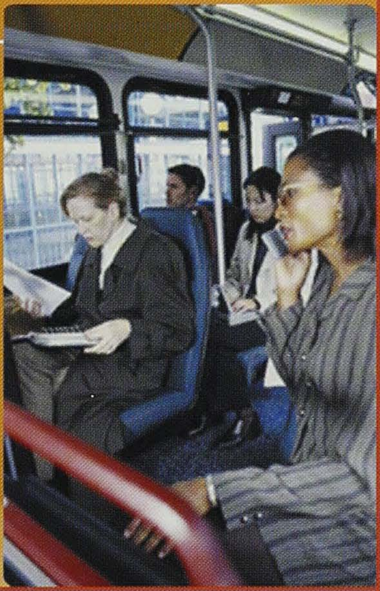
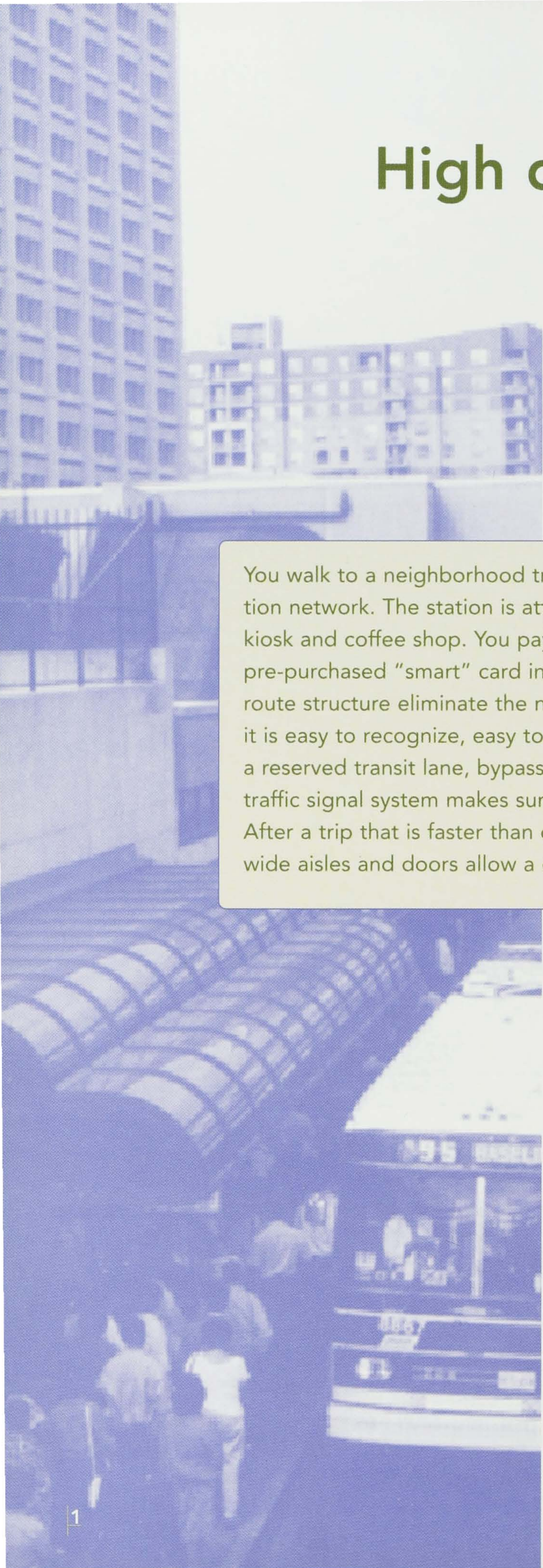
BRT

BUS RAPID TRANSIT



Why more communities are choosing Bus Rapid Transit



High quality public transit
makes high quality communities.

It improves the lives of their residents in many ways, from guaranteeing access and mobility for everyone to fostering economic vitality and protecting the environment. What characterizes high quality transit? For starters, it's convenient, reliable, fast, attractive and comfortable. High quality transit is also well integrated into its surroundings, advancing community goals and objectives while balancing them against public resources. Imagine for a moment, a hypothetical trip on a high quality, modern rapid transit system.

You walk to a neighborhood transit station, your access point to a regional transportation network. The station is attractive, well lit, and safe—there is even a newspaper kiosk and coffee shop. You pay your fare and enter the station simply by waving your pre-purchased "smart" card in front of an electronic reader. The short wait and simple route structure eliminate the need for a schedule or map. When your vehicle arrives, it is easy to recognize, easy to board, clean, and quiet. It pulls out of the station onto a reserved transit lane, bypassing congested traffic. At intersections, a computerized traffic signal system makes sure you get the green lights you need to keep on schedule. After a trip that is faster than driving, you arrive at your destination and the vehicle's wide aisles and doors allow a quick, easy exit.

This description may conjure the image of a big, expensive subway system, but all these features can also be found in an innovative and cost-effective form of public transportation: Bus Rapid Transit (BRT). Exclusive transitways, modern stations, high-tech vehicles, and frequent service—BRT combines these features to provide the high level of service that people have come to expect from more expensive transit systems. BRT has advantages because it can be built and improved incrementally, and it is flexible enough to serve both densely populated cities and less concentrated suburbs. BRT is also convenient because systems can be designed so that vehicles—not passengers—transfer from local routes to high-speed lines. Although BRT is a relatively new form of transit, existing systems in the United States and around the world have met with great success. If good public transit is characterized by speed, comfort, reliability, and rider satisfaction, communities seeking to improve their quality of life may want to carefully consider Bus Rapid Transit.

