Evaluation of Port Authority of Allegheny County's West Busway Bus Rapid Transit Project

April 2003

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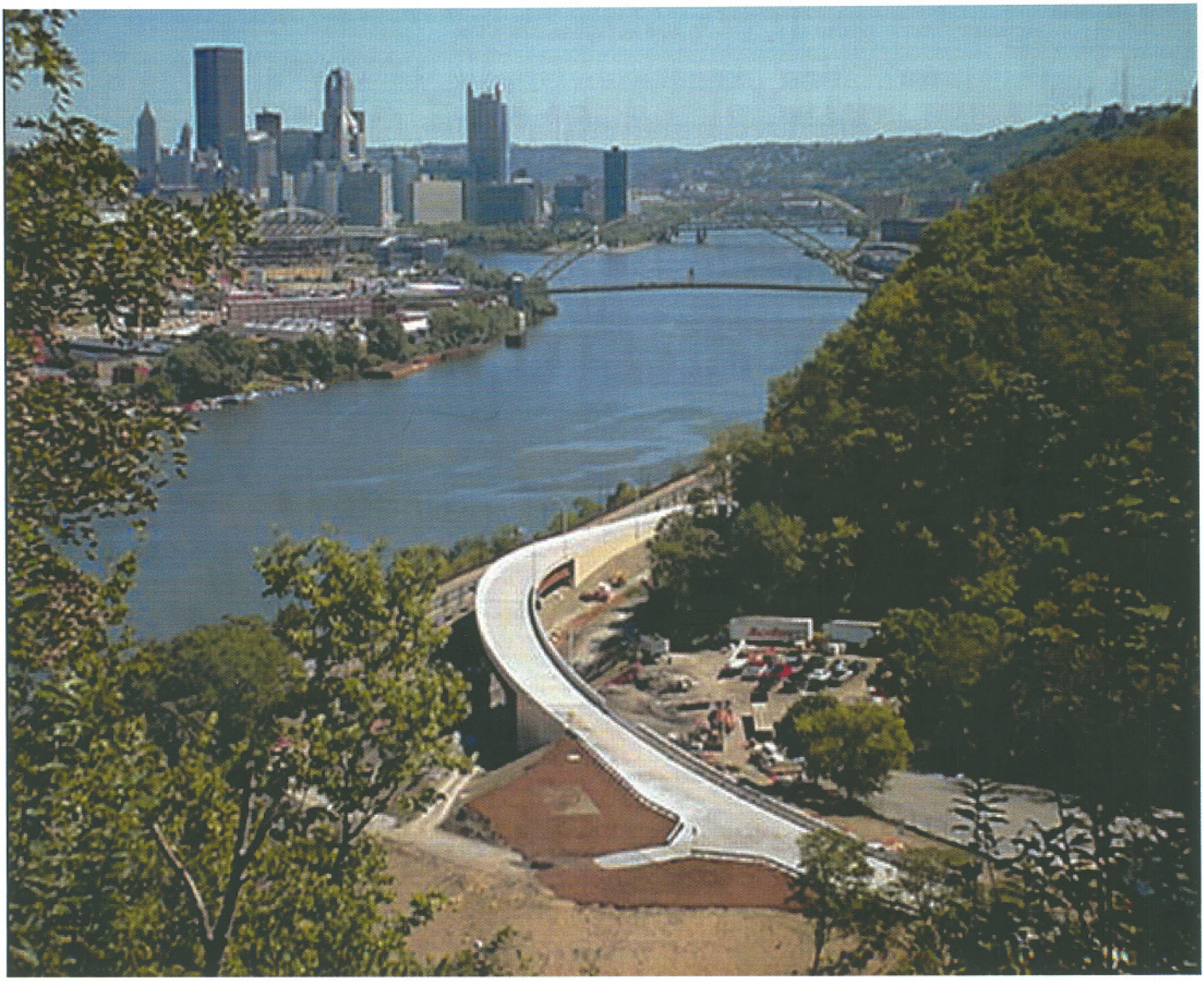

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13. ABSTRACT This report evaluates one of the FTA's BRT demonstration projects, Pittsburgh, PA's West Busway. The Port Authority of Allegheny County had a network of busways and light rail lines in place in the northern, southern, and eastern areas of Allegheny County, Pennsylvania. The West Busway consists of five miles of exclusive bus right-of-way and an exclusive interchange for buses with the Parkway West (I-279) in the Borough of Carnegie. Via direct bus service that extends beyond the busway, the West Busway connects the Pittsburgh International Airport and businesses surrounding the Airport and along Parkway West with downtown Pittsburgh and other employment and activity centers in the area. The West Busway is intended to improve mobility and transit access.

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ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
1 foot (ft) = 30 centimeters (cm)
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1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)
1 acre = 0.4 hectare (he) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gm)
1 pound (lb) = 0.45 kilogram (kg)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
1 tablespoon (tbsp) = 15 milliliters (ml)
1 fluid ounce (fl oz) = 30 milliliters (ml)
1 cup (c) = 0.24 liter (l)
1 pint (pt) = 0.47 liter (l)
1 quart (qt) = 0.96 liter (l)
1 gallon (gal) = 3.8 liters (l)
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x-32)(5/9)] °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
1 centimeter (cm) = 0.4 inch (in)
1 meter (m) = 3.3 feet (ft)
1 meter (m) = 1.1 yards (yd)
1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm) = 0.036 ounce (oz)
1 kilogram (kg) = 2.2 pounds (lb)
1 tonne (t) = 1,000 kilograms (kg)
= 1.1 short tons

VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 liter (l) = 2.1 pints (pt)
1 liter (l) = 1.06 quarts (qt)
1 liter (l) = 0.26 gallon (gal)

1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

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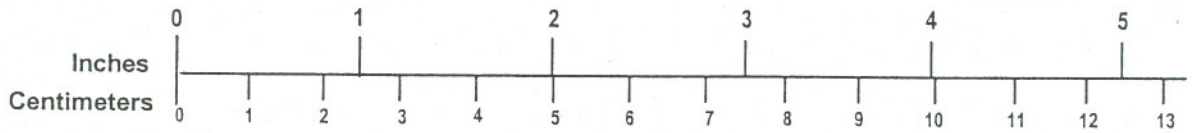

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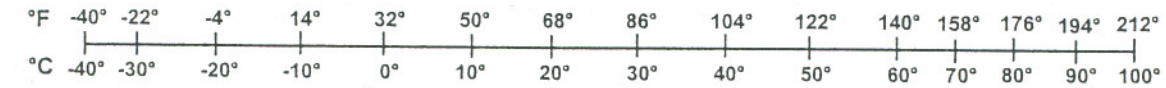

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Foreword

The Federal Transit Administration's (FTA) Bus Rapid Transit Demonstration Program is supporting demonstrations of Bus Rapid Transit (BRT) in selected cities across the United States (U.S.). The U.S. BRT Demonstration Program aims to adapt the principles of highly successful BRT systems, such as those of Curitiba, Brazil, Lyons, France and Nagoya, Japan, to U.S. conditions, laws, and institutions. A primary goal of the BRT Demonstration Program is to assess the demonstration projects through scientific evaluation. Pittsburgh, PA has a BRT System, which has been included in the FTA demonstration program.

This report evaluates the BRT system in Pittsburgh, PA in a format consistent with guidelines provided by the Research and Special Programs Administration/Volpe National Transportation Systems Center (Volpe Center).

The audience for this report is transportation professionals interested in the developments of public transportation. This report will be useful to state and local organizations independently designing BRT systems.

This information together with the opportunity for transit planners to visit operating U.S. BRT sites will facilitate the development of BRT at other locations in the United States.

This publication is a final report, having been reviewed by the Port Authority of Allegheny County, Pittsburgh, PA and the FTA Office of Research, Demonstration and Innovation.

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I. Executive Summary

The Federal Transit Administration (FTA) promotes the Bus Rapid Transit (BRT) concept with the slogan, "think rail, use buses." BRT combines the quality of rail transit with the flexibility of buses and focuses on speed, comfort and reliability. BRT encompasses a variety of approaches, including buses using exclusive busways, buses using High Occupancy Vehicle (HOV) lanes and improving bus service on city arterial streets.
A central concept in BRT planning is to give priority to transit vehicles, since on average they carry many more people than other road vehicles. The goal is to maximize person-throughput, not necessarily vehicle-throughput. One form of priority is to run transit service on exclusive rights-of-way such as busways. This technique can greatly reduce in-vehicle travel time for passengers.

Bus Rapid Transit may also include any of the following features:

- Traffic signal priority
- Boarding and fare collection improvements
- Limited stops
- Improved stations and shelters
- Intelligent Transportation System technologies
- Cleaner and quieter vehicles
- Exclusive lanes

The FTA is seeking to evaluate how technological advancements and improvements in the image of buses operating with the speed, reliability, and efficiency of light rail would increase bus ridership.

The objectives of FTA's BRT Demonstration Program are:

- Improve bus speeds and schedule adherence
- Increase ridership as a result of improved quality of service that encompasses bus speeds, schedule adherence, and convenience
- Minimize the effect of BRT on other traffic.
- Isolate the effect of each BRT feature on bus speed and other traffic.
- Assess the benefits of Intelligent Transportation Systems/Automated Public Transportation Systems.
- Assess the effect of BRT on land use and development.

A busway is a special roadway designed for the exclusive use of buses. It can be constructed in a transit agency's own right-of-way, or in a railway or highway right-of-way. Short stretches of streets designated for exclusive bus use are also sometimes called busways. A busway can also be built in an active rail corridor (example: Pittsburgh's East Busway). Busways usually have on-line stations, constructed with passing lanes, so that there is room for overtaking stopping buses.

This report evaluates one of the FTA's BRT demonstration projects, Pittsburgh, PA's West Busway. The Port Authority of Allegheny County has a network of busways and light rail lines in place in the northern, southern, and eastern areas of Allegheny County, Pennsylvania. The West Busway consists of five miles of exclusive bus right-of-way and an exclusive interchange for buses with the Parkway West (I-279) in the Borough of Carnegie (see map on page 5). Via direct bus service that extends beyond the busway, the West Busway connects the Pittsburgh International Airport and businesses surrounding the Airport and along Parkway West with downtown Pittsburgh and other employment and activity centers in the area. The West Busway is intended to improve mobility and transit access. The following Bus Rapid Transit components are demonstrated in this system:

- exclusive busway
- enhanced stations
- simplified route structure
- limited stops
- signal priority
- high operating speed
- multi-modal interfaces

The goal of the Port Authority for the West Busway is to improve mobility within the increasingly congested Parkway West corridor.

The Port Authority's objectives for the West Busway are to:

- reduce traffic congestion and travel time,
- promote increased economic development,
- conserve energy and reduce regional air pollution,
- improve access to job opportunities,
- improve neighborhood transit routing via bus access ramps near each station, and
- provide convenient connections to other Port Authority fixed guideway facilities (the South and East Busways and the Light Rail Transit System)

Approximately 45 buses per peak period use the busway in the peak direction. Speeds on the busway portion of West Busway routes are approximately 30 mph, which compares with 19 mph on routes prior to the re-direction to the busway.

The following points identify summary results of this evaluation. More detailed analysis of these items is included within the appropriate sections of this report.

