

# REINVENTING TRANSIT

AMERICAN COMMUNITIES FINDING SMARTER,  
CLEANER, FASTER TRANSPORTATION SOLUTIONS



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ENVIRONMENTAL DEFENSE FUND

finding the ways that work



# Reinventing Transit

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**ENVIRONMENTAL DEFENSE FUND**

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### *Our mission*

Environmental Defense Fund is dedicated to protecting the environmental rights of all people, including the right to clean air, clean water, healthy food and flourishing ecosystems. Guided by science, we work to create practical solutions that win lasting political, economic and social support because they are nonpartisan, cost-effective and fair.

*Cover photos (clockwise from top left):* Manufacturing streetcars in Portland, OR (photo courtesy Oregon Iron Works). DART light rail station in Dallas, TX (photo courtesy Dallas Area Rapid Transit). EmX bus rapid transit station in Eugene, OR (photo courtesy Lane Transit District). KART rural vanpool service in King County, CA (photo courtesy KART).

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The complete report is available online at [www.edf.org/transit](http://www.edf.org/transit).

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## What's inside this report?

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This report showcases the new generation of innovative public transit already operating in a variety of communities across America. Our goal is to shatter the preconceived notion that transit is exclusive to more traditional urban centers and that it is slow and unreliable. Through 11 case studies, we demonstrate how cutting edge transit has been implemented quickly and cost-effectively in a variety of settings from urban to rural.

Expanding cost-effective transit options is key to our nation's economic and environmental health. On the environmental side, transportation sources are responsible for about a third of U.S. global warming pollution—most of which comes from cars and trucks. Economically, investments that expand transit provide more and longer-lasting jobs than investments to expand highways, while boosting economic development, enhancing real estate values and helping relieve consumer reliance on foreign oil.<sup>1</sup>

Case studies featured in this report:

- 1 Rural transit in San Joaquin Valley (King County, CA)
- 2 Bus Rapid Transit in a suburban area—L.A.'s Orange Line (Los Angeles, CA)
- 3 Streetcars and economic development (Portland, OR)
- 4 Flexible suburban bus routes (Prince William County, VA)
- 5 Bus-only shoulder lanes (Minneapolis, MN)
- 6 Bus Rapid Transit in a mid-sized city—Eugene's EmX (Eugene, OR)
- 7 Community shuttles to commuter rail (New Jersey)
- 8 Community-tailored transit options (Grand Rapids, MI)
- 9 Bus Rapid Transit in a downtown—Orlando's LYMMO (Orlando, FL)
- 10 Bike transit centers (California; Seattle, WA; Chicago, IL; Washington, DC)
- 11 Subways on the streets: New York City's Select Bus Service (New York, NY)

As local and state governments work on plans to invest in our nation's infrastructure, and as Congress writes a new transportation authorization bill, there is an unparalleled opportunity to transform and improve our country's transportation network. Lawmakers and authorities must seize the moment to support and expand upon the innovative transit investments already occurring that will reduce greenhouse gas pollution, create permanent new jobs and revitalize our national economy.