Components of Bus Rapid Transit

BRT is more than just special buses or improved bus stops. It is a complete rapid transit system that combines flexible service and new technologies to improve customer convenience and reduce delays. There are seven major components to BRT, and communities can choose from a variety of options to assemble a fully integrated system that meets their needs and their budget.

Running Ways

BRT vehicles operate primarily in fast and easily identifiable exclusive transitways or dedicated bus lanes. Vehicles may also operate in general traffic.

Stations

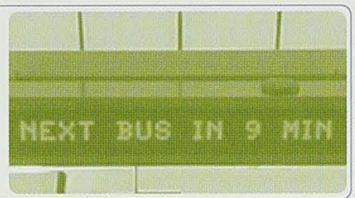
BRT stations, ranging from enhanced shelters to large transit centers, are attractive and easily accessible. They are also conveniently located and integrated with the community they serve.

Vehicles

BRT uses rubber-tired vehicles that are easy to board and comfortable to ride. Quiet, high-capacity vehicles carry many people and use clean fuels to protect the local environment.

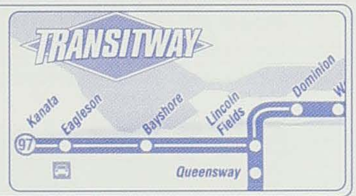
Service

BRT's high-frequency, all-day service means less waiting and no need to consult schedules. The integration of local and express service can reduce long-distance travel times.



Route Structure

BRT uses simple, often color-coded routes. They can be laid out to provide direct, no-transfer rides to multiple destinations.

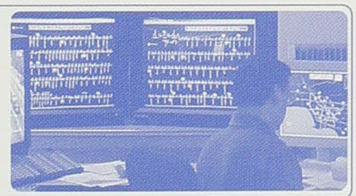


Fare Collection

Simple BRT fare collection systems make it fast and easy to pay, often before you even get on the bus. They allow multiple door boarding, reducing time in stations.

Intelligent Transportation Systems (ITS)

BRT uses advanced digital technologies that improve customer convenience, speed, reliability, and operations safety.



Running Ways

BRT vehicles can operate practically anywhere, but the use of dedicated "running ways" (the general term for BRT travel lanes) is what gives BRT its speed, reliability, and identity. BRT running ways can be built wherever a linear route is possible—on an abandoned rail line, within a highway median, or on city streets.

Exclusive Transitways	Limited access running ways, often along existing or abandoned rail lines or along wide boulevards. Transitways may be fully "grade-separated" (avoiding street intersections through bridges or tunnels) or "at-grade" (crossing streets at signalized intersections).
HOV Lanes	Separate highway lanes for High-Occupancy Vehicles (HOVs) such as BRT vehicles, vanpools, carpools, and shuttles. HOV lanes may have exclusive on- and off-ramps for BRT vehicles.
Dedicated Transit Lanes	Exclusive or priority lanes set off from regular traffic by curbs, unique paving, or striping, usually on wide thoroughfares.
Transit Streets or Malls	Transit-only streets, often in dense downtown areas and suburban business districts.
Mixed Traffic	BRT vehicles can operate in regular mixed traffic in order to reach local destinations or where reliable, high-speed operation is possible without dedicated lanes.
Queue Jumpers	Short exclusive lanes at signalized intersections. Queue jumpers allow BRT vehicles to "go to the head of the line" and bypass stopped auto traffic.

BRT systems can combine two or more types of running ways in order to meet local needs. For example, a BRT vehicle might collect riders in mixed traffic along a neighborhood street, use an exclusive ramp to enter an HOV lane for the high-speed trip downtown, and then pass through a transit mall to distribute passengers in the central business district. BRT running ways can be upgraded later with additional grade separations to eliminate delays at intersections.

HONOLULU, HAWAII
The new Country Express! service connects the Waianae Coast with Honolulu via an HOV lane with exclusive entry and exit ramps, in the median of the H-1 freeway. New low-floor buses circulate through neighborhoods to pick up passengers and then run express to downtown and the Alapai Transit Center. Ridership on the transit system has risen dramatically, due in part to the excellent reliability, high speed, high frequency, and identity of the new service.

EUGENE, OREGON
The Lane Transit District is currently planning the Franklin Boulevard Busway, a 4-mile BRT line that will include a combination of exclusive transitways (shown above), dedicated transit lanes, and queue jumpers that will make BRT travel times equal to or better than private autos. Vehicles will have small guide wheels that will "track" special vertical curbs; this simple mechanical guidance system allows narrower transit lanes and "precision docking" at BRT stations.

BOSTON, MASSACHUSETTS
The Massachusetts Bay Transit Authority is constructing the new Silver Line, a BRT service that will connect historic Roxbury to Downtown Boston. The segment under construction will use dedicated transit lanes and limited mixed traffic operation. Also under construction is an underground transitway that will provide direct connections to the subway, commuter rail, Amtrak, intercity bus, and Logan Airport.