- Buses using the busway are more reliable (68%) in adherence to schedule than buses operating on city and county roads.
- Operation on the West Busway has reduced passenger wait time by 78%.
- Accidents occur less frequently on the busway.
- Drivers reported vehicle breakdowns are easier to deal with on the West Busway.
- A comparison of the average speed of routes before and after West Busway indicates an average increase of 2.4 mph (13%) after routes were diverted onto the busway, counting the entire route not just the portion on the busway.

- Travel times have been reduced for passengers of routes diverted onto the busway and new busway routes. The West Busway has reduced travel time an average of 20 minutes in the corridor.
- Passengers reported that the West Busway has improved schedule reliability and improved the availability of seating.
- 95% of passengers surveyed responded that the West Busway was an important factor in their decision to start using the bus.
- The introduction of the West Busway increased total ridership in the corridor by approximately 5,000 riders (135%) per average weekday.
- The new busway routes have generated an average weekday ridership of 5,400.
- The routes diverted to use the busway now carry about 3,300 average weekday riders.
- West Busway ridership growth has been constrained by the lack of parking near busway routes.
- Operating costs for the new West Busway routes are lower than non-busway routes due to higher operating speeds. West Busway operating costs are lower than Light Rail in all categories, especially costs per revenue mile and hour.
- Land acquisition for park-and-ride lots near the busway is requiring additional time to deal with land use issues. Passengers had been parking at a retail store lot in Robinson Township along the route 28X (Airport Flyer), which prompted the Port Authority to use a temporary 950 space lot on county land at Settlers Cabin and institute a new West Busway Route, 28J from Settlers Cabin to downtown Pittsburgh via the West Busway.

The Port Authority's West Busway has received several awards regarding, among other attributes, its benefits to the community, aesthetic qualities, and innovative design and construction features. The following are the awards achieved to date:

- Diamond Award for Engineering Excellence, from the Consulting Engineers Council of Pennsylvania
- Pennsylvania Quality Initiative Transit Award for 2001, from the Pennsylvania Partnership for Highway Quality
- Outstanding New Multi-Span Bridge for 2000, from the Pittsburgh Chapter of the Association for Bridge Construction and Design
- Outstanding Highway Project of 2001, from the American Society of Highway Engineers, Pittsburgh Section
- Governor's Award for Environmental Excellence in Land Use for 2001, from the Pennsylvania Department of Environmental Protection
- Project of the Year Award for 2001, from the Engineers Society of Western Pennsylvania
- Civil Engineering Achievement of the Year Award for 2001, from the Pittsburgh Chapter of the American Society of Civil Engineers

II. Project Background

A. Introduction

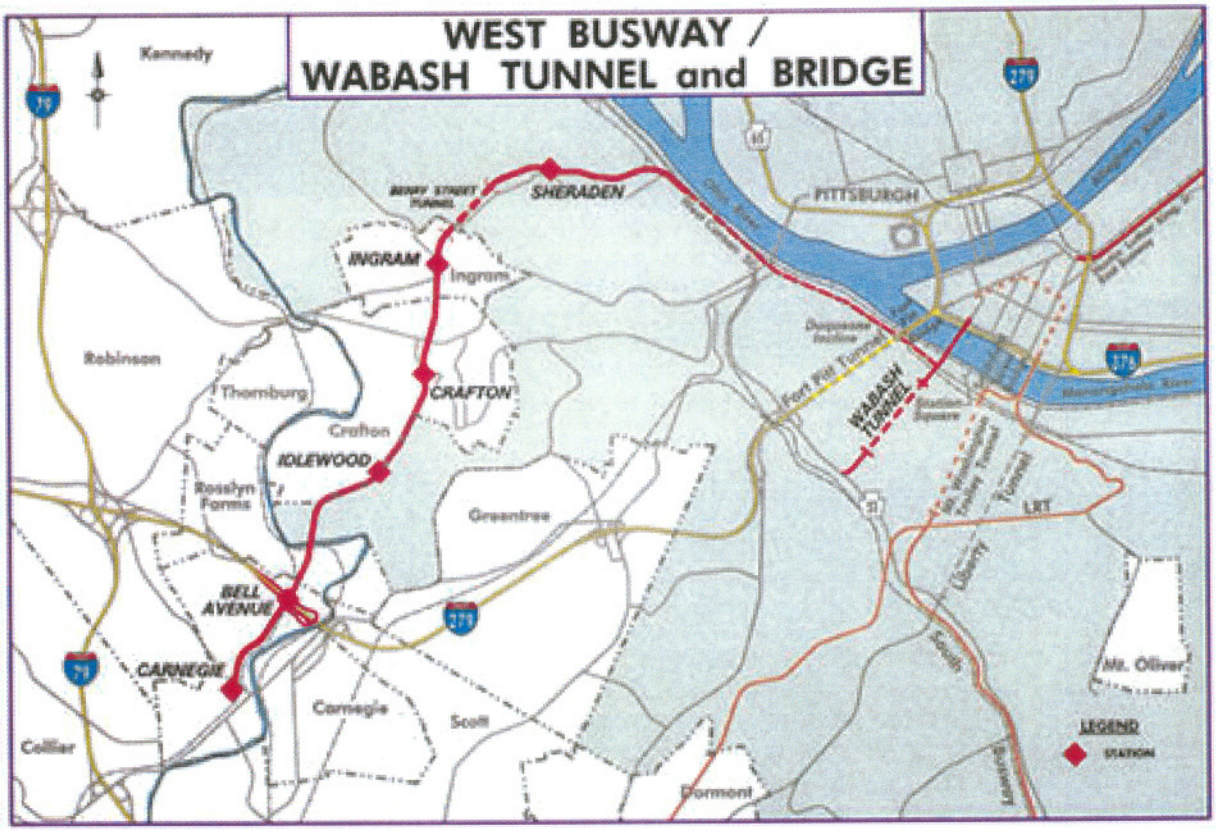
The Port Authority of Allegheny County (Port Authority) operates a fleet of 1032 buses, serving all parts of Allegheny County and portions of adjacent counties in Southwestern Pennsylvania. The Port Authority uses three exclusive busways and a high-occupancy vehicle express lane reserved for buses and car pools, which functions as a busway.

The Port Authority also operates a light rail system, the "T", a 25-mile light rail transit system that operates in the Downtown Subway and throughout several South Hills suburbs. The southern end of the line, between South Hills Village and Washington Junction, opened in May 1984. The downtown subway opened on July 3, 1985. The main portion of the stage I LRT reconstruction program opened in May 1987 and the at grade portion opened in 1993. The remainder of the system, known as stage II LRT, is under construction and scheduled to open in 2004. Twelve stations have high-level platforms for easy access and wheelchair accessibility and 23 stops have street-level boarding. In the downtown area the "T" has five stations: three underground and two above ground. Underground stations are at Gateway, Wood Street and Steel Plaza. The above ground stations are located at First Avenue and Station Square. The "T" and all four busways converge in downtown Pittsburgh providing for easy transfers.

The Monongahela and Duquesne Inclines, overlooking the cityscapes, are also components of the Port Authority transit system. Tourists enjoy the view while riding two of only a few remaining inclines in the country. The inclines remain the best way for thousands of residents on Mt. Washington to get to their jobs and shopping in downtown Pittsburgh. The Monongahela Incline was built at a cost of $50,000 and opened on May 28, 1870. Since then, it has transported millions of passengers. The incline opened Mt. Washington to development, enabling people to live 600 feet above the city and still have easy access to factories and businesses along the river. The Monongahela Incline was consolidated into the Port Authority operations in 1964 and declared a historic structure by the Pittsburgh History and Landmarks Foundation in 1970. The Duquesne Incline opened in 1877 and is leased by the Port Authority to the Society for the Preservation of the Duquesne Heights Incline.

Paratransit service to passengers with disabilities and elderly in the Port Authority service area is provided by ACCESS, using private carriers operating lift-equipped vans and taxis.

Since the 1980's, the western area of the Allegheny County, from west of I-79 to the Airport, has been experiencing rapid development. The West Busway represents a major component of a comprehensive regional transportation corridor network for the Pittsburgh Metropolitan Area; the early planning of which dates back to the mid-1980's. Transportation improvements were needed in the Airport corridor to maintain mobility and labor pool accessibility in the face of tremendous employment growth and development. As part of the Transitional Analysis and subsequent alternatives analysis, Light Rail Transit (LRT) was rejected as an alternative. According to the Transitional Analysis, Light Rail was found to cost two to three times as much to construct, and significantly more to operate and maintain, than a busway. Busways are also more flexible, allowing segments of the right-of-way to be constructed and opened as land became available.



The goal of the Port Authority for the West Busway is to improve mobility within the increasingly congested airport corridor.

The Port Authority produced a Final Environmental Impact Statement, which summarized the impacts, costs and contained a comparative evaluation of the alternative transportation improvements being considered for the airport corridor. The Busway Alternative, an 8.1-mile busway, contained the following components:

- An exclusive interchange for buses with the Parkway West (I-279) in the Borough of Carnegie.
- An exclusive roadway for buses along a mostly abandoned railroad corridor to the Corliss section of the City of Pittsburgh and then alongside a CONRAIL freight line.
- A High Occupancy Vehicle (HOV) facility through a tunnel through Mount Washington, connecting with a HOV Bridge across the Monongahela River into downtown Pittsburgh.
- Provision for 2,700 park-and-ride spaces at locations both adjacent to as well as remote from the facility.

A Full Funding Grant Agreement (FFGA) was signed with FTA and construction ground breaking took place on October 27, 1994. Subsequent to the execution of the FFGA, the West Busway project encountered a major challenge, due to significantly changed conditions. This increased the estimated cost to complete the project from 328.8 million to $515 million. The bulk of the increase in cost was due to two components of the project: the section of the busway along the CONRAIL line and the new Monongahela River Bridge. Specific items that

contributed to the increased cost included those associated with property acquisition and relocation costs of the Gateway Clipper Fleet, a tour boat operation, lack of consensus on the alignment of the Monongahela River Bridge, and increased cost associated with a second track addition by CONRAIL.

Railroad Bridge At Morrange Road Prior to West Busway Construction

West Busway Bridge at Morange Road

The CONRAIL land acquisition option has since been abandoned. The new Monongahela River Bridge has been moved to a stand-alone project with the Port Authority and the Pennsylvania Department of Transportation taking the lead in guiding the revised project design through environmental assessment and preliminary engineering.

The Port Authority submitted a recovery plan to FTA, which eliminated the CONRAIL section and the HOV Bridge. The FTA accepted the recovery plan in August 1997, subject to environmental review and public input. The Final Environmental Assessment was completed and the FTA made a Finding of No Significant Impact (FONSI) in September 1998.

B. *West Busway Project Description*

West Busway approaching Crafton-Ingram Section

1. Physical Characteristics

The Port Authority had a network of busways and light rail lines in place in the northern, southern and eastern areas of Allegheny County. The West Busway provides service to downtown Pittsburgh, Oakland, East Busway corridor, western Allegheny County neighborhoods and the Airport Corridor. More than 43,000 customers use the busway each week. The West Busway consists of five miles of exclusive bus right-of-way and an exclusive interchange for buses with the Parkway West (I-279) in the Borough of Carnegie.

