



# Bus Rapid Transit Case Studies

**Final Report:**

Prepared for: Lane Transit District

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## **INTRODUCTION**

The University of Oregon's Community Planning Workshop (CPW) provided technical assistance to the Lane Transit District (LTD) in creating a framework for evaluating LTD's bus rapid transit (BRT) line – the Emerald Express (EmX). This project is sponsored through a grant from the Oregon Transportation Research and Education Consortium (OTREC).

LTD is the transit agency that serves the Eugene-Springfield metropolitan area, and the EmX is a BRT system that LTD is in the process of developing for the area. Since its launch in early 2007, the EmX has experienced high ridership along its pilot route, the Green Line. A second line, the Pioneer Parkway Extension, is in the construction phase, and a third line, the West Eugene EmX Extension, is in the planning stages.

## **PURPOSE**

CPW conducted case studies of five BRT systems in other cities throughout the United States in order to better understand BRT and how transit agencies are implementing BRT. CPW analyzed systems in Cleveland, Ohio; Eugene and Springfield, Oregon; Honolulu, Hawai'i; Kansas City, Missouri; and Pittsburgh, Pennsylvania.

Each city has taken a slightly different approach to implementing BRT, and they have each had different experiences with BRT. In short, CPW wanted to learn why different transit agencies chose BRT as a preferred transit alternative and what they had to do to make its implementation possible. The goal of this research was to identify key BRT "lessons learned" by other transit agencies that may help LTD improve its planning processes in the future.

We were also looking for information about evaluations that transit agencies were doing or planned to do. The overall purpose of our project is to help LTD evaluate the EmX, so we thought other transit agencies might have insight into the evaluations that have been useful in their cities. In addition, we hope that the information about BRT evaluation will be useful to other transit agencies, as well as LTD.

## METHODOLOGY

Using a list of U.S. cities that have BRT, found at <http://www.nbrti.org/index.html>, the CPW team chose five BRT systems to study, including LTD in Eugene-Springfield. The systems were chosen as a result of the availability of information on the internet and whether the system was currently in operation. The CPW team initiated the case studies with internet-based research about each city's transit agency and BRT route. Each case study is organized as follows:

- *General background information* – This section includes basic information about the transit agency, transit system, and BRT routes.
- *Why BRT?* – This section discusses why each transit agency chose BRT, in particular instead of other transit options such as light rail or system improvements.
- *Funding Sources* – This section explains the funding structure for each BRT line.
- *Evaluation* – This section discusses any evaluations that the transit agency has done or is working on.
- *Public Perceptions* – This section addresses public reactions to BRT in each city.

We supplemented the internet research by conducting phone interviews with agency officials to develop a better understanding of each system and gather information that was not available online. These interviews were integrated into the case studies; the individual case studies are found in Appendices A, B, C, D, and E of this report. The appendices also identify who we spoke to from each agency.

## WHAT IS BRT?

BRT is a mass transit option that achieves many of the same goals of light rail, but with a much smaller price tag. Because BRT uses buses instead of light rail trams, no tracks, cables, or wires are needed. This results in a significantly less-expensive infrastructure investment over light rail, and a lower overall project cost.

According to the Federal Transit Administration, there are seven important elements that distinguish BRT from traditional bus routes. They are:

- *Running Way*—This major element has two characteristics or elements: running way type and running way marking.
- *Stations*—There are seven primary characteristics of stations: station location, station type, passenger amenities, curb design, platform layout, passing capability, and station access.
- *Vehicles*—There are four primary attributes of BRT vehicles: vehicle configuration, aesthetic enhancement, passenger circulation enhancement, and propulsion/fuel.
- *Fare Collection*—There are three primary design characteristics of fare collection: fare collection process, fare media and payment options, and fare structure.
- *Intelligent Transportation Systems (ITS)*—There are various ITS applications that could be implemented in a BRT system. They can be categorized into six groups: transit vehicle prioritization, intelligent vehicle systems, operations management systems, passenger information systems, safety and security systems, and electronic fare collection systems.
- *Service and Operating Plans*—The characteristics of service and operating plans are route length, route structure, and service span, service frequency, station spacing, and methods of schedule control.
- *Branding Elements*—The report cites at least two characteristics or elements of branding: marketing classification of BRT service and branding devices.

## **OVERVIEW OF CASE STUDIES**

This section contains a brief description of the transit agencies and BRT systems in each of the five cities we studied.

### **CLEVELAND, OHIO**

The Greater Cleveland Regional Transit Authority started plans in 2005 for a BRT route along Euclid Avenue, an important economic development corridor. The route, named the Health Line, began operation on October 24, 2008, and consists of 58 stops over 6.8 miles. BRT was chosen for Cleveland in 1995 over rail alternatives for financial reasons, even though rail alternatives outperformed BRT in most evaluations. The Regional Transit Authority specifies three main goals for the Health Line: (1) improve transit system efficiency, (2) promote long-term economic and community development, and (3) improve quality of life along Euclid Corridor.

### **EUGENE-SPRINGFIELD, OREGON**

The Emerald Express (EmX) is a BRT system that serves the Eugene-Springfield metropolitan area in Oregon. Since its launch in early 2007, the EmX has experienced high ridership along its pilot route, the Green Line. LTD, who operates the EmX, estimates that 2,700 riders use this service each weekday. The current route connects the central LTD bus stations in Eugene and Springfield using the Franklin Boulevard corridor. The concept of creating a BRT system in the Eugene-Springfield area developed as part of an update to the Eugene-Springfield Transportation System Plan (TransPlan). LTD's goal for the EmX is to create an integrated transit system that is competitive with the automobile.

### **HONOLULU, HAWAI'I**

The Express! is a multiple route express BRT system in Honolulu, Hawai'i. The Express! system for Honolulu was devised as part of a strategic plan implemented by Honolulu's Department of Transportation Services in the late 1990s. The primary goal of that strategic plan was to address growing transit demand and reconfigure the transit system to a "hub and spoke" configuration. Critics argue that the Express! offers very few advantages over a conventional bus system, despite generating higher operating costs. Many residents support light rail, which had become a more politically viable transit mode in Honolulu

### **KANSAS CITY, MISSOURI**

In July 2005, the Metro Area Express (MAX) BRT system was introduced in Kansas City, Missouri, by the Kansas City Area Transportation Authority (KCATA). The MAX system is a six-mile line that runs north and south between two major park-and-ride lots. The MAX links dense, important areas in downtown Kansas City to one another, and is part of a 12-year comprehensive collaborative plan for transit in the Kansas City

metropolitan area called Smart Moves. The Smart Moves plan sets out a metro-wide transit expansion that would involve additional BRT, commuter rail, local buses, trolleys, and express freeway buses.