Stations

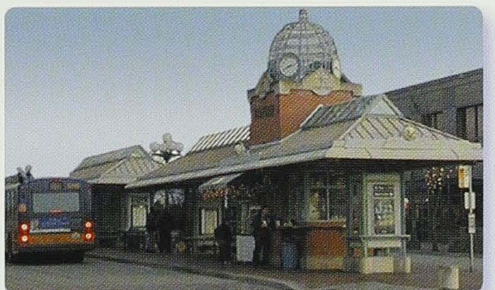
BRT systems can use a variety of stations, from enhanced shelters to large transit centers. The design and location of BRT stations depends on the surrounding community, transit ridership, and operational requirements. Major stations may include parking facilities, taxi stands, and support transfers to other transportation services. In less dense areas, high-quality shelters might suffice. As with all transit systems, BRT stations are clean, well-lit, safe, and protected from the elements.

BRT stations can also include customer information, including maps, schedules, and real-time vehicle arrival information. BRT stations are excellent locations for many services, including coffee shops, newspaper vendors, bank ATMs, and dry cleaners, which can also provide additional revenue to the transit operator. Signage and graphics will readily distinguish BRT stations from regular bus stops, and good design ensures that BRT stations contribute to the character of the community.

Good station design also facilitates fast, efficient service. Passing lanes at BRT stations allow express vehicles to pass a vehicle stopped to pick up passengers, permitting simultaneous operation of local and express service on the same running way. Station design can also reduce the amount of "dwell time" that a vehicle spends in the station picking up or discharging passengers. Raised passenger platforms can provide level, no-step boarding into low-floor vehicles, allowing faster and safer boarding for people with disabilities, parents with strollers, and the general public.

SEATTLE, WASHINGTON
The Seattle Bus Tunnel provides an excellent circulation system for Seattle's downtown. The attractive stations, simple tunnel route structure, high frequency, and free fares for local trips offer BRT passengers easy, direct access to many urban amenities and employment centers.

QUITO, ECUADOR
The BRT system in Quito, Ecuador uses enclosed, "controlled access" stations adjacent to an exclusive transitway. Passengers pay a fare upon entering the station, and then walk directly onto the BRT vehicles. Ramps and "level-entry" boarding allow easy access for passengers with disabilities.



BELLEVUE, WASHINGTON
The Bellevue Transit Center is part of a regional BRT commuter system that includes an extensive network of HOV lanes and park-and-ride facilities. Improvements underway include public restrooms, a Community Police Station, bicycle storage and rental, and concessions.

Many different vehicles are available to meet local needs. From top: A compressed natural gas-powered bus from Los Angeles; the articulated Iris Civisbus; a Neoplan diesel-electric vehicle ordered for Boston's Silver Line, and the mechanically guided Bombardier Tram-on-Tires, in service in Nancy, France.

Low-floor BRT vehicles with precision docking systems can pull up level to, and within inches of, station platforms, allowing direct, unassisted wheelchair access.

Vehicles

BRT vehicles are comfortable, attractive, and environmentally friendly. A variety of sizes and configurations is available to meet local needs and perform specific functions. In bustling urban corridors, double- and triple-section "articulated" vehicles (see photos at left) can carry more than 150 passengers, providing enough capacity for even the busiest rush hours. In less dense suburban areas, smaller vehicles can be used. Whatever the function, BRT vehicles have features that improve comfort, speed, and safety:

- Low floors and multiple double-wide doors allow fast and convenient boarding.
- Wide aisles provide space to move around.
- Alternative fuels and noise and air pollution reduction technologies can help protect the environment.
- Distinctive design, color, and graphics provide a unique identity for vehicles in BRT service.
- On-board customer information systems help passengers know when and where to get off.

Rubber-tired vehicles are also flexible and relatively inexpensive to buy. They are not limited to exclusive BRT running ways but can operate on local streets where necessary. Even accounting for service life and capacity differences, special-purpose BRT vehicles are less expensive than most rail transit vehicles, and, if necessary, conventional buses can be used in BRT systems.

Service

BRT can provide many service options to effectively meet customer needs. The most significant option is the operation of local and express service on the same BRT route. This type of operation can speed travel from outlying suburbs while still providing effective local service in urban areas. "Skip-stop" routes, in which vehicles stop only at selected stations, can also reduce long distance travel times. Operators can vary the mix of local, express, and skip-stop services at different times of day to meet varying demand.

Frequent service and reliability are basic benefits of BRT. Many systems operate vehicles every few minutes, eliminating the need for a schedule. The use of exclusive running ways reduces competition with traffic, speeding longer routes and helping them to stay reliably on schedule.

Route Structure

The flexibility of BRT allows routes to be tailored to meet the needs of the community and the passengers. Because BRT vehicles can operate practically anywhere, routes can be designed to allow more passengers the convenience of a no-transfer, one-seat ride. For example, a suburban-urban route may use neighborhood streets to collect riders and then a transitway for express service to a major destination such as downtown. Unlike light rail, a BRT system may also have "off-line" stations located at some distance from the running way; in this case, a vehicle might exit a transitway, travel a short distance to a major destination, and then return to the transitway. In both examples, BRT offers extra convenience because vehicles, not passengers, transfer from line to line.