The busway has six stations: Carnegie, Bell Avenue, Idlewood, Crafton, Ingram and Sheraden. There are seven access points along the busway, which allow buses and authorized vehicles to merge with the busway and provide flexibility for detours and diversions. Access points are Campbells Run Road, the Parkway West, Idlewood, Crafton, Ingram, Sheraden, and West Carson Street. These access points allow buses from feeder routes to use the Busway without the need for transfers; providing one-seat ride convenience. The busway serves as an efficient bypass to Greentree Hill and the Fort Pitt Tunnels for buses serving western Allegheny County communities, including those in the Airport corridor. Direct access to the communities of Carnegie, Crafton, East Carnegie, Ingram, and Sheraden is also provided.

Construction of the West Busway transformed a corridor of abandoned, debris-filled railroad right-of-way into a modern bus rapid transit facility. The West Busway includes approximately 4,936 linear feet of noise walls. The walls have a concrete core, bonded by a sound-absorptive material made from a combination of Portland cement and wood fibers. Construction of the West Busway included the rehabilitation and enlargement of the 130-year-old Berry Street Railroad Tunnel. This tunnel was widened from 28 feet to 34 feet using the New Austrian Tunneling Method. The project also included construction of four new bridges, including a 120-foot radius curved girder bridge constructed under the existing Parkway West Bridge. Eleven existing bridges were renovated and/or reconstructed, including renovating and constructing a new, wider deck on a 70-foot-high former railroad bridge over Chartiers Creek.

Railroad Right-0f-Way at Crennell Ave. Prior to West Busway

West Busway at Crennell Avenue

The busway widens to four lanes at each station to permit express buses to pass buses stopped at stations. Two buses can be accommodated at each station platform. Speed limits on the busway range from 15mph in stations to a top speed of 50 mph. Buses are able to access the West Busway at seven ramps, strategically located along the busway. The shoulder widths vary along the busway due to the changing terrain. Local police and other emergency personnel are permitted to use the West Busway, thereby reducing their response time to emergencies and providing a security presence.

The West Busway is similar to the Port Authority's Martin Luther King, Jr. East Busway, a 6.8-mile exclusive bus facility serving the eastern suburbs of Pittsburgh. The East Busway, which began operation in February 1983, shares its right-of-way with an active adjacent railroad. The communities served by the East Busway are denser and therefore have significantly more passengers walking to stations than the western section of the city, which requires park-and-ride lots to generate incremental ridership.

The West Busway demonstrates the following Bus Rapid Transit (BRT) components:

- exclusive busway
- enhanced stations
- simplified route structure
- limited stops
- signal priority
- high operating speed
- multi-modal interfaces.

2. Stations

Six stations are on the West Busway's mainline: Sheraden, Ingram, Crafton, Idlewood, Bell Avenue and Carnegie. Each ADA compliant, low platform station consists of a shelter, system map, 24-hour lighting, and a dedicated phone system with automatic connections to the Port Authority Customer Service and 24-hour accessibility to the Port Authority Transit Police. All West Busway station shelters provide the station name, a detailed system map with the names and destinations of all connecting bus routes, the span of service, and frequency of bus service. Station amenities also include benches, trash receptacles, bicycle racks, and exhibit space.

West Busway Bell Avenue Station

3. Vehicles

West Busway routes use a combination of 24', 35', 40', and 45'suburban-type buses. Articulated buses (60 feet) are not used on the West Busway due to insufficient storage space at the Collier Bus Division, which serves the West Busway. All Port Authority buses are diesel fueled except five CNG buses operating from the West Mifflin division and there are a few hybrid diesel-electric buses planned in the next few years.

40' Port Authority Bus at West Busway Sheraden Station

4. Routes and Parking

Express bus service from the Pittsburgh International Airport to downtown Pittsburgh and Oakland (Route 28X) was instituted four years prior to the opening of the West Busway. Ten existing Port Authority bus routes now operate on the West Busway: 28E Robinson Express, 28F Forrest Grove Express, 28G Oakdale Express, 28X Airport Flyer, 33D Bridgeville-Washington Avenue, 33E Bridgeville–Main Street Express, 33F McDonald, 33U Oakland-Bridgeville, Moon Flyer, and BF Bridgeville-Fairview Flyer.

Initial travel timesavings for existing routes have been approximately 20 minutes on inbound morning trips.

When the West Busway initially opened on September 10, 2000, a new service, the Route 100 West Busway All Stops, was initiated. The Route 100 service serves all stations on the West Busway, the downtown area, the East Busway Herron and Penn Park Stations, Oakland, University of Pittsburgh, Carlow College and Duquesne University. Service on the Route 100 West Busway - All Stops begins at 5:15 AM and ends at 12:25 AM. Express buses operating on the West Busway stop to board passengers on inbound trips when peak demand exceeds the capacity of the regular routes.

Effective September 4, 2001, two additional routes were added to the West Busway, Route 33X from Carnegie Station to downtown, Penn Station and Route 28J from Settlers Cabin Park-and-

ride lot to downtown Pittsburgh and the headway on Route 28X was changed from 15 to 20 minutes. The 28J has been renamed Moon Express and serves the Port Authority's 600-space park-and-ride lot on Beers School Road in Moon Township.

The Beaver County Transit Authority (BCTA), with service originating west of the busway, has an agreement with the Port Authority to use the West Busway. Under terms of the agreement, BCTA pays the Port Authority a yearly fee based on the miles its buses travel along the busway and a percentage of the Port Authority's West Busway daily operating expenses. BCTA is not charged for major capital expenses including road construction or other improvements along the route.

FULL WEST BUSWAY PARK-AND-RIDE LOT AT BELL AVENUE

Park-and-ride lot locations throughout western Allegheny County are planned to provide approximately 2,400 new spaces for West Busway routes. Parking at all facilities is free. Land acquisition for additional park-and-ride lots near the busway is requiring long lead-time to deal with land use issues.

Park-and-ride lots adjacent to the West Busway stations

Sheraden (153 spaces)
Crafton (106)
Bell Avenue (32)
Carnegie (215)

Park-and-ride lots that serve buses using the West Busway

Neville Island (239)
Collier Township (136)
Beers School Road (600)
Ambridge Park-and-ride - (153)
Knights of Columbus (50)
Settler's Cabin (424)

Park-and-ride lot under design (this lots will serve buses using the West Busway)

Robinson Town Center Intermodal Facility (820)
This lot is at a 90 percent design level. Official site plan submissions have been made to Robinson and North Fayette townships for inclusion on the Planning Commission agendas.

5. Fares

Fare collection on the West Busway uses the standard Port Authority fare system, which includes cash fares, passes and ten trip tickets. The use of pay-on-exit on out-bound trips, prepaid fare media and a free-fare zone has reduced the time required for fare collection. On the Route 100, all fares are paid as you enter. All other West Busway routes are pay as you enter inbound and pay as you exit outbound, to expedite boarding and alighting in congested areas, especially the Central Business District. The existence of passing lanes at West Busway stations allows express buses to pass local buses in the stations, minimizing the impact of fare collection on operations.

A fare increase went into effect on all Port Authority vehicles on September 1, 2002. The Port Authority operates on a zone system, with fare increasing as you travel greater distances. A Free Fare Zone is offered within the Golden Triangle in the downtown area for all buses including West Busway routes. Cash fares are $1.25 for Downtowner Zone, $1.75 for zone one, $2.25 for zone two, and $2.75 for zone three. Transfers are $.50 and are valid for three hours in any direction for a one-zone ride. Tickets and weekend, weekly, monthly and yearly passes are offered at discounted prices.

(Effective September 1, 2002)

BUS, T LIGHT RAIL SYSTEM AND INCLINES

SINGLE RIDE CASH FARES

	Adult Price	Children/Disabled Price
Free Zone	Free	Free
Downtowner Zone	$1.25	$0.60
One Zone	$1.75	$0.85
Two Zone	$2.25	$1.10
Three Zone	$2.75	$1.35
Inclines	$1.75	$0.85

"T" SYSTEM SURCHARGES

A surcharge shall be applied only to "T" cash fares from 6:00 a.m. until 9:00 a.m. on inbound trips and 4:00 p.m. to 6:30 p.m. on outbound trips on weekdays only.

	Adult Price	Children/Disabled Price
Downtowner Zone	$0.25	$0.10
One Zone	$0.50	$0.25
Two Zone	$0.50	$0.25

SPECIAL EVENTS

	Adult Price	Children/Disabled Price
Downtowner Zone	$1.25	$0.60
One Zone	$3.50	$1.75
Two Zone	$4.50	$2.25

TRANSFERS

	Adult Price	Children/Disabled Price
Price of a one-zone ride in any direction on a connecting vehicle.	$0.50	$0.25
	$0.50	$0.25
Transfers are valid for a three-hour time period.		

PASSES AND TICKETS

WEEKLY PASS

	Price
One Zone	$16.50
Two Zone	$20.75
Three Zone	$25.75

MONTHLY PASS

	Price
One Zone	$60.00
Two Zone	$75.00
Three Zone	$93.00

ANNUAL PASS

	Price
One Zone	$660.00
Two Zone	$825.00
Three Zone	$1,023.00

Annual passes shall be priced at 11 times the monthly zone pass price and shall provide customers with one free monthly pass.

TEN TRIP TICKETS

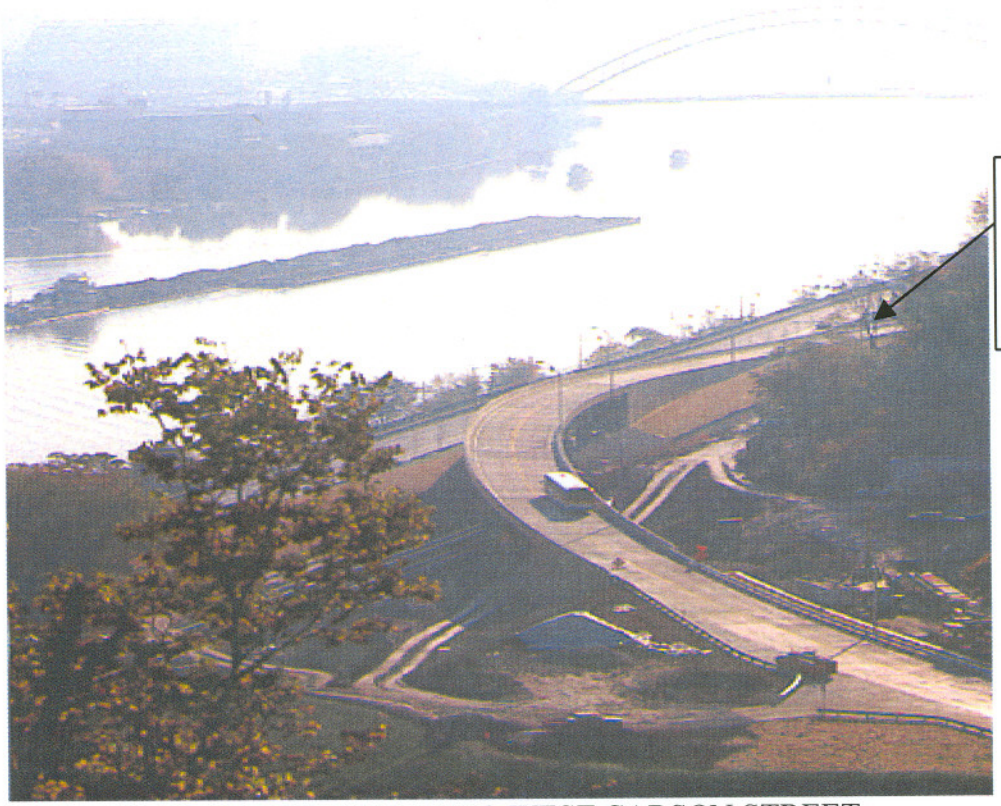
	Adult Price	Children/Disabled Price
Downtowner Zone	$12.50	$6.00
One Zone	$17.50	$8.50
Two Zone	$22.50	$11.00
Three Zone	$27.50	$13.50

Transfers are valid for a three-hour time period.