## **PITTSBURGH, PENNSYLVANIA**

BRT in Pittsburgh is provided by the Port Authority of Allegheny County. The Port Authority also runs regular bus lines, light rail, public transportation inclines, and a paratransit system. The three BRT lines, called busways, opened in 1977, 1983, and 2000 and total 18.4 miles. The planning process for the busways in Pittsburgh began in the 1960s in response to congestion, at a time when there were no other BRT systems in the nation to look to. Busways were chosen over light rail because there was uncertainty about the feasibility of new light rail technology, light rail would have taken longer to build, and light rail would have cost two to three times more to construct.



## FINDINGS

The case studies provide foundational information about what BRT is, why transit agencies choose to implement BRT, how BRT is paid for, how agencies approach BRT system evaluations, and the role of public participation in the BRT implementation process. This section summarizes key findings from the case studies.

- *Most BRT routes don't have all the components of BRT* – In most cases, transit agencies give up certain aspects of BRT for political or financial reasons. The following table shows what aspects of BRT each agency we studied has (for more information on why they do not incorporate certain elements, see the appendices to this document).

**Figure 1: Elements of BRT in each case study city**

City	Dedicated Lanes	Enhanced Stations	Specialized Vehicles	Off-Board Fare Collection	Intelligent Transportation Systems (ITS)	Branding Elements
Kansas City	Partial	Yes	Yes	No	Yes	Yes
Pittsburgh	Yes	No Data	No Data	No	No Data	No Data
Cleveland	Partial	Yes	Yes	Yes	Yes	Yes
Honolulu	Partial	Partial	Partial	No	Partial	No
Eugene-Springfield	Partial	Yes	Yes	No (Yes in future)	Yes	Yes

- *The degree to which the elements of BRT are implemented affects public perceptions* – Compromising on the elements of BRT can negatively impact the success of the system. In Honolulu, for example, the Express! did not incorporate all elements of BRT, and lost public support. The outcome was that Express! routes are being replaced by light rail. This situation was just one example of how BRT systems without all the components of BRT are often just viewed as additional buses and, therefore, the public do not perceive any added benefit of BRT technology.
- *BRT is sometimes seen as the second best choice* – People are familiar with light rail technology and know that it is successful, but are often less familiar with BRT and see it as inferior to light rail. This was the case in Honolulu and has been the case in Eugene-Springfield. If the community really wants light rail and BRT is seen only as a stepping-stone to this mode, it is difficult to gain community support for BRT. However, in cities where BRT is treated as being part of an integrated system rather than a backup for light rail, it is more readily accepted.

In Cleveland, for example, BRT was implemented because it was appropriate for the corridor and it connects well to the rest of the transit services in the city.

- *BRT is often subsidized through taxes* – In four of the five cases we looked at, tax money was used to subsidize public transit. In both Kansas City and Honolulu, sales taxes are appropriated for transit, while in Pittsburgh an alcohol tax is used to cover some of the costs of transit. In Eugene-Springfield, payroll taxes are used to subsidize transit.
- *Evaluations are conducted because they are required by the FTA* – The FTA requires that transit agencies conduct a before and after study to qualify for New Starts funding. Cleveland is in the process of completing a FTA-required evaluation but also has other, more comprehensive evaluations planned. The MAX was one of several demonstration BRT lines, which were evaluated by FTA. In Pittsburgh, the FTA required an evaluation that addresses land use. Pittsburgh is currently working on more comprehensive system evaluation.
- *Most of the evaluation that has been conducted so far consists of rider surveys* – Rider surveys are common type of evaluation. Among the transit agencies we studied, two had completed rider surveys, while Cleveland has not yet completed any evaluation. In Kansas City, a rider survey showed that, after implementation of the MAX, ridership increased, particularly among choice riders (e.g., riders that choose transit over autos or other modes). A rider survey in Honolulu showed time savings and increased customer satisfaction
- *Controversy surrounding BRT projects often manifests itself through public participation* – It can be difficult to educate the public about and gain public support for BRT projects. In Honolulu, Pittsburgh, Cleveland, and Eugene-Springfield, transit agencies conducted extensive public outreach and education campaigns. In Honolulu, public participation led to compromise over the basic components of BRT. In Cleveland, public participation, including the use of collaborative corridor committees, led to public support and buy-in for BRT. In Kansas City, it was difficult to get buy-in for the placement of the second line of the MAX. Transit agencies use different kinds of public outreach processes and have received varied responses to BRT in each case.

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## **Appendix A**

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Heath Line  
Cleveland, Ohio

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## BACKGROUND

The Greater Cleveland Regional Transit Authority (RTA) is the transit agency in Cleveland, OH. In 2005, RTA started plans for a Bus Rapid Transit (BRT) route along Euclid Avenue, an important business corridor. The route, named the Health Line, began operation on October 24, 2008.

The Health Line replaced Route 6 which was the most used bus line in the system with an average of 15,000 to 18,000 riders per day. Since the implementation of the Health Line, RTA has seen an average increase in ridership of 39% per month. The Health Line is the only operating BRT line in Cleveland; another line that would serve west Cleveland is in the preliminary study stage. Other modes of public transportation in Cleveland include one heavy rail line, two light rail lines, and an extensive bus system.

The route consists of 58 stops over 6.8 miles and runs 24 hrs/day with frequencies ranging from every five minutes to every 30 minutes depending on the time of day. RTA recommends that riders buy fare cards, which have a minimum of five rides with 2.5-hour transfers on them. A five-ride fare card costs \$10, but the cost of a single trip depends on the type of card purchased.

**Figure 1: Map of rapid rail lines (green, blue, red) and the Health Line (grey)**



Source: [http://www.gcrta.org/pdf/maps/System\\_Map\\_Rapid.pdf](http://www.gcrta.org/pdf/maps/System_Map_Rapid.pdf)

RTA specifies three main goals for the Health Line: (1) improve transit system efficiency, (2) promote long-term economic and community development, and (3) improve quality of life along Euclid Corridor. In developing these goals, RTA looked primarily at existing roadway conditions, specifically problems with flow and efficiency. The existing Route 6 was at capacity and was only running at about 5.5 mph due to congestion, and RTA wanted to address these problems.

To fulfill the second and third goals for the Health Line, RTA explored how the Health Line could be a catalyst for economic development along the corridor. RTA knew that the Euclid Avenue Corridor was a valuable corridor, since it connects downtown Cleveland to University Circle, and includes hospitals, clinics, and significant amounts of commercial and residential development. The economic and cultural opportunity along the corridor informed the second two goals of the project.

## **BRT Features**

The HealthLine includes most of the major features of BRT, including:

- **Specialized vehicles:** There are twenty-one 62-foot Euclid Corridor Vehicle (ECV) that runs on diesel-electric.
- **Fast-loading/unloading:** The system has raised platforms and off-board fare collection and is ADA accessible.
- **Dedicated bus lanes**
- **Fare collection at stops:** The fare collection system allows an expedited boarding process
- **Frequent service:** The Health Line runs every 5 to 10 minutes between 5:00 am and 7:00 pm, and every 15 to 30 minutes overnight.