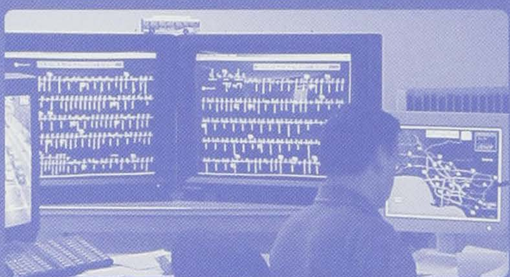
LOS ANGELES, CALIFORNIA
On Wilshire Boulevard in Los Angeles, a Metro Rapid BRT vehicle comes along every 2 minutes during rush hour and at least every 10 minutes during off-peak periods.

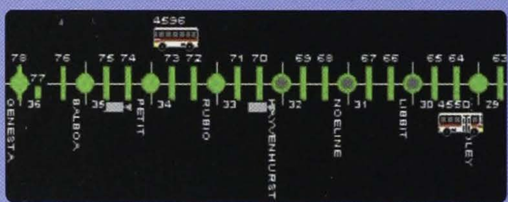
"I think BRT is the transportation system of the future for the City of Angels."

-Los Angeles Mayor Richard Riordan

SEATTLE, WASHINGTON
Seattle's downtown bus tunnel is one segment of a regional BRT system that also includes an extensive network of exclusive transitways and HOV lanes. The attractive "dual-mode" vehicles run on diesel power aboveground and then switch to electric power, supplied by overhead wires, while in the tunnel. Routes are structured to provide no transfer, high-speed rides for commuters going from home to work in Seattle's downtown, one of the largest in the Nation.

PARIS, FRANCE
This BRT station in Paris, France offers protection from the elements, bus route and schedule information, and a ticket vending machine for the "proof of payment" fare system that makes boarding faster and more convenient. The fare system and the basic station design are the same as used on Paris's two light rail lines.





LOS ANGELES, CALIFORNIA
The new Metro Rapid BRT system along Ventura, Wilshire, and Whittier Boulevards uses existing traffic signal sensors to determine the location and speed of BRT vehicles. New signal priority software (display above) holds or advances green lights, if needed, to allow a BRT vehicle to get through intersections without stopping. In combination with increased station spacing, signal priority has shaved 20-25% off BRT transit travel times compared to the previous limited service in the corridors. Total ridership in the corridors is up by almost 30%.

Fare Collection

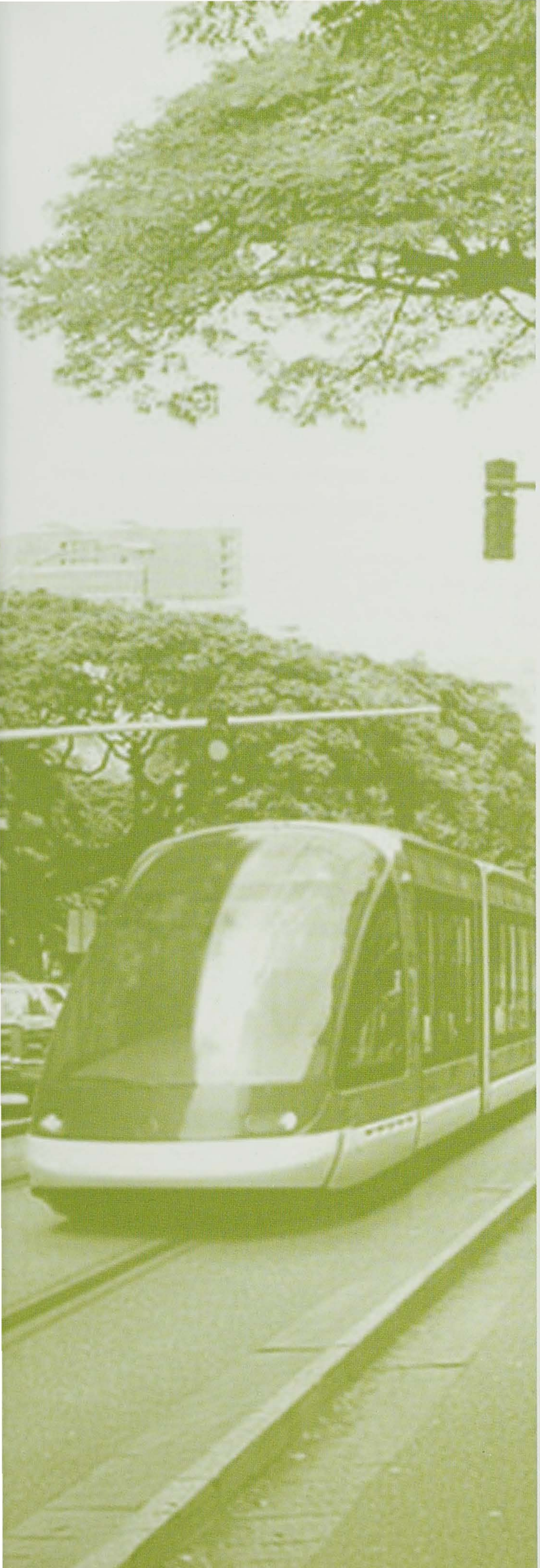
BRT systems typically include fast and efficient fare collection to speed boarding and increase convenience. Cashless fare systems rely on passes, pre-purchased tickets, or "smart cards" that automatically deduct the fare from a customer's prepaid account. Some cities are experimenting with systems that allow people to pay for parking, transit fares, highway tolls, and gasoline purchases using a single smart card.