Continuation Transfer (CT) privilege permits transfer to a second transit vehicle at no additional charge between the Mon Incline, T and buses on East Carson Street, between the Duquesne Incline and buses on West Carson Street and at other authorized locations and under special conditions.

6. Signalization

The West Busway uses an active bus signal priority system where the busway terminates and merges with West Carson Street in the in-bound direction. There is also a left-turn arrow priority from West Carson Street to the West Busway in the out-bound direction. Buses traveling in the inbound direction enter West Carson Street at an exclusive bus ramp. The traffic signal is activated by an embedded loop, which when activated allows buses to enter West Carson Street on an exclusive bus phase; thereby benefiting from priority entry to West Carson Street. Outbound buses enter the West Busway using a loop-actuated left turn phase of the existing traffic signal.



BUSWAY MERGING ONTO WEST CARSON STREET
FROM CORLISS FLYOVER BRIDGE

Abandoned Rail Road Right-of-Way at Crafton

West Busway Crafton Station

7. Other Technology

The West Busway does not use Advanced Bus Technologies (ITS/APTS) such as: precision docking systems, tight terminal guidance systems, onboard bus stop announcements, real-time passenger information or smart cards for fare collection. AVL systems are not presently used on the West Busway or other Port Authority buses. A pilot AVL program is being planned.

C. *Overall Project Cost*

Capital Costs

Due to significantly changed conditions, it was not possible to construct the Busway as originally planned. The original construction estimate was for $328.8 million, but the estimated cost increased to $515 million due to CONRAIL land acquisition costs and community issues related to the HOV bridge. The Port Authority submitted a recovery plan, which eliminated the CONRAIL section and the HOV Bridge components of the project and brought the estimated cost to $326.8 million. The FTA accepted the recovery plan, after public review and environmental analysis, in September 1998.

Capitals cost were obtained from the Port Authority capital accounting system. The capital budget for the West Busway BRT system consists of the following elements:

Engineering	$49,173,528
Construction	155,740,000
Project Management	11,001,347
Construction Management	19,600,000
Wrap-Up Insurance	21,600,000
Real Estate Acquisition	17,604,160
Real Estate Relocation	3,673,058
Real Estate Demolition	1,500,000
Real Estate Appraisal	2,509,355
Utility Relocation	5,856,195
Park-and-ride Lot Acquisition	1,000,000
Project Administration	13,974,210
Transportation Study	642,362
Total Project Budget	$326,800,000

Exclusive busways, such as the West Busway, generally have the highest capital cost per mile of all BRT projects due to the acquisition cost of land, engineering, and general construction costs. West Busway costs are higher than normal due to the requirement to build connecting ramps to the existing highway, which facilitate continued trips to the airport and other destinations, stabilizing the slopes along the corridor, sound barriers, and the rebuilding of eleven bridges and a tunnel. These costs are the result of the hilly topography of the area.

Light Rail construction would have taken longer to build, and cost two to three times more to construct due to the incremental costs of track, power, signals, separate maintenance facilities

and vehicles and significantly more to operate and maintain. Light Rail also requires additional materials needed for the guideway- rail, ties and ballast. Other additional components needed for Light Rail include train signalization, communications, and electrical power systems with overhead wires to deliver power to trains. Light Rail vehicles cost about $2.5 million each compared with $283,000 for a standard 40-foot transit bus. A light rail vehicle can carry three times as many people and has twice the useful life of a bus. Buses have the advantage of being able to operate at tighter headways than light rail, making the carrying capacity of the two vehicles equivalent.

Operating Costs

The Port Authority's accounting system does not segregate busway costs from overall bus operating costs. All costs are reported as the general category of bus by operating divisions. Operating costs include driver's salaries, fuel, vehicle maintenance and maintenance of the busway or track system. Operating costs that apply specifically to the West Busway, such as maintenance of the busway are included in the operating cost calculations below.

	Port Authority Bus	Port Authority Light Rail
Operating cost per vehicle revenue mile	$6.40	$15.25
Operating cost per vehicle revenue hour	$81.90	$222.37
Operating cost per passenger mile	$0.65	$0.84
Operating cost per unlinked passenger trip	$2.73	$3.78

West Busway operating costs are lower than Light Rail in all categories, especially costs per revenue mile and hour. Since the operating speed of the West Busway is higher than the bus system average, West Busway routes are considered to be more efficient. The Port Authority's Light Rail operating costs reflect the fact that the light rail system is a reconstruction of a former streetcar line with a large number of stops and significant on-street operation.

III. Project Development

A. Site Characteristics of the West Busway

1. Demographic and Socioeconomic Characteristics

Downtown Pittsburgh

In 1989, the Southwestern Pennsylvania Commission (SPC) determined that transportation improvements were needed in the Pittsburgh Downtown/Airport Corridor to maintain mobility and labor pool accessibility in response to employment growth and development. The improvements are intended to connect Pittsburgh International Airport and businesses surrounding the Airport with downtown Pittsburgh and other activity and employment centers in the area. The transportation improvements were proposed to facilitate access to the industrial, commercial, and service jobs in the study area. At the time of the initial study of alternatives, the Pittsburgh metropolitan area had a population of approximately 2,426,800 (1990 census). The population had decreased four percent from 1980 primarily due to the decline of the Pittsburgh steel industry. The most current census data (1997) shows the population metropolitan area is 2,393,008.

Allegheny County had a population of 1,336,449 in 1990. According to the census bureau, the 2001 population is estimated to be 1,270,612, a reduction of 65,837 (5.18%). The Pittsburgh metropolitan region is projected to have a slight increase in population in future years, a relatively larger increase in the number of households due to decreasing household sizes, and an increase in employment due to the shift from a heavy industrial-based economy to one based on service-related industries.

Total annual ridership for the Port Authority was 76,328,688 in 2001, and average weekday ridership is 258,000.

2. Transportation Characteristics of the West Busway

The Busway is designed for bus speeds of up to 55 mph. The top posted speed limit on the busway is 50 mph. Busway speeds average 30 mph, which compares favorably with 13.8 mph for the entire bus system and 15.4 mph for light rail. When routes were diverted onto the West Busway, vehicle speeds increased and passenger travel times decreased.

3. Land Use

Allegheny County has more than 727 square miles of land area. The City of Pittsburgh is the most densely developed jurisdiction in Allegheny County, and has historically provided the foundation for the development of the entire Pittsburgh metropolitan region. Pittsburgh serves as the employment and transportation hub of the region. The primary employment centers of the region are Pittsburgh and Oakland. Fast growing areas outside of the City of Pittsburgh, in terms of business and residential developments, light industry and the subsequent generation of income, include the suburbs in the western portion of the region. The Pittsburgh International Airport (PIA) in western Allegheny County, is the major generator for growth and is the area's largest single employer with over 10,000 employees in airline and ancillary operations.

With the exception of the Pittsburgh central business district and Pittsburgh International Airport, (where commercial and aviation uses predominate), the major land use area is residential.

The western area of the county, extending west of I-79 to the Airport, was experiencing rapid development. In particular, the area along the Parkway West and Steubenville Pike (PA 60), which had been primarily low density residential with small supporting commercial establishments, was being transformed into a medium density residential area with medium to large scale retail and office centers.

Travel in the area is capacity-constrained by the topography, rivers and limited bridges and tunnel alternatives. Pittsburgh is located in Allegheny County in western Pennsylvania, approximately 35 miles from the Ohio border. The Allegheny and Monongahela Rivers meet here to form the Ohio River. Downtown Pittsburgh is built on the point of land formed by the confluence of the rivers, so it is separated from the remainder of the city by water on two sides. The surrounding terrain is very hilly. The climate in Pittsburgh is classified as "humid continental", with cold winters, hot summers and precipitation distributed throughout the year. Between December and February, the temperature does not rise above freezing one day out of three, there are ten days when an inch of snow falls and total snowfall equals 31 inches.

Water barriers, hills, and cold snowy winters combine to create difficulties for all forms of travel in Pittsburgh. The road network is very irregular and not always in good repair. Icy conditions make it impossible to navigate some hills. Of the 80-100 bridges used by the bus system, it is not unusual for one or more to be closed, at least to heavy vehicles, such as buses and sometimes to all traffic.

Transit service is provided by the Port Authority, which consolidated 33 companies in 1964 and now operates in Allegheny County, including the City of Pittsburgh, and portions of the adjacent counties of Washington, Westmoreland, Armstrong Butler and Beaver. Public transportation

service in the surrounding counties and to downtown Pittsburgh is provided by small transit agencies located in those counties. The Pittsburgh International Airport (PIA) is a major land use in western Allegheny County that consists of 12,080 acres and contains 826,937 square feet of structures. In recent years, major residential, commercial and office developments along the Parkway West have generated significant travel demands in western Allegheny County. Traffic has increased to the point where motorists on Parkway West are experiencing significant delays both inbound to and outbound from downtown Pittsburgh during both the morning and evening rush hours.

The West Busway uses the corridor of the former Pittsburgh and Steubenville Railroad. This railroad, incorporated in 1849 and chartered in 1851, was the extension of the Pennsylvania Railroad from Pittsburgh to Steubenville, Ohio, where rail links were made with the Midwest and the West. The original Pittsburgh and Steubenville Railroad line ran from Birmingham (now the Station Square area) to Mansfield (now Carnegie) without a stop. However, as the population of Pittsburgh grew in the latter half of the last century, residential and commercial development spread outward from the congested center of the city. The Boroughs of Ingram, Crafton, Roslyn Farms and Carnegie grew along the route of the railroad and stations were built. Industrial complexes developed in the area to the southeast of Idlewood and to the northwest of Carnegie. Commercial areas appeared around the rail stations, then subsequently declined as rail disappeared and other dispersed shopping areas and malls developed.

B. Planning, Design, and Implementation

1. Project Chronology and Milestones

As part of the 1989 Transitional Analysis, Light Rail Transit (LRT) was rejected as an alternative since it was found to cost two to three times as much to construct and significantly more to operate and maintain than a busway. The busway alternative was also selected because it could be more effectively constructed in stages than LRT. The busway was designed to accommodate conversion to LRT, if demand and financial resources warrant at some future date. HOV was rejected in the Transitional Analysis because projected volumes on the busway were sufficient to justify an exclusive facility.

The Port Authority had previously constructed two busways to relieve increasing commuter congestion. The 4.3-mile South Busway opened in 1977 and the 6.8-mile East Busway opened in 1983.