## **WHY BRT?**

RTA had been planning to redesign the Euclid Corridor for the past 35 years. In 1983, RTA worked with the city to create a preliminary analysis of the corridor, which looked at past transit projects funded by the Federal Transit Administration (FTA). RTA also looked to Curitiba, Brazil to determine the impact of their BRT system on the transit agency and to the city. In Curitiba, RTA was looking not only at the transit system, but also at improvements and impacts on local infrastructure. RTA found that it was a reliable, lower-cost alternative to light rail.

RTA chose BRT as the Locally Preferred Alternative (LPA) for the Euclid Corridor in 1995. After conducting an assessment of ridership forecasts, environmental impacts, financial feasibility, and capital, operating, and maintenance cost estimates. In these

assessments, rail alternatives performed very well, but BRT was chosen because of cost – less than half of the cheapest rail alternative.

Although cost was the preliminary factor when choosing BRT, RTA emphasizes the environmental advantages of the system as an important selling point. The vehicles have 90% less emissions than traditional buses, and the development process included planting 1,500 new trees along the corridor.

## FUNDING SOURCES

RTA has looked to a number of different sources for capital funding. About half of funds are local, while the other half comes from the FTA. Funding sources are listed in the table below.

<b>Funder</b>	<b>Amount</b>	<b>% of Total</b>
FTA+FTA Rail Mode	\$82.2 million+\$0.6 million	49%
State of Ohio	\$50 million	30%
Cleveland Regional RTA	\$17.6 million	10%
City of Cleveland	\$8 million	5%
NOACA	\$10 million	6%
<b>Total</b>	<b>\$168.4 million</b>	<b>100%</b>

## Naming Rights

The Cleveland Clinic and University Hospital purchased the naming rights of the route, which is why it is called the HealthLine. They are paying \$6.25 million over 25 years for that name, and those funds are dedicated to maintaining the bus stations. Other funding for the operation of the HealthLine comes from advertising on the sides of trolleys and buses.

## EVALUATION

Per FTA funding guidelines, RTA has started working on a “before and after” study of the HealthLine. This study looks at how changes in operations, amenities offered, funding, and marketing affect ridership. The resulting evaluation criteria measure public behaviors in regards to transit, service changes, and safety.

RTA is also conducting a study of value engineering. When they designed the project, it was expected to cost \$425 million, but capital costs were about \$200 million. Getting the project to \$200 million required RTA to cut a lot of amenities and, in turn, assess what effect those cuts had on the ultimate value of the project.

The planning department at RTA is also looking at the sustainable development opportunities of the HealthLine. Local community development corporations (CDCs), are working closely with the planning department to evaluate those opportunities and the existing impacts.

## **PUBLIC PARTICIPATION**

Public participation was a key element of implementing the HealthLine. At the beginning of the planning process, RTA held public meetings, which filled auditoriums and gyms with people who had questions about the project, mostly about how their tax money was being spent. To make these meetings more manageable, RTA decided to hold much smaller meetings with specific groups of people, such as church groups, healthcare workers, and students. In these meetings, RTA was able to specifically address the concerns of those groups. This process was deemed a success because, as the project went along, the meetings became consistently smaller and smaller because residents began to understand and support the project.

To further involve the public, RTA created the Euclid Corridor Committee (ECC), which originally consisted of 98 local stakeholders. This committee worked closely with CDCs, who are responsible for promoting certain types of development in the community, offering guidance, and allocating funds. These CDCs, such as the Downtown Neighborhood Alliance, became champions of the project. When RTA appealed to the FTA for funding or sent progress reports, they were able to make a strong argument for their project by including letters of support from the community.

Construction was an important issue to the public, and one that RTA had to clearly address in their public outreach. RTA worked very closely with businesses to inform them about when construction was taking place and how to deal with the inconvenience. RTA was in contact with businesses a month in advance of construction to figure out the best way to update them about construction schedules (email, posters, visits, etc.) and made an effort to promote businesses along the corridor so they would not lose too much business. Further, RTA worked with the city to provide loans to businesses to cover loss of income as a result of construction disruptions. Because of these practices, the response from businesses has been very positive and most are very supportive of the HealthLine.

Local governments were also important champions of the projects. City government and the Northeast Ohio Area-wide Coordinating Agency (NOACA) have had buy-in for the project since it first started, which has helped RTA get interagency agreements

that are necessary to continue the project. Senator George Voinovich, the senior Senator from Ohio has been an open champion of the project. At different stages of the process, Voinovich has been Governor of Ohio, mayor of Cleveland, and a Senator. Having a champion in those important government positions has helped RTA as well.

## **OTHER INFORMATION**

Development of the Euclid Corridor has played an important role over the course of this project. RTA has improved the infrastructure, repaved roads and sidewalks, and devoted \$1.2 million to public art installments along the corridor.

One particularly interesting aspect of the project relates to RTA's desire to create a sense of community and continuity along the corridor. Cleveland is extremely proud of its history, which often makes new development difficult. To address this issue, RTA is making a concerted effort to make the project not only about progress and the future of the city, but also about its history. For example, each station has a map that points out the different historic sites within a 1/2-mile radius. These maps encourage people to explore the neighborhood, which helps maintain a history of the place, and also helps economic development in the sense that people walking around might patronize local businesses. The Library of Congress is interested in RTA's work of exploring the history of the corridor and provided a grant for archiving the historical research they are conducting. It was clearly important to RTA that, beyond implementing a better form of transit, they were trying to develop the corridor both economically and as a community.

## **CONTACT INFORMATION**

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## **SOURCES**

RTA: <http://www.riderta.com/index.asp>

HealthLine: <http://www.rtahealthline.com>



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## **Appendix B**

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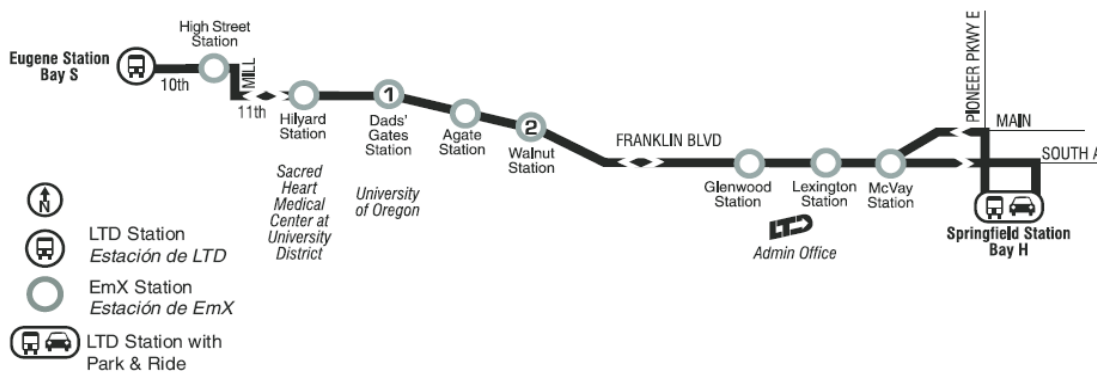
Emerald Express  
Eugene & Springfield,  
Oregon

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## BACKGROUND

The Emerald Express (EmX) is a Bus Rapid Transit (BRT) system that serves the Eugene-Springfield metropolitan area in Oregon. Since its launch in early 2007, the EmX has experienced high ridership along its pilot route, the Green Line. Lane Transit District (LTD), who operates the EmX, estimates that 2,700 riders use this service each weekday.