Alternatively, many BRT systems collect the passengers' fare as they enter the station, so when a vehicle arrives, they can walk right on. "Proof of Payment" systems, common on light rail lines, have also been successful on BRT systems. For proof of payment, the customer buys a ticket before boarding and validates it on board the vehicle; roving inspectors then check for validated tickets.

Intelligent Transportation Systems (ITS)

Many BRT systems use advanced computer and communications technologies, known as Intelligent Transportation Systems. Transit ITS often includes Automated Vehicle Location technologies such as satellites or roadside sensors to track the location of BRT vehicles. This information can be used for a variety of services that improve convenience and safety:

- Automated Vehicle Location allows for electronic "next vehicle" displays in transit stations and on-board automated stop announcements for passengers, especially those with disabilities.
- Signal priority systems use vehicle location information to control traffic signal cycles to give priority to BRT vehicles. Meanwhile, transit operators use the same information to reduce vehicle "bunching" and achieve more consistent wait times.
- ITS also improves surveillance and security at stations and aboard vehicles.



Bus Rapid Transit Opportunities

The flexibility of BRT allows transit planners to tailor individual systems to effectively meet local needs. The following pages present hypothetical examples of how BRT systems might operate in various situations, based on examples of existing systems.

BRT in Urban Corridors

In cities both large and small, many urban corridors along major arterial streets are prime candidates for transit investments that can ease traffic congestion, improve air quality, enhance mobility, and stimulate development. Existing development is often too dense to allow the construction of a new exclusive surface right-of-way, but not dense enough to generate the heavy ridership that justifies construction of an underground or elevated transit line. Service must operate within the street right-of-way, and must be designed to effectively serve both local and long-distance trips.

BRT Opportunities and Solutions

In urban corridors, BRT lines can operate in dedicated transit lanes marked by distinctive paving or curbing and designed to minimize competition with auto traffic. Signal priority systems ensure that BRT vehicles get the green lights they need to stay on schedule. Vehicles can pull right up to curbside stations and provide level boarding, similar to light rail cars, but have the added advantage of being able to maneuver around illegally parked cars or other obstructions.

BRT routes can be designed to collect riders in surrounding neighborhoods and then enter a running way for speedier travel. Routes may also connect to urban or suburban transit centers where coordinated arrival and departure times can reduce travel time for riders who need to use more than one bus to reach their destination.

Stations may consist of enhanced shelters with ticket vending machines and real-time vehicle arrival displays. A unique system identity represented on vehicles and at stations will help to promote use of the new service. In areas characterized by low-density, auto-oriented sprawl, designation of higher-density zoning districts around BRT stops can encourage compact development and promote transit use.

BRT Extensions to Existing Rail Rapid Transit Systems

Increasing travel demand between growing suburban areas and downtown employment centers is causing many regions with rail systems to consider rail system extensions. In rapidly developing areas it is important to establish a transit corridor, build a transit market, and promote compact, transit-oriented growth as soon as possible. However, the existing market for transit may not justify the considerable public funding needed to develop a rail extension at this time, or sufficient funds to do so may not be available. What can be done?

BRT Opportunities and Solutions

BRT can be an economical, quickly implemented, and flexible approach to extending the reach of a rail transit system. The conversion of an abandoned rail right-of-way to an exclusive transitway costs less than rail development and often can be planned and built in just two or three years. BRT can offer local and express service on the same route, as well as speedy, coordinated transfers to connecting rail service. High platforms and precision-docking technologies can allow fast and easy "cross platform" transfers to rail services.

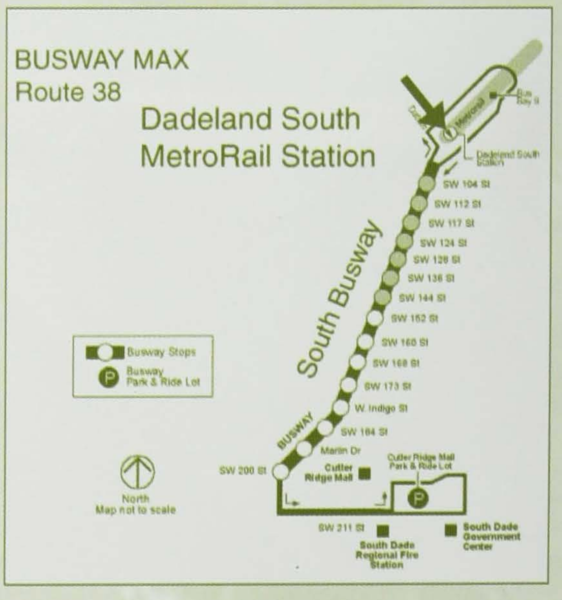
Development of a BRT extension to the rail system can preserve rights of way, especially around stations. Transit-oriented zoning and other incentives can help to stimulate and focus development nearby. As the transit market grows, consideration can be given to further investment. BRT service can be extended incrementally, and grade-separated crossings can be constructed at major intersections to improve speed and safety.