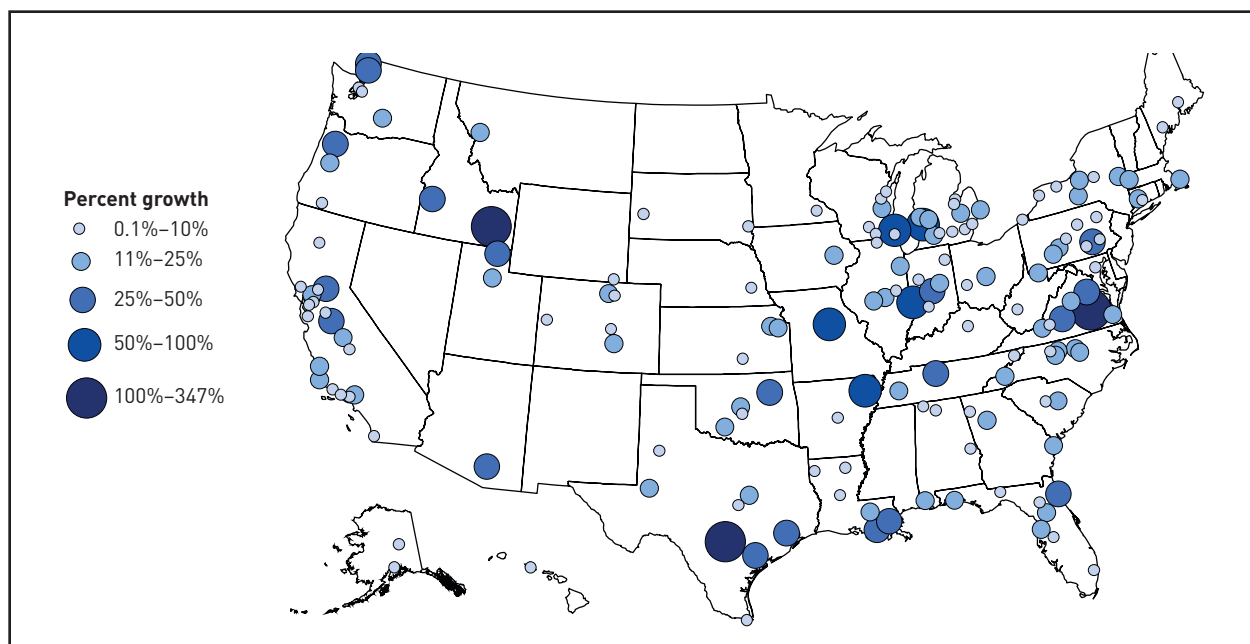
# Transportation at a crossroads

## Where is our transportation system heading today?

Recent events have put the United States' transportation system at a fundamental crossroads. After decades of growth, car travel began to slow in 2005 and soon gave way to an unprecedented decline.<sup>2</sup> This drop is in part due to fluctuating fuel prices, but also because of the diminishing number of new drivers and increased travel choices made available from investments in the 1990s. Meanwhile, transit ridership increased dramatically in recent years, remaining strong even as gas prices dropped steeply in late 2008 (Figure 1).<sup>3</sup> However, despite surging transit demand, diminishing tax revenues are forcing many municipalities to make draconian service cuts and layoffs to close budget gaps in their transit systems.

In the face of these trends, the United States is now poised for a large-scale investment in its transportation infrastructure. The Obama administration and Congress enacted an economic stimulus package to create new jobs through new infrastructure investment. President Obama has also proposed a National Infrastructure Bank to finance future infrastructure needs. Furthermore, Congress will be writing a new federal transportation authorization when the current law (SAFETEA-LU) expires in September 2009. But regardless of which mechanisms ultimately yield federal transportation funding, questions remain about how those funds should be spent to address national priorities. Will a large share go for road expansions that compound the long-term problems of traffic congestion, air pollution, sprawl, oil dependence and global warming? Or will we see new emphasis on sustainable transportation options that provide more affordable commutes, reduce

FIGURE 1  
Percent change transit ridership 2007–2008



Transit ridership has increased in cities all across the country. For the online interactive map that matches cities and transit growth rates, go to: <http://www.edf.org/transittrends>. Cartography: Peter Black/EDF.

pollution and generate a permanent stream of operating jobs well into the future? Now is the time for state and local officials to think creatively about new forms of transportation that match the increasing demand for public transit and address national priorities on energy, the environment and the economy.