**Figure 1. EmX Green Line route (Source: Lane Transit District)**



The current route (Figure 1) connects the central LTD bus stations in Eugene and Springfield using the Franklin Boulevard corridor. Roughly 60% of this route is exclusive lanes for the EmX, which allows for decreased travel times compared to conventional buses. Additional BRT routes along Pioneer Parkway in Springfield and in West Eugene are currently in the construction and planning stages, respectively.

LTD's goal with the EmX is to create a transit system that is competitive with the automobile. This means that the EmX had to be designed with convenience and accessibility in mind. As a result, the EmX contains a number of features that incorporate these qualities into its operation. Apart from being offered as a free service, EmX vehicles have been specially designed for easy wheelchair boarding and bike access. Raised station platforms serve to expedite the boarding process and audible pedestrian crossing devices have been installed at major EmX stops to aid the visually impaired. Furthermore, all EmX users benefit from decreased wait times and faster trips compared to standard LTD bus service because of improved boarding access, designated travel lanes, and the use of multiple vehicles to ensure a weekday wait time of no more than ten minutes. This improved level of convenience makes the EmX more accessible and attractive to riders with busy schedules.

Part of being dedicated to providing access to the entire community involves welcoming public participation throughout the planning and design process. LTD has gone to great lengths to educate and gain community input through focus groups, open houses, advertising campaigns, mailings, and design workshops. LTD met with hundreds of community members representing local businesses, environmental groups, neighborhood associations, and service groups to gather input on the pilot route of the EmX.

## **INCORPORATED FEATURES OF BRT**

The EmX has incorporated several features of a typical BRT system. Most notable are the designated travel lanes and improved transit stations and shelters. The EmX also has implemented signal priority and other transit technologies that help the system run more efficiently. Additionally, the EmX has level boarding at all stations, which improves access and reduces travel time. Travel time is further reduced by the EmX route having fewer stops than a standard bus, another important feature of a BRT System.

One final feature of BRT that the EmX has incorporated is the creation of a distinct vehicle image. EmX buses have custom paintwork, showcase the EmX logo, and do not feature advertising on the outside of the vehicles like standard LTD buses.

The EmX has yet to incorporate off-board fare collection terminals. LTD did not believe that including this technology would be cost effective for the Green Line alone, but they have plans to install fare collection terminals as the system expands. LTD will test these terminals over summer of 2009.

Another feature of BRT that has not been fully implemented is the creation of a park and ride service. LTD has secured a number of parking spaces for EmX riders through informal negotiations with area businesses. However, the construction of an official park and ride structure has not occurred. As the EmX expands, LTD is considering a number of locations to potentially locate a park and ride lot in the future.

## **WHY BRT?**

### **PLANNING AND DEVELOPMENT PROCESS**

The concept of creating a BRT system in the Eugene-Springfield area developed as part of an update to the Eugene-Springfield Transportation System Plan (TransPlan). During this process, several possible projects were considered and analyzed in accordance with future population growth and transit demand. TransPlan goals were also taken into consideration, including the goal of obtaining a 10% reduction in vehicle miles travelled in the region by 2020. These projects were then discussed in public forums where it became clear that BRT was the preferred choice.

The BRT proposal was approved in 2001, which allowed LTD to concentrate on finalizing the design of the system and the corridor plan for the Green Line. This process involved over 20 public meetings and design workshops that allowed input by local residents and business owners.

With regional and local government support, LTD has created a vision for the full build out of the EmX system. This vision involves the construction of an interconnected 61-mile system throughout the Eugene-Springfield Metropolitan Area. While expansion is ongoing, no date has been set for the completion of this EmX system.

## **POLITICS**

While LTD and local transportation officials are credited for rallying public support behind the EmX concept, securing funding for the project was a more difficult challenge. Facing the challenge of being the first to implement a BRT system in a medium-sized city, Senator Ron Wyden and Representative Peter DeFazio worked together to obtain federal funding from the FTA for the EmX.

During the planning and approvals process, a variety of community members voiced concern over the BRT concept. These concerns were primarily related to the uncertainty of BRT working in an area the size of Eugene-Springfield. Critics claimed that other successful BRT systems were in much larger cities like Los Angeles, Pittsburgh, and Boston – and that bringing BRT to the Eugene-Springfield area was a risky use of taxpayer dollars.

Other concerns were related to how the EmX would affect the flow of traffic along certain routes. Many business owners in particular were concerned that the exclusive lanes of the EmX would limit access to their businesses. This issue was one of the main challenges faced by LTD when planning for the expansion along Pioneer Parkway.

One final political issue that affects the EmX is balancing the expansion of the system evenly between Eugene and Springfield. Currently LTD's strategy is to alternate expansion projects from one city to the next. For example, the Green Line was built primarily in Eugene, so the next line will be built primarily in Springfield (Pioneer Parkway). While this strategy appears to work for the time being, there may be a shift in the future towards expansion of the EmX based on objective analysis rather than political boundaries.

## **FUNDING SOURCES**

The Green Line's original project cost was \$24 million. Roughly 80% (\$19.2 million) of the project cost was paid through grants from the FTA's New Starts program, and 20% (\$4.8 million) was raised locally.

The 7.8-mile extension along Pioneer Parkway that is currently in the planning stage is estimated to cost \$37 million. LTD submitted an application for \$29.6 million (80% of total cost) to the FTA for this project and, if funding is secured, will need to raise approximately \$7 million locally.

## EVALUATION

The FTA completed an evaluation of the EmX BRT system in 2009. This report analyzed passenger surveys and other studies conducted by LTD to assess the following measures of system performance:

- *Travel Time* – Time savings of one minute compared to previous bus route
- *Reliability* – EmX rated higher for schedule adherence than previous bus route by riders
- *Identity and Image* – Creation of “green” image was viewed as a success
- *Safety & Security* – A number of collisions, but no data on passenger’s perception of safety
- *Passenger Capacity* – The EmX operates at less than 20% of maximum capacity

The FTA also provided a report of the system benefits of the EmX service, characterized by the following performance measures:

- *Ridership* – Initial increase of 50% compared to previous bus route
- *Capital Cost Effectiveness* – Seen as comparable to similar systems in the U.S.
- *Operating Cost Efficiency* – Insufficient data to determine cost efficiency
- *Transit Supportive Land Development* – Increased interest in land adjacent to EmX lines
- *Environmental Quality* – EmX vehicles have 27% higher fuel economy over standard buses. Increased ridership may also have benefits, but this relationship is not documented.