"We don't have the kind of resources in public transit today where we can simply keep extending new routes... However, if we are astute, we can identify major travel corridors, establish large park-and-ride facilities where we can concentrate our service, and make that service frequent and attractive."

–Paul Skoutelas, Executive Director, Port Authority of Allegheny County

MIAMI, FLORIDA
The Metro-Dade County South Busway effectively extends the reach of the existing rapid transit system. The map to the right shows how a single route serves local neighborhoods and park and ride lots, then enters the 8-mile busway for express service to the Dadeland South Metrorail Station, where passengers can easily transfer to rail services or other bus routes.

There is also local service along the busway, which parallels U.S. Route 1. Pullout stations (above) allow express vehicles to pass local vehicles stopped at a station. Ridership along the corridor has doubled to over 15,000 trips per day since the South Busway went into operation in 1996. The first segment of a planned 11-mile extension is under construction.



BRT Commuter Service

Many cities with large downtown or outer suburban employment centers experience traffic congestion and poor air quality, especially during commuter rush hours. Efficient commuter transit service can provide an alternative to the private auto for trips from suburban locations to major employment destinations. This service must be structured to carry many riders during peak periods, and vehicles must be designed to provide a comfortable, seated ride for passengers travelling long distances. Suburban park-and-ride facilities are needed to allow commuters from dispersed suburban neighborhoods to drive to the station and leave their cars in order to ride the last stretch into the city center.

BRT Opportunities and Solutions

BRT express commuter service can help reduce rush hour congestion to downtown and suburban employment centers. A highway median lane with exclusive entrance ramps allows BRT passengers to get to their destination quickly, comfortably, and on time. "Over the road" coaches, departing every few minutes during rush hours, can carry large numbers of riders and still provide a comfortable, seated ride for the entire trip. BRT vehicles can also depart the exclusive median lane and use a dedicated transit lane or city streets to reach local destinations, allowing a one-seat ride for many passengers.

Large suburban park-and-ride facilities with local bus connections will help to attract customers from wider suburban areas. These stations may have covered walkways, sheltered waiting areas, electronic vehicle arrival and departure displays, and customer amenities such as coffee shops, dry cleaners, and convenience stores.

HOUSTON, TEXAS
The METRO Transit Authority of Harris County operates express commuter bus service on single-lane, reversible-direction HOV lanes located in highway medians. BRT vehicles average 50-55 miles per hour, roughly twice the average speed on the rest of the freeway during peak periods. Exclusive entry and exit ramps make it easy for buses to exit the transitways safely and deliver riders to downtown destinations. Park-and-ride facilities offer over 20,000 parking spaces, and over 35,000 commuters use the BRT service every day.

PITTSBURGH, PENNSYLVANIA
The Port Authority of Allegheny County operates 3 busways, totaling 16 miles, that provide fast, reliable rapid transit service to downtown. Easy pedestrian access, feeder services, and park-and-ride lots make it easy for commuters to leave their cars and ride into town. Once BRT vehicles reach the city center, they exit the busways and use a circulator loop on city streets to deliver passengers directly to their destinations. The design of core stations also makes it easy to transfer from BRT to the light rail system.

Proven Performance—The Benefits of Bus Rapid Transit

BRT has been providing high quality service for transit customers and operators worldwide for at least three decades. The following sections discuss several major advantages of BRT systems.

Customer Convenience

BRT offers exceptional customer convenience, with fast, one-seat rides. The use of a dedicated running way permits faster operating speeds and more flexibility than conventional bus service or light rail. Local BRT service in dedicated lanes can operate at a reliable average speed of 20-30 miles per hour. This is approximately twice as fast as conventional bus service, and just as fast as light rail. Unlike light rail, though, BRT can operate express, local, and "skip-stop" service all on the same running way. Local passengers get the frequent service they need, while express passengers enjoy vehicle speeds of 50–60 miles per hour.

BRT's flexibility also enhances customer convenience. Because BRT vehicles can operate practically anywhere, they can use local neighborhood streets, transfer to a dedicated running way for high-speed service, and then deliver passengers directly to their destinations.

Economical Implementation

BRT is unique in its ability to maximize the benefits from existing transportation resources. In particular, the capital costs of BRT are usually lower than light rail systems with the same capacity and level of service. Running ways can be built and operated at low cost using standardized highway design, construction, and maintenance practices. BRT vehicles generally cost less than rail vehicles and can be purchased "off the shelf" with many technology and configuration options. Furthermore, BRT does not require special power facilities or structures, and BRT can often use existing bus operations systems and maintenance and storage facilities, resulting in economies of scale that save money.

BRT systems can be implemented incrementally. For example, dedicated running ways can be built and extended in stages as demand grows and funds become available.

ROUEN, FRANCE
Dedicated transit lanes, like the one above in Rouen, France, can be easily and economically built, using distinctive painting or paving to identify the transit lane.