Early planning for the West Busway dates back to the mid-1980's. The Southwestern Pennsylvania Regional Planning Commission (SPRPC) sponsored a study of required transportation improvements to increase mobility in western Allegheny County. The Parkway West Multi-Modal Corridor Study (August 1989) identified several highway and transit improvements that would meet the transportation needs of the corridor, one of which was an exclusive busway between downtown Pittsburgh and the airport. The study also recommended that the busway be implemented in phases; with the first phase extending between downtown and Carnegie, and that High Occupancy Vehicles (HOV) should be considered in subsequent studies. The Port Authority commissioned a feasibility study of the Airport Busway to refine the costs, ridership estimates and issues associated with the busway. The Allegheny County Planning

Department published an Airport Area Impact Study, which set forth a strategy for development of the corridor from the airport to downtown Pittsburgh.

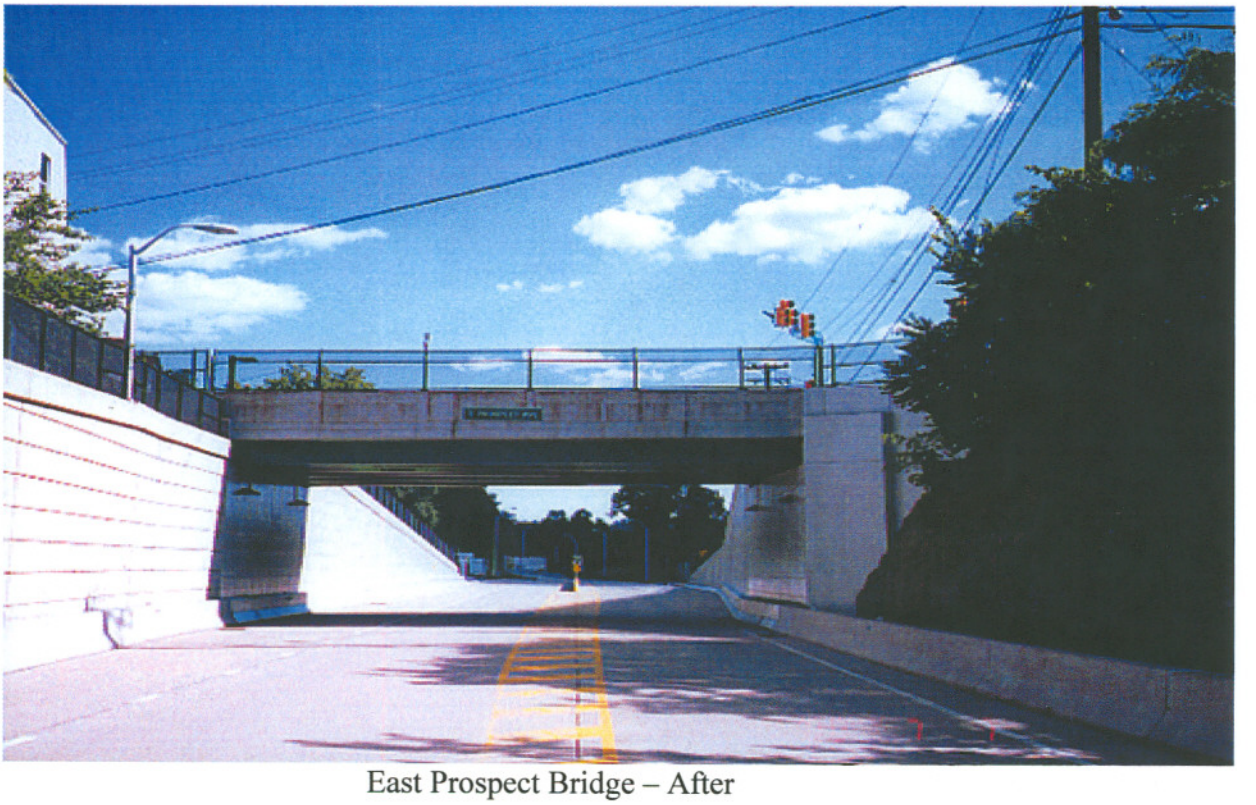
Transportation improvements were needed in the corridor to maintain mobility and labor pool accessibility in the face of employment growth and development. Transportation improvements were also required to reduce substantial peak period delays caused by extremely limited capacity and extensive congestion on Parkway West and its local feeder routes. Traffic has increased to the point where motorists on the Parkway West experience delays both inbound and outbound from downtown Pittsburgh. Projections of population and employment growth in Western Allegheny County indicate that travel will continue to grow. For example, SPRPC estimated that a trip from downtown Pittsburgh to the Airport would require 90 minutes in the year 2010 compared to 46 minutes in 1985. PennDOT had been planning major repairs and rehabilitation work for the Fort Pitt Bridge and Tunnel and needed the West Busway to handle diverted traffic.

The majority of the right-of-way required for the West Busway was existing railroad right-of-way, owned by railroads or individuals. The privately owned land was an abandoned rail line and acquisition was completed within budget. The negotiations with CONRAIL for the actively used section changed significantly when CONRAIL decided to add a second track and traffic significantly increased, including double-stack trains, which raised the acquisition cost to unattainable levels. The CONRAIL acquisition was subsequently cancelled.

East Prospect Bridge – Before

When the need for improved transportation in the corridor from downtown Pittsburgh to the airport was identified in a 1988-89 study, the Port Authority considered a third bus rapid transit facility. From study to groundbreaking to completion, the following are events and milestones in the West Busway project:

- From 1990 to April 1994, the Port Authority conducted the required environmental studies, and in June 1994 the FTA issued a Record of Decision for the Airport Busway (later renamed the West Busway) and the Wabash HOV (which became a separate project in 1997).
- Groundbreaking was held in October 1994 for the Airport Busway/Wabash HOV project, which had an estimated cost of $326 million.
- In November 1996, the project cost increased to $420 million due to higher property acquisition costs, necessary redesign, and inflationary factors.
- In May 1997, the Wabash HOV lane was dropped from the project, as well as the Mon River Bridge crossing. This trimmed the cost back to $326.8 million, very close to the original projection.
- In September 2000, the Port Authority began revenue service on the West Busway, with service from downtown Pittsburgh, Oakland, western Allegheny County communities, and the East Busway and Airport corridors.



East Prospect Bridge – After

Additional land required for park-and-ride lots has been obtained from Allegheny County, private property owners or is being negotiated with local municipalities.

2. Institutional Setting

BRT facilitates and channels growth. The West Busway conveys a sense of permanence and as it attracts new customers it is beginning to change the economic development patterns in the corridor. "There was resistance in many communities along our proposed alignment," according to the Port Authority. "Through an extensive public relations effort, one by one communities were converted into strong advocates of the project." That was accomplished in part by negotiations between community officials and project planners to redevelop municipal facilities in the area. Planning involved railroads, local communities, riverboat operators, downtown business owners and land developers.

3. Design Elements

The Port Authority does not use special buses for the West Busway. The majority of the buses on the West Busway are standard 40' buses. A blend of 24' and 40' buses are used on the 28X Airport Express line, which uses the West Busway for part of its trip.

The West Busway is five miles of exclusive bus right-of-way with one lane in each direction and passing lanes at stations to permit express buses to pass buses at all stations. Two buses can be accommodated at each station. The six West Busway stations have shelters with the station name, a detailed system map with the names and destinations of all connecting bus routes, and schedule information including the span of service and frequency of bus service. Station amenities also include benches, trash receptacles, bicycle racks and exhibit space.

Maximum speed on the busway is 50 mph. Buses are able to access the West Busway at seven ramps, strategically located along the busway. The shoulder widths vary along the busway due to the changing terrain. The West Busway uses an active Bus Signal Priority system where the busway terminates and merges with West Carson Street in the in-bound direction and a left-turn arrow priority from West Carson Street to the West Busway in the out-bound direction. Buses traveling in the inbound direction enter West Carson Street at an exclusive bus ramp. The traffic signal is activated by an embedded loop, which when activated allows buses to enter West Carson Street on an exclusive bus phase; thereby benefiting from priority entry to West Carson Street. Outbound buses enter the West Busway using a loop actuated left turn phase of the existing traffic signal.

4. Marketing and Promotional Efforts

A series of major public events were held on Friday and Saturday, September 8-9, 2000 in celebration of the opening of the Port Authority's new West Busway.

- At 10 a.m. on Friday, September 8, the West Busway Opening Ceremony was held on the Corliss Flyover in Sheraden, the segment of the busway that carries the Port Authority buses over the Norfolk Southern railroad tracks to West Carson Street near the Corliss Tunnel. Allegheny County Chief Executive Jim Roddey and Pittsburgh Mayor Tom Murphy, along with other local, state and federal

officials, joined the Port Authority Board Chairman Neal H. Holmes and Chief Executive Officer Paul Skoutelas in speaking at the event.

- On Saturday, September 9, the Port Authority provided free coffee and breakfast rolls for the public from 10-11 a.m. at three West Busway stations: Sheraden, Ingram and Crafton.
- For those interested in seeing the busway prior to the start of regular service on Sunday, September 10, the Port Authority operated free shuttle service, the West Busway Preview, from 10 a.m. until 4 p.m. on Saturday. The shuttle serviced all stops along the West Busway except Carnegie. The shuttle also serviced stops along West Carson Street at Gateway View, No. 1401 and the Duquesne Incline; along Liberty Avenue at Gateway Four, Market Street and Sixth Avenue; and along Penn Avenue at Seventh Avenue, Cecil and Gateway Two.
- From noon until 1:30 p.m. on Saturday, September 9, the Port Authority treated music fans to a free concert by Jan and Dean at the terminus of the West Busway in Carnegie, between West Main and Logan Streets. Persons attending the concert were urged to take advantage of the Port Authority's free shuttle, the West Busway Preview, which operated along the busway and included a short downtown loop. West Busway Preview shuttle service operated between 10 a.m. and 4 p.m. Saturday, September 9. The Port Authority also distributed free beach towels to those attending the concert.
- Regular Route 100 service, which was free for the first week, began Sunday, September 10, 2000.

5. Integration of BRT System with Land Use Planning

The West Busway uses the corridor of the former Pittsburgh and Steubenville Railroad. This railroad, incorporated in 1849 and chartered in 1851, was the extension of the Pennsylvania Railroad from Pittsburgh to Steubenville, Ohio, where rail links were made with the Midwest and West. The original Pittsburgh and Steubenville Railroad line ran from Birmingham (now the Station Square area) to Mansfield (now Carnegie) without a stop. However, as the population of Pittsburgh grew in the latter half of the last century, residential and commercial development spread outward from the congested center of the city. The Boroughs of Ingram, Crafton, Rosslyn Farms and Carnegie grew along the route of the railroad and stations were built. Industrial complexes developed in the area to the southeast of Idlewood and to the northwest of Carnegie. Commercial areas appeared around the rail stations, then died off as passenger rail traffic disappeared and other dispersed shopping areas and malls developed.

Since the West Busway is located on a narrow former rail right-of-way, with limited commercial activity, economic development in the area around the station is challenging. The Port Authority is working with community groups and local developers to stimulate development in the areas surrounding the West Busway. The Port Authority is advertising for joint development opportunities seeking developers interested in using agency-owned land to provide a development plan, which is compatible with the adjoining park-and-ride lots. The agency is seeking projects whose use and aesthetics integrate well with other proposed development, the adjacent residential area, and the business district in which the site resides. The Borough of Carnegie, which has recently constructed a municipal building adjacent to a 215 space park-and-

ride lot at the terminus of the West Busway, has received development plans for a new dry cleaner, shoe store, deli, coffee shop and card store. Carnegie Mayor Bob Heinrich said all of the merchants would locate within a half-mile of the busway station in Carnegie. Heinrich said a lawyer and doctor have also purchased land to open offices within walking distance of the bus line.