Ultimately, the FTA found that even though the time savings was not as great as initially projected (early estimations were five minutes), the increase in ridership was well above all expectations. This report also found that LTD had been particularly successful in branding the EmX system and showing residents that the EmX was a new and different transportation option in the community.

## **PUBLIC PERCEPTION**

Rider surveys conducted by LTD show that EmX users are mostly satisfied with the BRT service and see it as an improvement over the previous bus route. Ridership counts for the system are significantly higher than LTD anticipated, and they continue to increase.

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## Appendix C

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Express!  
Honolulu, Hawai'i

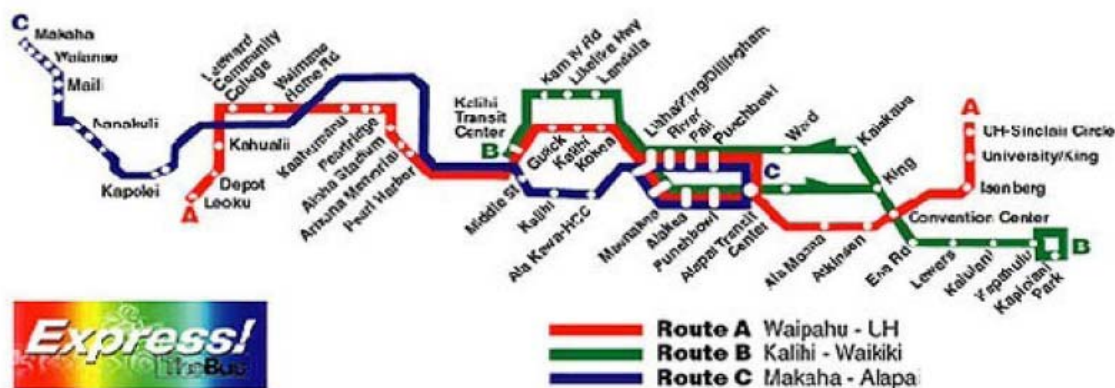
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## BACKGROUND

The Express! is a multiple route express bus rapid transit (BRT) system in Honolulu, Hawai'i. Honolulu's Department of Transportation Services (DTS) manages the service, while a larger organization, Oahu Transit Services (OTS), operates the buses.

Route A, the first of four BRT routes to be constructed, spans 19 miles and began operations in March 1999. One year later, the 8-mile Route B was added as well as the 39-mile Route C. These routes primarily use existing bus stops and shelters, as well as standard 40' buses. In November 2004, the 6-mile Route E was built in downtown Honolulu. This route closed in June 2005 due to low ridership.

**Figure 1 – Honolulu's Express! Bus Route Map, Routes A, B, and C**



Express! buses operate on the same routes as standard DTS buses, although they have longer routes and make fewer stops. This allows a dispersed population to be well-connected to Honolulu's downtown area, convention center, and community college. A voter-approved light rail system will eventually take over the role of the Express! service and provide these connections at much faster speeds.

In 2005, ridership for all Express! routes was just under eight million passengers, which accounted for around 12.7% of all DTS ridership. In order to increase ridership, DTS believes that it is important to better incorporate BRT features like designated lanes and signal priority into the Express! line than currently exist.

## INCORPORATED FEATURES OF BRT

The Honolulu BRT system has a limited number of BRT features. For example, routes A and B do not have designated lanes, and are therefore subject to congestion and other traffic delays. Route C, however, does operate on a 17.5-mile stretch of highway that is designated for high occupancy vehicles. This allows BRT vehicles that run along Route C to reach higher speeds and reduce travel times.



With the creation of Route E, DTS constructed improved bus shelters and purchased ten 60' hybrid-diesel buses. When this line closed temporarily, these state-of-the-art vehicles were incorporated into Route A.

## **WHY BRT?**

### **PLANNING AND DEVELOPMENT PROCESS**

The Express! system for Honolulu was devised as part of a strategic plan that DTS developed in the late 1990s. The primary goals of the strategic plan were to address growing transit demand and reconfigure their transit system to a “hub and spoke” configuration. Before BRT was selected, officials at DTS organized a public outreach project called “Oahu Trans 2K” to gain input from transit riders and other interested residents. This process drew thousands of Oahu residents to the table, and involved more than one hundred public meetings.

Out of these meetings, DTS assembled the plan for the Express! system. Citizen participation played a significant role in the project’s design. For example, DTS cancelled a plan to operate the Express! on designated traffic lanes due to public concerns that automotive congestion would increase. Community input also led DTS officials to eliminate elevated access platforms from transit stops. While DTS believed that having passengers board from these platforms would reduce boarding time, the public felt they were too costly to construct.

### **POLITICS**

City council members criticized the creation of Route E claiming it was poorly planned and did not provide the level of service that DTS officials said it would. Adding to this political disapproval, the Federal Transit Administration revoked its funding for the project. Still, Route E was implemented, only to be discontinued one year later. This initial failure has worried proponents of BRT in the area because they feel it may lower confidence among investors and developers of land that is served by the system.

These concerns later became a focus of Honolulu’s mayoral election in 2008. The incumbent, Mufi Hannemann, believed that Honolulu should move away from BRT and should develop a light rail transit system. His opponent, Ann Kobayashi, proposed her own solution to the city’s transit problem which involved reconfiguring the existing BRT system to incorporate designated lanes and a fleet of specialized vehicles. Voters ultimately reelected Hannemann and approved his \$3.7 billion light rail proposal. The 20-mile elevated line is projected to open in 2018.

As a result of this voter referendum, DTS currently plans to phase out the Express! service once the elevated light rail system is completed. This is because the Express! buses currently operate along the same basic route as the light rail system will, only the Express! will not be able to match the speed of the elevated light rail system.

The light rail system, championed by Mayor Hannemann, has sharply divided the residents of Honolulu, and organizations like Stop Rail Now and Light Rail Now argue over the necessity and efficiency of such a costly project.

## **FUNDING SOURCES**

### **INITIAL PUBLIC INVESTMENT**

Even though DTS only has detailed capital cost information for the Route E extension, the FTA estimates that the upfront cost on Routes A - C was fairly small. This is because these routes did not involve station and terminal improvements or construction of designated lanes. The total cost of Route E, however, is \$27 million including \$4 million for design, \$23 million for construction, and nearly \$8 million for new vehicles.

All Express! vehicles are equipped with onboard fare collection devices, and these routes generate more revenue per service hour than standard buses. DTS has rejected the implementation of fare collection terminals at stations because they want to maintain the same system for all of their vehicles.

### **LIGHT RAIL FUNDING**

Honolulu's City Council approved a 0.5% sales tax increase in January 2007 to raise funds for the future light rail system. This tax will extend through 2022, and it is estimated that it will raise \$4 billion for the construction and maintenance of the system. As a result, the majority of funds for the proposed project will be raised locally. However, FTA funds have been approved for the planning phase of the project which began in early 2009.