SOUTH BEND, INDIANA
This intermodal transit terminal in South Bend, Indiana illustrates the potential of a terminal BRT station. Such facilities, accessible by BRT, local bus, intercity bus, and intercity rail services, provide a great opportunity for joint development that can generate additional revenue for transit agencies and increase ridership.

"I have to eat my words with the busways. I used to say nobody would ride them. When they told me to expect 7,500 riders a day, I said, 'right, that'll be the day.' Well, we're hitting 15,000 now and we've only been open 4 years!"

– Danny Alvarez,
Miami Dade Transit

Low Operating Costs

At the demand levels present in many U.S. corridors, BRT can be the least expensive mode of rapid transit to operate. BRT drivers are highly productive at moving transit passengers, due to relatively high operating speeds and the ability to tailor service to demand. Without track or overhead wires, dedicated running ways are easy and inexpensive to maintain, often by existing highway department or transit agency personnel. Vehicles can be stored in existing transit garages and can be operated and maintained by existing transit agency staff or contractors. BRT usually avoids expensive to maintain, complex power and dedicated signal systems.

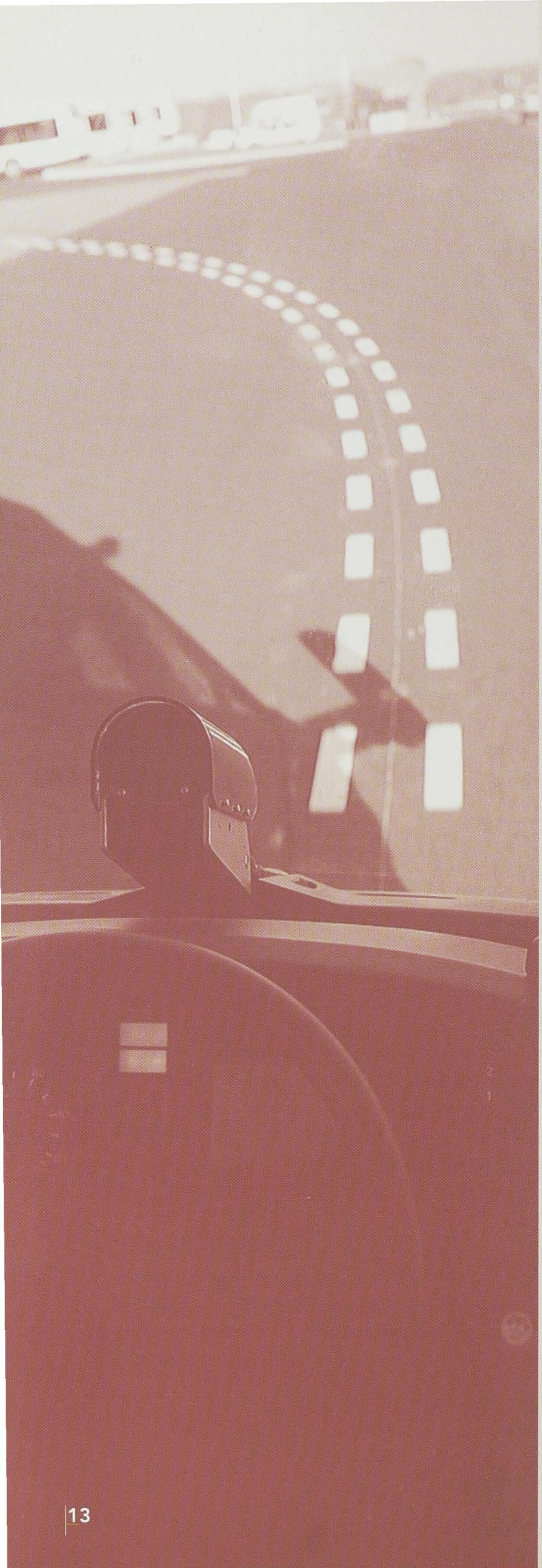
High Capacity

Where necessary, BRT systems can be designed to meet the needs of even the busiest urban corridors. With high-capacity vehicles, frequent service, and parallel local and express routes, BRT systems can carry as many passengers as the busiest light rail systems. During rush hours, the Ottawa Transitway commonly carries more than 10,000 passengers per hour, as many as the Green LRT Line in Boston, the busiest in North America. Meanwhile, BRT service can also be tailored to cost-effectively serve lighter demand during off-peak periods.

Development Possibilities

BRT has been successful in promoting positive changes in surrounding land use. For example, Pittsburgh's East Busway has attracted more than $300 million of new private development during its first 15 years of operation. In Ottawa, major urban and suburban development has clustered around BRT stations. Where full-featured BRT systems have been implemented, transit customers, community leaders, residents, and real estate developers have embraced them with similar levels of enthusiasm and financial investment accorded comparable rail investments.

When accompanied by complementary land use and zoning policies, BRT can encourage compact, pedestrian- and transit-friendly developments that are an alternative to auto-oriented sprawl. Convenient and reliable BRT service can stimulate the redevelopment of urban areas and help sustain historic resources.



Ensuring Bus Rapid Transit Success

Like other modes of transit, BRT depends on complementary supporting policies to attract riders, maintain performance, and build a larger transit market. Some of these are noted below.