"People are going to have the ability to park their cars, get something to eat, get something to drink, drop off their dry cleaning, their child and proceed to work," Mayor Heinrich said. University of Pittsburgh professor Jim DeAngelis said he expects more satellite businesses to pop up around public transportation lines. Many workers who rely on public transportation want the convenience of having a day care, grocery store and gas station next to the bus stop," said DeAngelis, a professor of public affairs who studies transportation trends. "This is part of the theme, as lifestyles change, of finding alternatives to private automobiles."

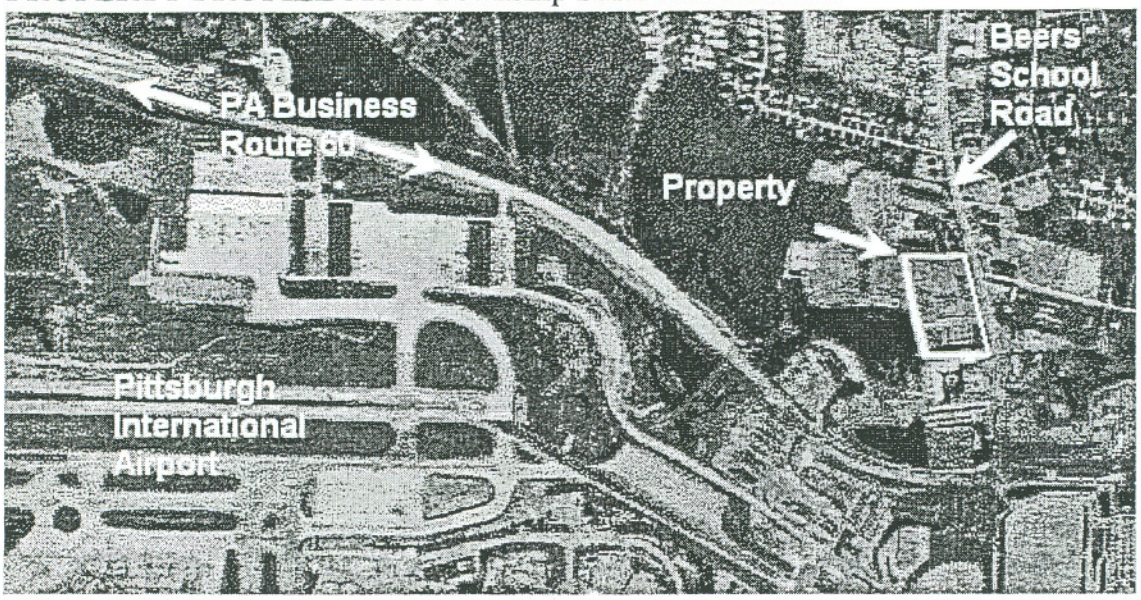
The Port Authority has advertised and is actively seeking development of the air rights above the 200-space parking lot adjacent to the Carnegie Station, which is the western terminus of the West Busway. The solicitation request, as seen below, requests development at the site, which is complementary to the demographics of the community.

Carnegie Borough Park-and-Ride

> Located at the intersection of West Main and Logan, the approximate three-acre park-and-ride site is situated at the terminus of the West Busway and adjacent to Carnegie Borough Municipal Campus. The Authority is seeking air rights development for the site, which is zoned M-1, Planned Industrial District, and whose use and aesthetics integrate well with the municipal campus, the adjacent residential area, and the business district in which the site resides.

The Port Authority has selected a development proposal for a five-acre parcel in Moon Township, located in front of a recently opened 600-space park-and-ride lot, which was built as part of the West Busway. The proposed concept includes 24,000 square feet of retail compatible with commuter conveniences.

PROPERTY PROFILE Moon Township Park-and-Ride Lot



Moon Township Development Site

Size: Approximately 5-acres;

Location: Township of Moon, Allegheny County
¼ mile from northwest corner of PA Business Route 60 and Beers School Road intersection.
1-½ miles from Pittsburgh International Airport and across from Airside Business Park.

Access: Via Route 60, Interstates 70, 76, 79 and 279.

History: The Port Authority acquired the property as part of its full-funded grant agreement in conjunction with the West Busway project.
The Port Authority has fee simple ownership and has completed an environmental assessment including a Phase I audit of the property.
Subdivision plan of the property will be necessary.
The Port Authority has recently opened a 600-space park-and-ride facility adjacent to the development site.

Zoning: C-2 Highway District
Permitted legal uses include many types of retail and commercial development including; retail stores, financial institutions, professional and business offices, automotive related activities, hotels and motels and restaurants.

IV. Evaluation Overview

This West Busway evaluation was commissioned after the busway was opened. The evaluation of the West Busway was a challenge because the base-line data from before the busway was not recorded. The evaluation project began with the preparation of a work plan, which was approved by the FTA on March 15, 2001. The evaluation plan was developed with input from the Port Authority staff. The availability of performance data such as travel time, transit system image, cost, productivity, schedule adherence and ridership were explored with the Port Authority staff. Specific requests were made for all available data. Quarterly reports were provided to the FTA Office of Research by the evaluation team. The evaluation plan was subsequently modified to include the BRT evaluation guideline recommendations produced by the Volpe Center, which were produced after the West Busway evaluation had begun.

The objectives for this evaluation of the Port Authority of Allegheny County West Busway are to:

- Determine the benefits, costs, and other impacts of individual BRT features, including ITS/APTS applications, and of the system as a whole.
- Characterize the successful and unsuccessful aspects of the demonstration.
- Evaluate the demonstration's achievement of FTA and the Port Authority goals.
- Assess the applicability of the demonstration results to other sites.

V. Results

A. Impacts

1. Service Quality

A comparison of the average speed of routes before and after the West Busway opened indicates an average increase of 2.4 mph (13%) after routes were diverted onto the busway. Bus speeds include the entire route.

West Busway Routes Average Speed (MPH)

Route	Before	After	Increase
28E	17.9	23.5	5.6
28F	17.6	21	3.4
28G	20.2	22	1.8
28X	27	27	---*
33F	19.8	22	2.2
33E	17.3	18.5	1.2
33D	21.7	22	0.3

** The 28X Airport Express used the interstate before re-routing to the West Busway.*

These are the average speeds on the entire route including the portion on the Busway. Speeds on the busway corridor portion increased from 19 mph to 30 mph.

The below listed response summary from a recent West Busway passenger survey indicates the creation of the West Busway improved the quality of the bus trip. In each circumstance, significantly more passengers felt the West Busway changed their bus trip for the better.

"How has the West Busway changed the following?"

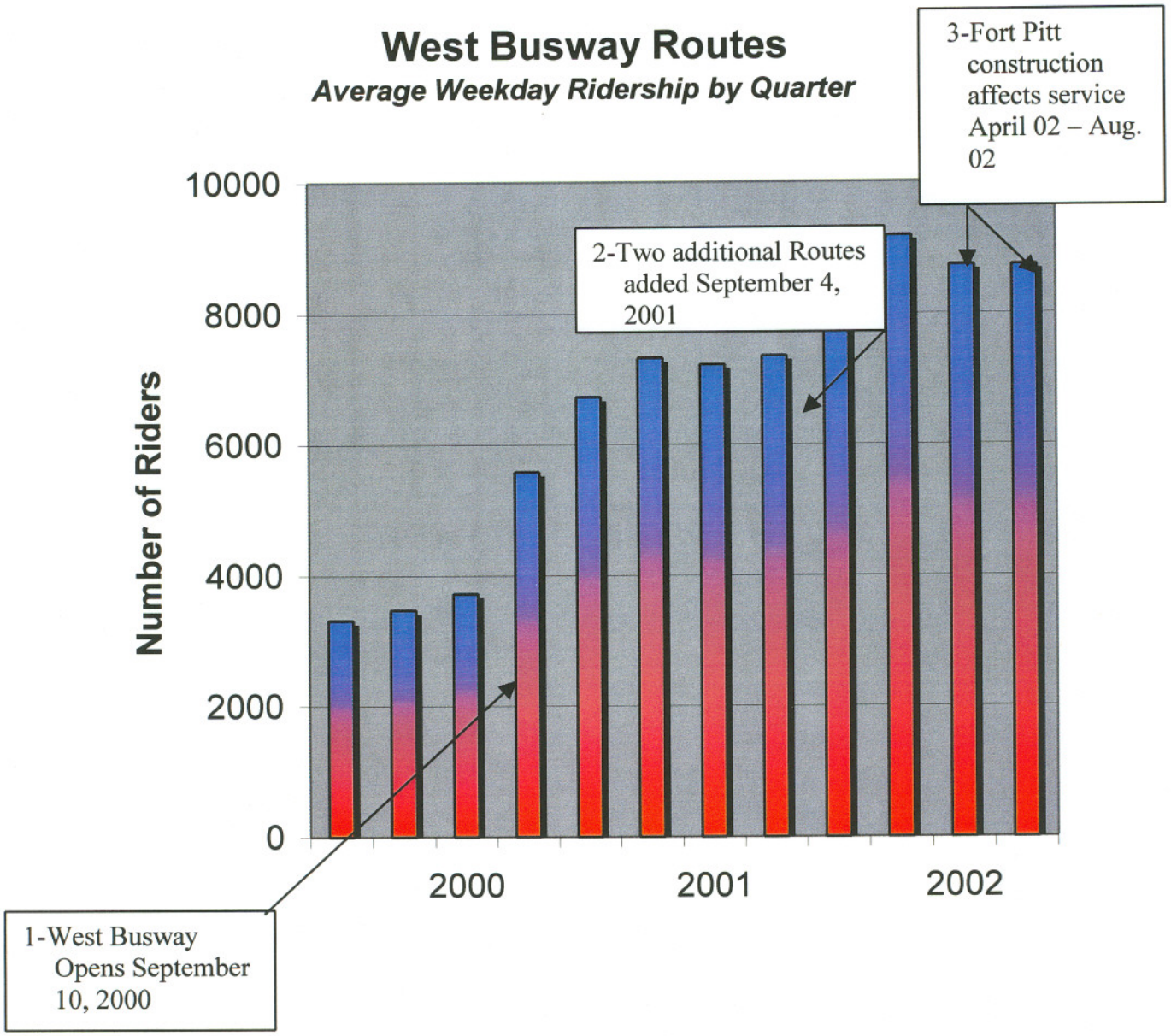
	Better %	**No change %**	**Worse %**
Chance of getting a seat	*58*	*19*	*23*
Convenience of time you arrive at your destination	*83*	*14*	*3*
How long you wait for a bus	*78*	*16*	*6*
Distance to the bus stop	*49*	*27*	*24*
Distance from the bus stop	*65*	*18*	*17*
Buses staying on schedule	*68*	*21*	*11*
Ease of transferring	*59*	*28*	*3*

Service reliability (buses staying on schedule) measured by passenger input (68% improvement) and verified by the Port Authority point checks improved when routes began using the busway. Passenger total travel time data was not available prior to the West Busway.