## **EVALUATION OF THE EXPRESS!**

The FTA completed an evaluation of the Honolulu BRT system in 2006. This report analyzed passenger surveys and other measures taken by DTS to assess the following measures of system performance:

- *Travel Time* - Time savings of up to 33% over local bus routes
- *Reliability* - Routes B and C performed better than comparable local routes, Route A performed worse
- *Safety and Security* - Insufficient data to assess safety and security
- *Customer Satisfaction* - Express! saw high ratings, but were no different from conventional bus service

The FTA also provided a report of the system benefits of the Express! service, characterized by the following performance measures:

- *Ridership* – Most Express! customers already used mass transit, and overall ridership has not increased a measurable amount since BRT implementation
- *Capital Costs* – Insufficient data to measure capital costs
- *Operating Costs* – Routes A and B have lower operating costs than the average of the entire transit system (regular buses included), Route C has higher costs
- *Land Development* – Insufficient time and resources to measure land development
- *Environmental Quality* – Ten hybrid-diesel vehicles reduced fuel consumption, but effects of the overall system are not quantifiable and appear marginal.

Ultimately, the FTA found it challenging to evaluate the Honolulu system as a BRT network because of its similarities to a conventional bus system. The FTA has determined that there is not enough information to determine if the cost-benefit relationship justifies using BRT in the future. Still, the FTA praises Honolulu for being able to achieve time savings of nearly 33% with very little capital investment.

## **PUBLIC PERCEPTION**

Rider surveys have shown that customer satisfaction is very high for the Express! BRT system. The vast majority of those surveyed recorded their experience with the Express! as “Good” or “Outstanding”. Only 1% of respondents claimed the BRT service was “Poor” or “Extremely Poor”. These customer satisfaction figures closely resemble those received by other conventionally bus routes operated by DTS.

There has been vocal criticism of the Express! service by advocates of light rail transit, particularly in the wake of the Route E failure. Critics argue that the Express! offers very few advantages over a conventional bus system, despite generating higher operating costs.

## OTHER CHARACTERISTICS

One unusual feature of the Express! service is the use of a freeway zipper lane. During morning rush hour, a zipper machine (see Figure 2) is used to construct a temporary barrier on part of the freeway. This allows DTS to change the directional designation of its freeway lanes to accommodate heavy traffic headed in one particular direction. For example, a lane heading away from downtown can be sectioned off and converted temporarily into a lane heading downtown (Figure 3). The Express! and other high occupancy vehicles are then allowed access to this lane during periods of heavy traffic.



Figure 2: Zipper Machine (Source: FTA Evaluation Report, 2006)

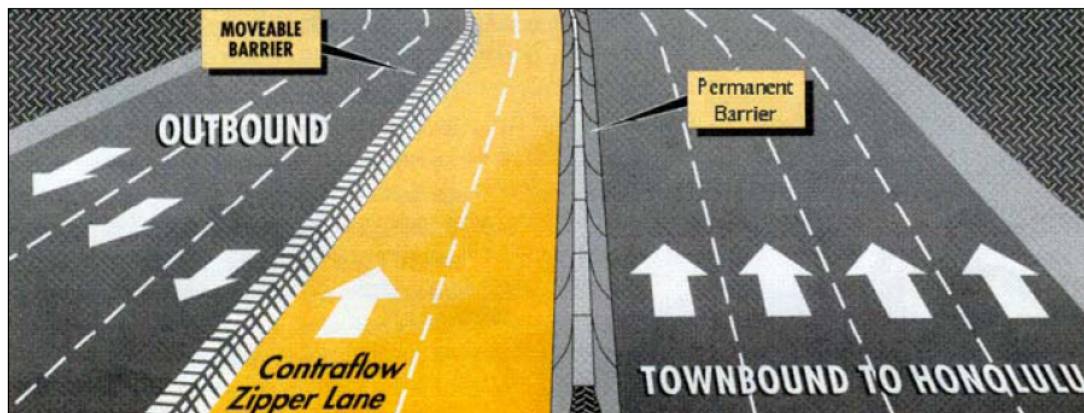


Figure 3: Creation of zipper lane during morning rush hour (Source: FTA Evaluation Report, 2006)

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## **Appendix D**

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Metro Area Express  
Kansas City, Missouri

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## BACKGROUND

In July 2005, the Metro Area Express (MAX) bus rapid transit (BRT) system was introduced in Kansas City, Missouri, by the Kansas City Area Transportation Authority (KCATA). The MAX system is a six-mile line that runs north-south between two major park-and-ride lots. The MAX links dense, important destinations in downtown Kansas City to one another including the River Market, the Government Center, the Convention and Hotel District, the Crown Center, Midtown and the Plaza. The KCATA estimates that the MAX has the capability to connect 150,000 individuals to their workplaces and thousands of convention visitors to their destinations while in the Kansas City area.

The KCATA advertises the MAX as a system that provides quicker commutes, exceptional customer service, easily identifiable buses, and real-time next-bus arrival information. The MAX operates on existing streets, uses dedicated lanes during rush hour and incorporates traffic signal priority in order to stay on schedule. During rush hours, the MAX has a frequency of every nine minutes. All other times the MAX runs every 15 minutes.

The MAX fare costs \$1.25, is collected onboard, and allows free transfers to the rest of The Metro system. All MAX stations are well-lit, feature distinctive markings, have easy to read maps, provide shelter, and show real-time transit information.

## WHY BRT?

The MAX is part of a 12-year comprehensive plan for transit in the Kansas City metropolitan area called Smart Moves. Smart Moves is a collaborative transportation plan put together by area residents, local cities, the Mid-America Regional Council (MARC), and KCATA. MARC coordinates transportation planning in the Kansas City metro area with outlying communities. The Smart Moves plan sets out a metro-wide



**Figure 2: MAX Route Map**  
<http://www.kcata.org/documents/routes/maps/maxmrvk.gif>

transit expansion that would involve additional BRT, commuter rail, local buses, trolleys, and express freeway buses.

When long-term transportation planning in the downtown Kansas City corridor began, light rail was the locally preferred alternative. However, due to cost, the locally preferred alternative was re-examined and BRT was ultimately selected.

Some of the objectives behind Smart Moves and its transportation plans include community revitalization, increased density, air quality improvement, and a reduction in energy consumption. The Kansas City metropolitan area views the MAX as a step in the right direction to meet the goals of the Smart Moves plan. Congestion was not one of the problems that KCATA was trying to solve with the MAX, but now that it has proven successful in its existing corridor, KCATA is moving extensions to more congested areas in hopes of alleviating future congestion.

BRT also serves as a stepping stone toward larger transportation projects in the Kansas City metropolitan area. Eventually, the goal of the Smart Moves plan is to put regional commuter rail lines in place on existing rail lines. These commuter rails would link to a whole series of public transportation options within the metro area, including BRT. Since federal funds are not easily obtained in metro areas that lack population density and have a plethora of cheap parking, the Smart Moves plan is using BRT as an initial strategy to increase density and reduce parking issues in hopes of receiving federal funding for larger projects in the future.