Effective Transportation Planning

BRT should be implemented only after a rigorous, open planning process that begins with the analysis of transportation needs, opportunities, and constraints. BRT should be analyzed objectively, along with other transit alternatives, against a broad set of criteria that reflect community needs and financial resources.

When BRT is selected for implementation, it should be part of a comprehensive transportation investment and operations management program that addresses other important elements, such as parking, other transit services, bicycle and pedestrian facilities, transportation pricing, and on-demand transit services for seniors and people with disabilities.

Land Use

At station sites, BRT creates permanent, high quality access to regional economic activity centers and thousands of potential customers. Complementary land use policies are necessary to translate this accessibility and customer base into viable development opportunities. If land use policies are effectively coordinated with the transportation planning process, development in BRT corridors can increase transit use and provide a source of revenue for the transit provider.

Where appropriate, zoning regulations should encourage compact, pedestrian- and transit-friendly urban design. Density bonuses are an excellent way to promote mixed residential and commercial development near transit stops. Joint development projects allow transit agencies to collaborate with developers on design and land use and to reap benefits from successful development.

Traffic Enforcement and Safety Education

It is critical to keep private autos and commercial trucks from parking and operating on BRT running ways and in stations. Consistent, aggressive enforcement has proved to be successful in many BRT systems, though it requires good coordination among transit agencies, police, and traffic departments. Public education about traffic and pedestrian safety at BRT grade crossings is also essential.

Glossary

Articulated bus	A 60- to 80-ft high capacity, multi-section bus (carrying up to 150 passengers) with hinged sections to allow tight cornering on city streets.
At-Grade Intersection	An intersection where roads and transitways intersect at ground level. At-grade intersections require signals or other traffic controls.
Commuter Rail	Regional passenger service with electric- or diesel-powered trains serving commuter trips between residential suburbs and the center city or other employment center.
Conventional Bus Service	Fixed-route, fixed-schedule bus service operating in mixed traffic and stopping frequently (every 300 to 500 ft).
Express	Non-stop service between two points.
Feeder	Bus route that collects riders on local streets and delivers them to a transit station.
Grade-Separated Intersection	An intersection where roads and transitway cross over or under one another by means of bridges or tunnels. No traffic signals are necessary.
Heavy Rail	Fully grade-separated rail systems, such as subways, with level entry boarding and alighting.
Light Rail Transit	A rail mode that can operate in mixed traffic or on a fully grade-separated line.
Line-Haul Service	Rapid transit service that carries a large numbers of riders a relatively long distance, with widely spaced stops to allow fast service.
Local Service	Transit service that stops frequently on city streets, or at every station on a rail or BRT line.
Running ways	The transitways, exclusive lanes, or roadways in which transit vehicles travel.
Skip-Stop Service	Transit service that makes limited stops at major destinations, but not all local stops.

Photo Credits

Cover: Clockwise from top right: nc3d.com, Honolulu Public Transit Division, Scott Rutherford (University of Washington); background: Irisbus, N.A. Page 1, Richard Soberman. Page 2, from top: Irisbus N.A., King County Metro, Massachusetts Bay Transportation Authority (MBTA), Los Angeles County Metropolitan Transportation Authority (LACMTA), OC Transpo, Washington Metropolitan Area Transit Authority (WMATA), LACMTA. Page 3, from top: Honolulu Public Transit Division, nc3d.com, MBTA. Page 4, from top: Planners Collaborative, Inc., DMJM + Harris, Scott Rutherford (University of Washington); background: King County Metro. Page 5, from top: LACMTA, Irisbus N.A., DMJM + Harris, MBTA, Bombardier Transportation; Background: DMJM + Harris. Page 6, from top: LACMTA (2), King County Metro; quote from "Simple Solutions" by Martha Welborne, 1999. Page 7, from top: WMATA, DMJM + Harris, LACMTA (2). Page 8: Honolulu Public Transit Division. Page 9: DMJM + Harris, Metro Dade Transit (route map); background: Metropolitan Transit Authority of Harris County, Texas; quote from Mass Transit Magazine, Jan/Feb 1999. Page 10, from top: Metropolitan Transit Authority of Harris County, Texas, Port Authority of Allegheny County. Page 11: DMJM + Harris. Page 12, from top: Irisbus, N.A., DMJM + Harris; quote from Mass Transit Magazine, Mar/Apr 2001. Page 13, Irisbus, N.A.

On the Web

Transportation Research Board:
www.trb.org
Federal Transit Administration:
www.fta.dot.gov
BRT Demonstration Program:
brt.volpe.dot.gov
American Public Transportation Association
www.apta.com

This publication was prepared by DMJM + Harris of Arlington Virginia, and Planners Collaborative Inc. of Boston MA, for the Transit Cooperative Research Program Project A-23, in consultation with the Transportation Research Board and TCRP Project Panel A-23. Ms. Gwen Chisholm-Smith was the TCRP Program Officer.

Publication of this report was made possible through the generous assistance of the Federal Transit Administration, which provided funding for printing and distribution.

Transportation Research Board
Transit Cooperative Research Program
The National Academies
2101 Constitution Avenue, NW
Washington, D.C. 20418