West Busway passenger response to the survey question below indicates that 85% of passengers reported that total travel time has been reduced by an average of 14 minutes.

"How has the West Busway changed your total travel time?"

Shorter	*85% by average of 14 minutes*
Longer	*5% by average of 16 minutes*
Not at all	*10%*



1-West Busway Service began on September 10, 2000 with the re-routing of eleven existing routes and the creation of a new route the 100 West Busway All Stops.

2-Two additional routes, the 28J (Moon Express) and 33X were added on September 4, 2001.

3-The Fort Pitt Bridge and Tunnel construction mitigation project added service from April 8, 2002 to August 1, 2002.

2. Ridership

The West Busway offered a significant, highly visible change in the bus service in the west corridor. Initially, the West Busway was projected to carry about 7,000 customers per day, with that figure projected to more than double by 2015. Currently, each weekday more than 8,700 daily riders travel these routes. The total weekly ridership, including Saturday and Sunday passengers is more than 48,000. A new route, the 100 West Busway All Stops, is now carrying more than 3,200 passengers a day, most of which are new riders. Due to significant increases in passenger loads, the headway on the route 100 has been reduced from 20 minutes to 10 minutes. In a passenger survey question asking, "Before this route began using the West Busway, how did you get to your destination?", 34% responded they drove or rode in a car, 4% walked and 6% used other means, which represents a total of 44% (3,842) new riders.

Ridership in the West Busway corridor increased from 3,722 in August 2000, prior to the West Busway, to 8,732 in October 2002, a 135% (5,010) increase in corridor ridership. Busway service which is operated similar to light rail tends to attract high ridership.

Ridership growth on the West Busway is constrained by the availability of parking and should continue to grow as additional park-and-ride facilities are completed. Ridership is currently projected to be approximately 10,000 new daily transit riders by 2010. The Port Authority's three busways East, South, and West, now carry a combined average of nearly 47,000 customers each weekday.

3. Impacts on Other Traffic

As demonstrated by the following excerpts from the Port Authority press releases, the West Busway was a significant part of the enhancement of public transit options made available to motorists seeking to avoid the congestion resulting from the reconstruction of the Fort Pitt Bridge and Tunnel from April to August, 2002. West Busway ridership increased 17% (1309 average daily riders) during the construction detour timeframe.

PORT AUTHORITY BOARD APPROVES FORT PITT BRIDGE AGREEMENT

Pittsburgh, PA – Port Authority will provide extra bus service during the upcoming Fort Pitt Bridge Reconstruction Project thanks to $2 million from the Pennsylvania Department of Transportation (PENNDOT) under terms of an agreement approved by the Port Authority Board of Directors today.

PENNDOT plans to reconstruct the Fort Pitt Bridge and Tunnels in 2002 and 2003, during which time Port Authority plans to enhance public transportation options by leasing additional buses, adding service and leasing temporary park-and-ride facilities.

"We are pleased to receive this funding, which will enable us to provide more public transportation service and help mitigate traffic congestion associated with this project," said Port Authority Chief Executive Officer Paul P. Skoutelas. "We believe Port Authority services will play an important role in maintaining a

high level of mobility for those persons traveling to and from downtown Pittsburgh during this construction project."
Port Authority has developed a service plan for the project and will use PENNDOT funding primarily to lease extra buses and operate additional service, some of which is anticipated to operate on the 100 West Busway-All Stops, 33X West-Busway All-Stops, 28X Airport Flyer, 28J Settler's Cabin Park-and-ride Express and 38C Green Tree Express, among other routes.

PORT AUTHORITY ADDS BUSES, PARK-AND-RIDE LOTS DURING FORT PITT BRIDGE AND TUNNEL PROJECT

Pittsburgh, PA - Public transportation will play a vital role in maintaining the mobility of Allegheny County residents during the initial phase of PENNDOT's Fort Pitt Bridge and Tunnel project, and Port Authority is prepared to enhance its regular service beginning Monday, April 8, 2002.
With traffic mitigation funds provided by PENNDOT, Port Authority has leased 20 buses and will place them into service beginning April 8. Port Authority will place three additional buses into service on the 33X West Busway-All Stops route that connects the Borough of Carnegie and downtown Pittsburgh via the five-mile West Busway. The remaining additional buses will be staged at various points in Port Authority's system so that they can be quickly dispatched by road operations personnel to serve those routes with the heaviest ridership.
Port Authority's T light rail transit system will also provide an excellent alternative for reliable transportation between South Hills communities and downtown Pittsburgh.
"We look forward to continuing our convenient service for current customers while providing an efficient, economical alternative for those persons who are considering a different way to commute to and from downtown Pittsburgh during this project," said Port Authority Chief Executive Officer Paul P. Skoutelas. "The predictable travel times afforded by the buses-only West Busway and the T, and the availability of numerous Port Authority park-and-ride lots, will play a key role in our efforts to provide an attractive alternative for motorists and thereby reduce traffic congestion."

A survey was recently conducted of West Busway passengers to determine trip data and passenger reaction to the busway. Survey results are as follows:

1. Where did your trip begin?

Home	*90%*
Work	*4%*
College	*2%*
Other School	*.3%*
Social	*.6%*
Shopping	*1%*
Other	*2%*

2. How did you get to the bus stop?

Walk	*38%*
Bicycle	*0*
Another bus	*2%*
Car – dropped off	*10%*
Car – parked	*50%*

3. Were you the driver or passenger of the car?

Driver *70%* *Passenger* *30%*

4. How many people were in the car?

You only	*76%*
You plus one	*19%*
You plus two	*3%*
You plus three	*2%*

5. Where is the car parked?

Port Authority Lot	*85%*
On the street	*15%*

6. How did you pay for this trip?

Cash	*19%*
Ticket	*17%*
Weekly Pass	*9%*
Monthly Pass	*41%*
Pitt U. ID	*9%*
Senior Pass	*3%*
Reduced fare	*1%*
Other	*1%*

9. Where are you going?

Home	*5%*
Work	*78%*
College	*5%*
Other School	*2%*
Medical	*1%*
Social	*2%*
Personal Bus.	*2%*
Shopping	*2%*
Other	*3%*

12. After you get off the bus, will you transfer to another bus?

No	*83%*
Yes	*17%*

13. Before this route began using the West Busway, how did you get to your destination?

Same bus route	*11%*
Other bus routes:	*45%*
Car driver	*26%*
Car passenger	*8%*
Bicycle	*0*
Walk	*4%*
Other	*6%*

14. How important is the West Busway in your decision to start using the bus?

Very important	*77%*
Fairly important	*14%*
Slightly important	*4%*
Not important at all	*5%*

15. Before this route began using the West Busway, how did you get to your initial transit stop?

Walk	*50%*
Bicycle	*1%*
Car – Parked	*38%*
Car – Dropped off	*11%*

16. How has the West Busway changed your total travel time?

Shorter	*85% by average of 14 minutes*
Longer	*5% by average of 16 minutes*
Not at all	*10%*

17. In the months since this route began using the West Busway, have you changed the time you leave to begin this trip?

No *49%*

Yes 24% *average of 18 minutes earlier*

Yes 27% *average of 17 minutes later*

18. How has the West Busway changed the following?

	Better %	**No change %**	**Worse %**
Chance of getting a seat	*58*	*19*	*23*
Convenience of time you arrive at your destination	*83*	*14*	*3*
How long you wait for a bus	*78*	*16*	*7*
Distance to the bus stop	*49*	*27*	*24*
Distance from the bus stop To destination	*65*	*18*	*17*
Buses staying on schedule	*68*	*21*	*11*
Ease of transferring	*59*	*40*	*3*

19. In the last seven days, how many times have did you ride this bus route?

Average of 6 rides per week.

20. How many cars are in your household?

Average of two cars per person.

21. Was one of your household vehicles available for this trip?

Yes *78%* *No* *22%*

22. Age

Under 15 0%

15-24 22%

25-34 17%

35-49 36%

50-64 21%

65 + 4%

23. *What is the total income of your household? (Optional)*

Under $10.000	*12%*	*$10,000-$20,000*	*7%*
$20,000-$30,000	*18%*	*$30,000-$40,000*	*22%*
Over $50,000	*41%*		

4. Land Use and Urban Design

Community-friendly economic development is an objective of the Port Authority West Busway project. The Port Authority, working with the local community of Carnegie, is currently soliciting responses to their request for proposals to bring retail development to the land adjacent to the Carnegie West Busway Station and park-and-ride lot. Located at the intersection of West Main and Logan, the approximately three-acre park-and-ride site is situated at the terminus of the West Busway and adjacent to Carnegie Borough Municipal Campus. The Port Authority is seeking air rights development for the site, which is zoned M-1, Planned Industrial District, and whose use and aesthetics integrate well with the municipal campus, the adjacent residential area, and the business district in which the site resides.

As part of an agreement under which the Borough of Carnegie provided enhanced automobile access to the Port Authority's 200-space park-and-ride lot, the Port Authority conveyed approximately 81,000 square feet of land to the borough for a new municipal complex. The Port Authority's lease agreement for the Crafton Park-and-Ride Lot helped the Crafton Volunteer Fire Department finance and build a new firehouse.

The Port Authority is also evaluating six development proposals received for a five-acre parcel in Moon Township, located in front of a recently opened 600-space park-and-ride lot, which was built to serve the West Busway.

The West Busway has begun to stimulate economic development in concert with the communities contiguous to the busway.

5. Transit System Image

The Port Authority viewed positive public perception of BRT as vital to the success of the system. In a survey conducted twenty months after the West Busway was opened, 95% of passengers surveyed responded that the West Busway was an important factor in their decision to start using the bus.

A survey question asked;

"How important is the West Busway in your decision to start using the bus?"

Very important	*77%*
Fairly important	*14%*
Slightly important	*4%*
Not important at all	*5%*

In the following recent Port Authority press release the West Busway was declared a success:

> ***PORT AUTHORITY'S WEST BUSWAY: A SUCCESS STORY***
> *Pittsburgh, PA - Just 17 months after its opening, Port Authority's five-mile West Busway has exceeded initial ridership expectations, attracted capacity usage at four adjacent park-and-ride facilities, earned seven awards and generated numerous benefits for the communities along its right-of-way.*
> *"We are pleased that the West Busway has so quickly become a popular and important part of Allegheny County's public transportation network," said Paul P. Skoutelas, Port Authority Chief Executive Officer. "Based on various factors, including the immediate use of park-and-ride lots, the rapid growth of ridership, the enhancement of mobility for local communities and honors received at the local, regional and state levels, the West Busway has proved to be a tremendous success - and will continue to do so."*
> *Since opening in September 2000, the buses-only roadway that connects the Parkway West in the Borough of Carnegie with West Carson Street in the City of Pittsburgh has carried more than three million riders. Average weekday ridership on the West Busway has grown 23 percent to 8,000 since its first full month of operation, which means approximately 4,000 fewer automobiles are operating on streets and highways along the corridor, resulting in improved air quality.*
> *Port Authority customers traveling inbound on the West Busway during morning peak periods realize timesavings of 20 minutes or more as they bypass routine congestion on the Parkway West.*

Two new bus routes are among the 14 Port Authority routes operating on the West Busway. Many peak morning and afternoon trips are filled to capacity on Route 100 West Busway-All Stops, which connects Carnegie with downtown Pittsburgh and Oakland via the Martin Luther King, Jr. East Busway, and Route 33X West Busway-All Stops, which provides service between Carnegie and downtown Pittsburgh.