## **FUNDING SOURCES**

The MAX was planned and created by the Kansas City Area Transportation Authority (KCATA) and the City of Kansas City, Missouri with a budget of \$21 million, with \$16.8 million from federal funding (New Starts and other programs), and \$4.2 million from local funding.

Kansas City contributes \$48 million annually to the operation and maintenance costs associated with the transit system because of two local, dedicated transit taxes and is the primary provider of funds for the Metro's transit system; a 1/2-cent sales tax was initiated in the early 1970s, and a 3/8-cent sales tax was implemented in 2004. The 3/8-cent tax, which expired in March 2009, provides almost half of the \$48 million. The KCATA recognizes that losing the 3/8-cent tax will have a negative impact on the transit agency's general progress and policymakers are currently scrambling to find alternative funds. If alternative funds are not found, KCATA will have to cut back its services.

## **EVALUATION**

To measure system performance, KCATA annually out-sources evaluation of its transit system. The main form of evaluation used is rider surveys. These evaluations have shown that the MAX attracts more choice riders than the previous traditional bus

service did and that the amount of young professionals using KCATA has increased without sacrificing patronage by loyal or transit-dependent riders.

One of Kansas City's unique obstacles is overcoming the anti-urban sentiment in the area. A lot of workers commute from more rural areas to Kansas City for work and historically these people have not been in support of enhancing public transportation. By creating a clean, modern, and fresh look, the MAX has also helped some of these more rural communities that were traditionally opposed to funding public transportation become supporters.

Because Kansas City is so spread out, connectivity is one of KCATA's goals. Kansas City's regional transportation plan, Smart Moves, calls for BRT and other public transportation implementation to connect the various parts of the region. KCATA reports that since the MAX line has been open, KCATA receives requests from area residents for extensions of the MAX from the downtown area to suburban and rural regions.

The Troost Corridor line of the MAX, currently under construction, is being evaluated by KCATA for the FTA under the FTA's Very Small Starts program. This extension of the MAX is part of a larger transportation plan for the Kansas City Metro Area.

## **PUBLIC PERCEPTIONS**

From KCATA's perspective, the MAX has been a success. Overall ridership is up 30% since the MAX first began operations in 2005, and a study shows that 15% of the MAX's passengers did not use public transportation before the MAX.

The MAX has been so successful that a second line is planned. During March and April of 2008, open houses were held by the KCATA to discuss the expansion of the MAX to the Troost Corridor in Kansas City. Construction has begun and the line is scheduled to open in 2010. The Troost Corridor extension will link to the existing MAX line; starting downtown, continuing along Troost Avenue to Hospital Hill, then continuing to the Bannister redevelopment area in Kansas City.

Some of the key objectives of the MAX are improving the image of mass transit by offering a new transportation alternative that operates like rail (stations rather than stops and unique identity/branding), using state-of-the-art technology (signal priority, real-time signs, and stop announcements), reducing travel time by 20%, and developing a system using community partnerships.



## **OTHER INFORMATION**

### **HIGH OZONE FARES**

During June through September, the area's high ozone months, fare is reduced to 50 cents to encourage more riders. Additionally during the summer months, the KCATA offers discounts on monthly passes.

### **TRUE COST OF DRIVING CALCULATOR**

The KCATA website offers a True Cost of Driving calculator so that potential riders can see the savings that bus passes offer.

### **EQUITY ISSUES**

The extension of the MAX to the Troost Line opens the MAX up to the largely African-American part of Kansas City. During the design and planning process, it was published that the Troost Line would be a different color than the original MAX line. Due to a lack of communication as to the purpose of distinguishing the lines by color, the African-American population was upset by the Troost Line being different from the original line of the MAX.

Believing that the distinction was based on some racial or socio-economic reason, the African-American population argued for the Troost Line to be the same color as the original MAX line. Not until KCATA took the time to explain the purpose behind the different colored lines did the objecting residents finally get behind the Troost Line being referred to as the Green Line of the MAX.

This is an example of how social competency and communication are both key in transportation projects. Any detail that is left out of communications between a transit agency and the public can turn into big issues that in turn result in delays and poor community perceptions of the project.

### **FUTURE PROJECTS**

KCATA is currently in the middle of submitting a light rail proposal to the FTA's Small Starts funding program.

## **CONTACT INFORMATION**

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## **SOURCES**

Kansas City Area Transportation Authority website:

[http://www.kcata.org/light\\_rail\\_max/max\\_and\\_bus\\_rapid\\_transit/](http://www.kcata.org/light_rail_max/max_and_bus_rapid_transit/)

The Bus Rapid Transit Policy Center website: <http://www.gobrt.org/funding2.html>

American Public Transportation Association website: <http://www.apta.com>

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## **Appendix E**

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Busways  
Pittsburgh,  
Pennsylvania

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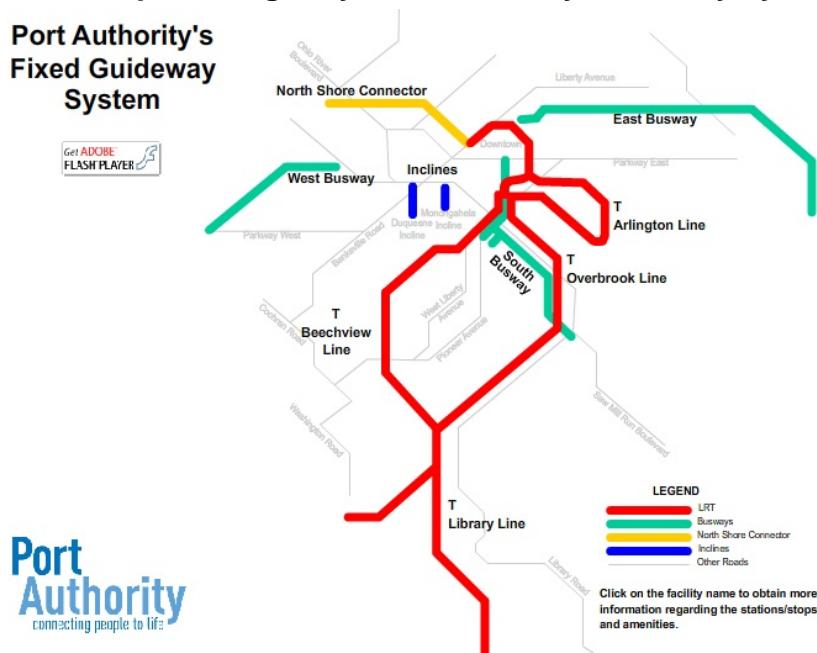
## BACKGROUND

Bus Rapid Transit in Pittsburgh is provided by the Port Authority of Allegheny County. The Port Authority also runs regular bus lines, light rail, two inclined railways, and is associated with a paratransit system. The three bus rapid transit lines, called busways, opened in 1977, 1983, and 2000 and total 18.4 miles. The weekday ridership of the busways totals about 43,000 riders.

