetic Compatibility Program

As a direct result of a major electrical compatibility problems between chopper propulsion systems and signal systems in Chicago and Atlanta, the FTA formed a technical group of propulsion and signal experts from the supply industry and, over a three-year program, developed a set of industry standards to eliminate the compatibility problems. In Atlanta, the program was instrumental in assuring that the rail system would open on time. Since the completion of the program all purchases of new transit cars have used the standards to assure proper integration of the car and its propulsion system with existing signal systems. The standards were used on the Northeast Corridor to assure compatibility between the New Jersey Transit's alternating current powered rebuilt commuter cars and the existing AMTRAK signal system. The program investment was less than $1 million; the benefits include millions of dollars saved and improved safety through preventing collisions.

Electrical Energy Management Model

Developed by Carnegie Mellon University with FTA and FRA funds for under $1 million, the model has saved transit authorities over $19 million. The model has been used by 4 transit operators to provide realistic information on operational strategies to reduce energy consumption, as well as providing detailed information during rate negotiations with utilities. It simulates operation of rail transit systems, predicting electrical energy consumption with accuracy of better than 10%. The program continues with a goal of additional saving in energy costs through improvements in energy control strategies to reduce energy consumption.

determine possible employee safety issues; and

- completed similar surveys of transit agencies using natural gas buses.
- completed facilities guidelines for transit agencies using natural gas and alcohol fueled buses

Alternating Current (AC) Propulsion for Rail Transit

AC propulsion offers significant advantages in rail transit: brushless, low maintenance AC motors, and the ability to regenerate power back into the power system. FTA and the Cleveland Transit System (now Greater Cleveland Regional Transit Authority) collaborated with WABCO and Reliance Electric by running 3 AC powered transit cars for one year in the early 1970s. The cars converted traction power from direct current to alternating current for power on the car. This demonstration program proved the feasibility of AC traction in mass transit service. The local telephone company conducted tests adjacent to the rail line to make sure there was no interference with their service. For various reasons, primarily due to the early state of power electronic componentry at the time, no other transit authority adopted AC propulsion. In the early 1980s, FTA, the New York City Transit Authority (NYCTA), Garrett AiResearch and Westinghouse converted a number of rapid transit cars and operated the Garrett cars in service in New York using state-of-the-art power conversion equipment. The NYCTA AC powered cars were found sufficiently reliable so that the first production order of AC propulsion was made by the Mass Transit Administration of Maryland for the Baltimore Light Rail Vehicle fleet. Other subsequent orders for AC propulsion by SEPTA (Norristown Line and Market-Frankford), WMATA and MBTA confirm the significant benefits of this technology

Construction Management

Guidelines for Construction Management. As a result of serious construction problems and cost overruns with the Miami and Detroit fixed guideway systems, FTA funded several "guidelines" documents to improve the management of large-scale transit construction projects. The two principal products were *Project and Construction Management Guidelines* and *Quality Control and Quality Assurance Guidelines*. The Construction Management Guidelines document outlines the process of managing the design and building of facilities from planning through start-up of service. The Guidelines are use by FTA grantees, their consultants, project management oversight contractors, and FTA regional office staff as the framework for managing construction and reconstruction of facilities.

New Austrian Tunnel Method (NATM). This "fast-track" method of designing and building a tunnel was first demonstrated in the U.S. through an FTA grant to the Port Authority of Allegheny County for its Mount Lebanon light rail tunnel in Pittsburgh. This tunneling technique is now a standard for tunnel construction (when the soil condition permits) for all new U.S. tunneling because it reduces construction costs. FTA provided funds to import the technology, which was originally developed in Europe.

Concrete Tunnel Liners. FTA funded the first use of pre-cast concrete tunnel liners. Baltimore bid both conventional steel and pre-cast liners, and selected concrete for its initial rapid transit tunnel segment. Use of pre-cast concrete liners reduces installation time and therefore cost. Other transit systems including Washington, Atlanta, and Los

Transit Demonstration Projects that Made a Difference

Rail Car Cost Containment

FTA established a project to reduce or stabilize the cost of new rail cars. Cooperating transit agencies included SEPTA, METRA (Chicago), MARTA and New Jersey Transit (NJT). Three of the four agencies worked with consultants on a rigorous analysis of their technical and procurement specifications and procurement process with the goal of improving, eliminating or modifying existing practice. SEPTA, METRA and NJT used the results of their work when new cars were purchased, or existing cars rebuilt. METRA's bid price was estimated at approximately $200,000 per car lower than expected based on results of the FTA sponsored project for a 173 car order. Project cost: $1 million.

People Mover Systems

Automated small vehicle transit vehicles have been newspaper "Sunday Supplement" features for years. In the mid-1960s, FTA's research staff, the Port Authority of Allegheny County (Pittsburgh) and Westinghouse collaborated on the first full-scale automated small vehicle transit system in Pittsburgh's South Park. The system was designed to test the technology for a line haul, Sky Bus system, which was supposed to replace several streetcar lines serving Pittsburgh's South Hills area. The South Park Sky Bus system operated successfully for several years, and was in effect the prototype for all contemporary airport people mover systems in the world Westinghouse's successor company, AEG, now ADtranz, is still building airport people mover systems based on the South Park technology

In addition, the Skybus System led the way for the much more complex Morgantown circulator system, which opened in 1975 at West Virginia University. The Morgantown Personal Rapid Transit (PRT) system is a unique 8.7-mile automated people mover system which carries over 2 million passengers yearly. It features station bypass capability, which means that vehicles bypass stations if no passengers are boarding or deboarding at the station en route. Although controversial in its early years because of its cost, it remains one of the world's most reliable fixed guideway systems with a reliability rate of over 98%! Other successful people mover systems, built to a similar concept include: the Airtrans system at the Dallas-Fort Worth Airport; and the downtown systems in Detroit and Miami.