All four park-and-ride facilities adjacent to the busway are filled to capacity on weekdays, providing convenient bus connections and free parking for almost 500 cars: Carnegie (200 spaces), Sheraden (153), Crafton (106) and Bell Avenue (26).

Port Authority is actively planning or constructing three new park-and-ride facilities associated with the project that will be served by buses operating over the West Busway and will attract even more new riders to Port Authority service. The Moon Park-and-ride Lot, located at the former Airways Parking site on Beers School Road, will open this spring with 600 spaces and can eventually grow to 1,000 spaces, depending on demand. The Robinson Township Intermodal Facility, planned for a site along Montour Church Road in Robinson Township, will accommodate 950 new spaces, and planning continues for a 136-space park-and-ride lot on Route 50 near Thoms Run Road in Collier Township.

The West Busway, which cleaned up abandoned railroad right-of-way that previously was overgrown and littered, has provided numerous benefits to the communities through which it passes. As part of an agreement under which the Borough of Carnegie provided enhanced automobile access to Port Authority's 200-space park-and-ride lot, the Authority conveyed approximately 81,000 square feet of land to the borough for a new municipal complex. Port Authority's lease agreement for the Crafton Park-and-ride Lot helped the Crafton Volunteer Fire Department finance a new firehouse.

In addition, Port Authority renovated or reconstructed 11 bridges along the West Busway right-of-way. In the process, Port Authority reopened the Center Street Bridge in the Borough of Ingram; improved pedestrian access along Crennell Avenue in the Borough of Crafton; and eased vertical clearance restrictions on four overpass bridges in Carnegie, Crafton and the City of Pittsburgh.

To date, the Port Authority's West Busway has earned seven honors:

- Diamond Award for Engineering Excellence, from the Consulting Engineers Council of Pennsylvania
- Pennsylvania Quality Initiative Transit Award for 2001, from the Pennsylvania Partnership for Highway Quality
- Outstanding New Multi-Span Bridge for 2000, from the Pittsburgh Chapter of the Association for Bridge Construction and Design

- Outstanding Highway Project of 2001, from the American Society of Highway Engineers, Pittsburgh Section
- Governor's Award for Environmental Excellence in Land Use for 2001, from the Pennsylvania Department of Environmental Protection
- Project of the Year Award for 2001, from the Engineers Society of Western Pennsylvania
- Civil Engineering Achievement of the Year Award for 2001, from the Pittsburgh Chapter of the American Society of Civil Engineers

6. Costs, Productivity, and Cost-Effectiveness

Pittsburgh is one of the few urban areas in the U.S. that has implemented both BRT and LRT facilities. The West Busway has an advantage over Light Rail by offering a single seat ride to passengers from beyond the busway. West Busway routes circulating through neighborhoods enter the busway at access ramps enroute to downtown, thereby eliminating the need to transfer from a feeder bus, as found in Light Rail operations.

The West Busway capital budget totaled $326 million. Exclusive busways, such as the West Busway, generally have the highest capital cost per mile of all BRT projects due to the acquisition cost of land, engineering, and general construction costs. West Busway costs are higher than normal due to the requirement to build connecting ramps to the existing highway, which facilitate continued trips to the airport and other destinations, stabilizing the slopes along the busway, sound barriers, and the rebuilding of eleven bridges and a tunnel. Despite these factors, West Busway capital costs per mile are lower than light rail.

Operating costs for the new West Busway routes are lower than non-busway routes due to higher operating speeds. West Busway operating costs are lower than Light Rail in all categories, especially costs per revenue mile and hour. Since the operating speed of the West Busway is higher than the bus system average, West Busway routes are more efficient.

B. Attainment of Objectives

The Port Authority objectives for the West Busway are to:

- reduce traffic congestion and travel time
- promote increased economic development
- conserve energy and reduce regional air pollution
- improve access to job opportunities
- improve neighborhood transit routing via bus access ramps near each station

- provide convenient connections to other Port Authority fixed guideway facilities

West Busway results relative to the Port Authority objectives are:

- *Travel time* on the West Busway was reduced up to 20 minutes for morning peak direction trips, with somewhat less timesavings in the afternoon peak.

- Average weekday *ridership* on the West Busway has grown 134 percent to 8,700 since its inception, which means more than 4,000 fewer automobiles are operating on streets and highways along the corridor, resulting in improved *air quality*.

- *Job opportunities* are created by the availability of convenient transportation in the western region. 78% of all trips on the West Busway are to work.

- *Convenient connections* are provided to other Port Authority fixed guideway facilities with 45 trips in the peak direction each weekday.

- *Traffic congestion* has been reduced by the 4,000 less automotive trips in the corridor.

- The West Busway stations in Sheraden, Ingram, Crafton and Carnegie are located within walking distance from the communities' main business districts, providing a potential for economic development within the corridor. *Economic development* has begun with the development plans in the borough of Carnegie and Moon Township.

The objectives of FTA's BRT Demonstration Program are:

- Improve bus speeds and schedule adherence
- Increase ridership as a result of improved bus speeds, schedule adherence, and convenience
- Minimize the effect of BRT on other traffic
- Isolate the effect of each BRT feature on bus speed and other traffic
- Assess the benefits of Intelligent Transportation Systems / Automated Public Transportation Systems
- Assess the effect of BRT on land use and development

West Busway results relative to FTA objectives are:

- *Bus speeds* have increased 13%, *schedule adherence* is 68% better,
- *Ridership* in the corridor increased 135%,
- BRT has had a positive *effect on traffic* by taking more than 4,000 cars off the adjacent highways,
- The exclusive busway and limited stops contributed to the increased *bus speeds*,
- The traffic signal priority elements *(Intelligent Transportation Systems)* contributed to increased bus speeds and perception of an enhanced ride and
- The West Busway has stimulated *economic* growth and *development* in Crafton, Carnegie and Moon Township, all adjacent to West Busway facilities.

C. Operational Feasibility

Port Authority West Busway bus operators were surveyed to determine their assessment of driving characteristics on the West Busway. Selected West Busway operator survey questions and responses are below:

"Compared to breakdowns on local streets, are there any special problems pertaining to breakdowns on the West Busway?"

95% no *5% yes*

"How does driving on the West Busway compare to driving on local streets?"

	Easier %	Harder %	Same %
a. *In good weather?*	*90*	*0*	*10*
b. In rainy weather?	*90*	*0*	*10*
c. In foggy weather?	*75*	*5*	*20*
d. In snowy weather?	*87*	*3*	*10*
e. At night?	*88*	*0*	*12*

Is there any way in which dealing with breakdowns is easier on the West Busway than on other streets or highways?

79% yes *21% no*

Does pedestrian activity on the West Busway create any safety problems?

67% yes *33% no*

Do vehicles other than buses, which are currently using the West Busway, have a positive or negative effect on:

	Positive	Negative	None
a. *bus speeds and schedule reliability?*	*2%*	*24%*	*74%*
B, safety of the operation of the West Busway?	*25%*	*20%*	*55%*

The driver responses indicate the bus operation on the West busway improved the driving conditions significantly, which supports the construction and use of an exclusive busway. Ninety percent of West Busway operators reported driving on the West Busway is easier than on local streets. An issue, which is being handled through the Port Authority's safety committee and safety training, is the safety concerns regarding pedestrians crossing the busway, especially at Sheraden Station.

VI. Lessons Learned

A. West Busway Benefits

- Improves mobility within the increasingly congested Parkway West corridor.
- Diminishes traffic congestion on Green Tree Hill and Ft. Pitt Bridge and Tunnel.
- Reduces travel time.
- Provides a reliable transportation option to gridlock during the reconstruction of the Ft. Pitt Bridge and Tunnel.
- Promotes increased economic development.
- Helps conserve energy and reduce regional air pollution.
- Improves access to job opportunities in the Airport/ Parkway West corridor.
- Improves neighborhood transit routing via bus access ramps near each station.
- Provides convenient connections to other Port Authority fixed guideway facilities - the South and East Busways and the Light Rail Transit System
- Reduction in travel time along with reliable service and the convenience of a one-seat ride are significant contributors to increases in ridership.

B. Assessment of Site-Specific Characteristics and External Factors

Community impacts of the West Busway are positive, the opening of the busway has stimulated community improvements such as the construction of the new firehouse adjacent to the Crafton Station, a new municipal facility with retail components in Carnegie and economic development projects in Carnegie and Moon Township.

C. Transferability of Results

BRT components that contributed to the West Busway success and are most likely to succeed elsewhere are:

- use of an abandoned rail right-of-way for an exclusive busway,
- signal priority for transit, especially on left hand turns,
- enhanced bus stations,
- free parking,
- limited stops and
- community involvement in planning and development.

Suggested variations that might be necessary in other locales or might work better in other conditions include:

- use of smart cards to speed fare processing
- use of specially designed, alternative fueled BRT buses,

- implementation of an evaluation plan as an integral part of the BRT project management plan to ensure the availability of relevant before and base –line data and

D. Appraisal of Evaluation Procedures and Recommendations for Improvement

- The evaluation plan, as amended to include the Volpe Center evaluation guidelines, is thorough and flexible to adapt to various BRT applications
- Make the evaluation plan a mandatory component of the project and grant approval process
- Implement the evaluation plan and collect before data prior to operation of the BRT component
- Develop a shared role for the agency and the evaluator in conducting the evaluation

Appendices

1. Evaluation Plan

FTA Office of Research, Demonstration and Innovation
Pittsburgh West Busway BRT Evaluation
Outline-Detailed Project Work Plan

Kickoff Meeting
Detailed Project Work Plan
Conduct Site Visit
Define BRT Elements
Determine Performance Measures
Determine Data Indicators
Collect before Data
Conduct On-going Monitoring
Obtain New Data
Quarterly Reports
Final Report

2. Data Collection Instruments

On-board Passenger Survey
West Busway Operator Survey
Ridership Counts
Point Checks

3. BRT Project Costs

Capital Cost Summary
Calculation of Operating Costs Detailed Performance Measures and Supporting Data

4. Marketing and Promotional Materials

WEST BUSWAY
OPENING CEREMONY

SEPTEMBER 8, 2000 10 A.M.

PROGRAM

Call to Order and Introduction of Master of Ceremonies
NEAL H. HOLMES
Chairman of the Board
Port Authority

Invocation
FATHER DAVID MICHAEL

Master of Ceremonies
PAUL P. SKOUTELAS
Chief Executive Officer
Port Authority

Welcome
JAMES C. RODDEY
Chief Executive
County of Allegheny

Remarks
MAYOR TOM MURPHY
City of Pittsburgh

STATE SENATOR JACK WAGNER
42nd District

STATE SENATOR TIM MURPHY
37th District

STATE REP. TOM PETIRONE
27th District

STATE REP. JOHN PIPPY
44th District

SUSAN SCHRUTH
Region III Administrator
Federal Transit Administration

RAY HACK
District 11 Engineer
Pennsylvania Department of Transportation

Closing Remarks
PAUL P. SKOUTELAS

5. West Busway Ramps