The following are aspects of Port Authority Busways:

- *Bus Rapid Transit Features* - The BRT system has dedicated lanes and signal prioritization. These dedicated lanes mostly run along old streetcar and railway lines.
- *Parking* - The Martin Luther King Jr. East Busway and the West Busway have adjacent park-and-ride lots. There are currently 2,000 free park and ride spaces and more are planned.
- *Fares* - Fares range from free within the downtown area to \$3.25, depending on the distance traveled and the time of day. Passengers pay on entrance for inbound trips and pay on exit for outbound trips, reducing the time used for fare collection.

**Figure 3: Map of Allegheny Port Authority's busway system**



## **WHY BRT?**

The planning process for the busways in Pittsburgh began in the 1960s in response to congestion. At this time, there were no other BRT systems to look to. Busways were chosen over light rail because there was uncertainty about the feasibility of new light rail technology, light rail would have taken longer to build, and light rail would have cost two to three times more to construct.

## **FUNDING SOURCES**

Historically, the Federal Transit Administration (FTA) has funded 80% of the capital costs of transit projects in Allegheny County. More recently (since the Clinton administration), the FTA has funded 60% of the capital costs of transit projects. To build the busways in the 1970s, the Port Authority used funds from the U.S. Department of Transportation (DOT), the Commonwealth of Pennsylvania, and Allegheny County.

Currently, 3% of the total capital costs for transportation projects come from Allegheny County, though they cannot afford to give this much for every project. However, before the FTA approves a project, the Port Authority must prove that the county and state are financially committed to the project. Allegheny County also provides operating assistance through a controversial tax on alcoholic beverages. There is no dedicated funding for mass transit operating costs through municipal taxes.

## **EVALUATION**

The Port Authority has not done much evaluation over its long history. Between 2001 and 2003, the FTA funded the Port Authority to do an evaluation of the West Busway BRT project as part of the FTA Bus Rapid Transit Demonstration Program. This report summarized the FTA objectives and the Port Authority's objectives for the project, described the system, and addressed whether these objectives were met. It focused on service quality, ridership, impacts on other traffic, land use and urban design, transit system image, costs, productivity, cost effectiveness, and operational feasibility. Unfortunately, an accurate evaluation was difficult because baseline data was never recorded.

Interestingly, the evaluation report examines land use, which is an objective for both the FTA and the Port Authority. Mostly, this section of the report describes the major factors (such as topography, industry, etc.) that affect transportation and land use. It also describes how BRT facilitates and channels economic development, and describes the extent to which this has happened along the BRT routes.

The Port Authority is creating a Transit Development Plan that includes evaluations of each route in the network. The evaluations are being done because of criticism that some of the 182 bus routes and five rail lines are inefficient. The Port Authority is using

this opportunity to examine whether it could use its limited resources more efficiently. Each route has been evaluated in terms of ridership, productivity, and cost effectiveness. In particular, the Port Authority is looking for parallel services that could be adjusted to reduce redundancy and inefficiency.

Three sets of alternatives will be developed in this plan, and these alternatives will be open to public discussion. The Port Authority is publicizing the plan through press releases, brochures, and station notices. They are also notifying partner agencies and their advisory committee, which consists of 25 members who represent transportation management organizations, universities, transit advocacy groups, Allegheny County, and the city.

## **PUBLIC PERCEPTION**

There are many avenues from which the public perceives the Port Authority and its busway system. These include public relations, media, and neighborhood response.

### **Public Relations**

The Port Authority has a Community Connections outreach program, which gives presentations to town meetings, church socials, company events, and others about any transit related topics.

Port Authority planners work hard to make public relations and participation as effective as possible. When a meeting for a transit planning study at a community college was not well attended, they planned the next meeting at a shopping mall. People already there stopped by to examine the study. Many people are not inclined to go to a public meeting, especially concerning a planning issue (rather than a proposal), but were willing to stop if the meetings came to them.

During another discussion of the light rail extension for the North Shore, planners realized that the neighbors of the proposed project were not familiar with the technology involved in light rail. The planners took them out on the light rail system downtown to show them what it was like. The planners also took the residents on a tour along the proposed route.

### **Media**

On its website, the Port Authority discusses the numerous benefits of transit in general, but does not specify the benefits of bus rapid transit nor how these benefits can be measured.

Overall, the public perceives the Port Authority very negatively in Pittsburgh. A lot of this criticism comes through the newspapers, particularly the Pittsburgh Tribune Review. This newspaper is ideologically conservative and its publisher also funds a research group called the Allegheny Institute for Public Policy, which has historically

criticized the Port Authority and pushed for its privatization. The Tribune Review is also part of a broader media conglomerate, including radio stations, which have been critical of the Port Authority.

## **Public Comment**

In 2009, the Port Authority began its Connect '09 program to involve neighborhoods in Pittsburgh, other towns in the region, and transit systems in the development of the Transit Development Plan. This plan addressed the city's bus system in detail.

Five hundred comments were received in response to the Transit Development Plan. Most positive comments came from people who have seen other cities of comparable sizes (like Baltimore, Saint Louis, and Minneapolis) and have observed that Pittsburgh's system compares favorably to those systems. In the comments, the same routes are within Pittsburgh have been both criticized and applauded. In the most recent focus group, the overall perception of the Port Authority is narrowly favorable. Those who use the busways are generally satisfied by them.

A few years ago there was a lot of negative public comment when a newspaper said that Port Authority employees had overly generous benefit packages. These benefits were cut by 50% for non-unionized employees as a result of the public comment, but a strike was threatened when the Port Authority discussed cutting union benefits too. The tax on alcoholic beverages to fund operations is also very controversial.

A few years ago, an environmental justice suit was brought against the Port Authority because the East Busway serves predominantly African American, lower income residents while the light rail serves white, higher-income residents. While this suit did not progress very far, it introduced the question of equity. Ironically, there has been a lot more development along the busways than along the light rail corridors, in part due to a medical corridor that has developed along East Busway. Recently the county has been pushing for more redevelopment along the light rail corridor.

## **OTHER CHARACTERISTICS**

### **Neighborhood Response**

When the original East Busway was built, it was very controversial. Originally, the busway was supposed to go to the suburb of Swissvale, nine miles to the east of Pittsburgh. Because residents of Swissvale opposed the busway, it stopped in Wilkesburg, approximately two miles from Swissvale. However, as soon as the busway opened and was successful, residents of Swissvale wanted it to continue to their town. This was not the only place where busways have been fought. In another location, a station was designed and the roadway was built, but the station was not used because the opposition was so strong.

The extension process for the West Busway took two years, in part because of the opposition to the plan. Planners held meetings at the library, school gyms, auditoriums, and local municipal offices. Residents often identify themselves by their neighborhoods, and the Port Authority meets with these recognized neighborhood groups. Other important stakeholders for the Port Authority include the local chambers of commerce, large employers, shopping mall owners, representatives from the universities, the African American Chamber of Commerce, and representatives from medical institutions.