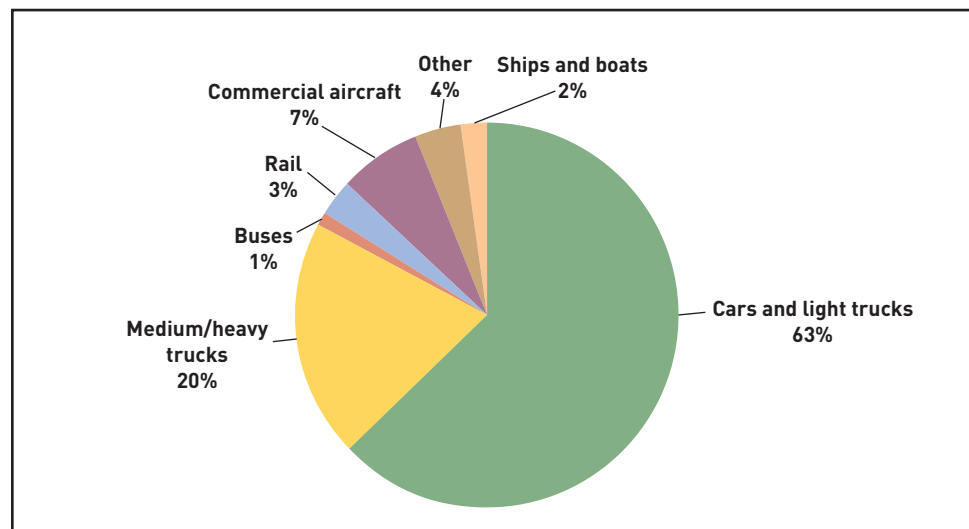
### Transit brings environmental and economic benefits

Providing better transit options is one of the keys to our nation’s economic and environmental recovery. From an environmental perspective, transportation sources are responsible for nearly a third of U.S. global warming pollution—most of which comes from cars and trucks (Figure 2). Tailpipe emissions are also linked to health problems including heart disease,<sup>4</sup> lung development,<sup>5</sup> and even lower IQ levels in children.<sup>6</sup>

Getting these transportation emissions down, however, will require more than just technological fixes. In fact, predicted traffic growth in the coming years threatens to cancel out emissions reductions gained from more fuel-efficient cars, thereby increasing the cost of meeting greenhouse gas targets needed to avert catastrophic climate change.<sup>7</sup> While many factors contribute to traffic growth, studies show that adding new road capacity leads to more driving over the long-term, contributing to additional growth in transportation emissions.<sup>8</sup> Meanwhile, cars generate significantly more greenhouse gas pollution on a per passenger-mile basis than transit systems (Figure 3). Thus, an infrastructure program that focuses on expanding innovative transit while using existing roads more efficiently could effectively help reduce transportation pollution while improving traffic congestion.

Transit investments make sense economically too. Transit projects have been shown time and again to provide greater and more cost-effective job creation than highway projects.<sup>9</sup> Not only will transit investments create short-term construction jobs, but they will support long-term operating jobs long after construction is over.

FIGURE 2  
GHG emissions from U.S. transportation sector by mode (2006)

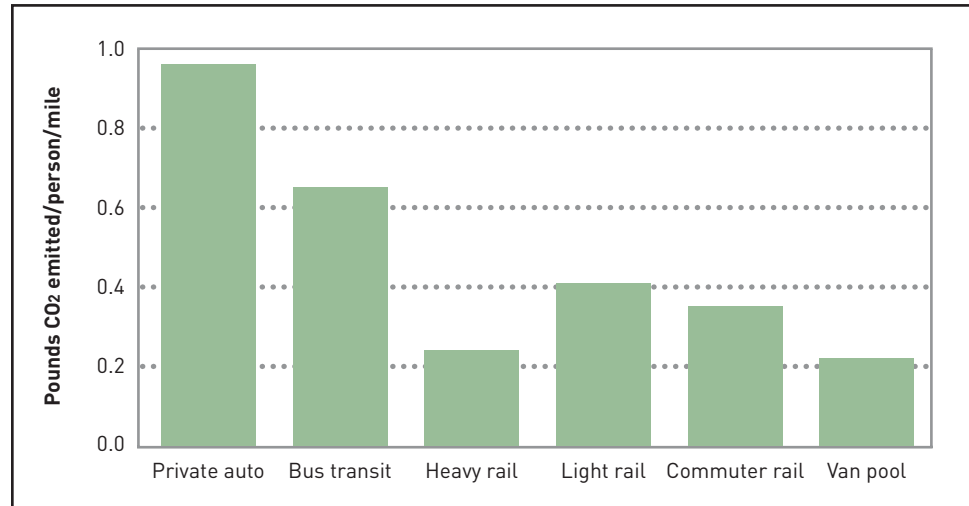


Cars and trucks make up the majority of GHG emissions from transportation. Source: U.S. EPA Greenhouse Gas Inventory 2006, published April 2008.



FIGURE 3

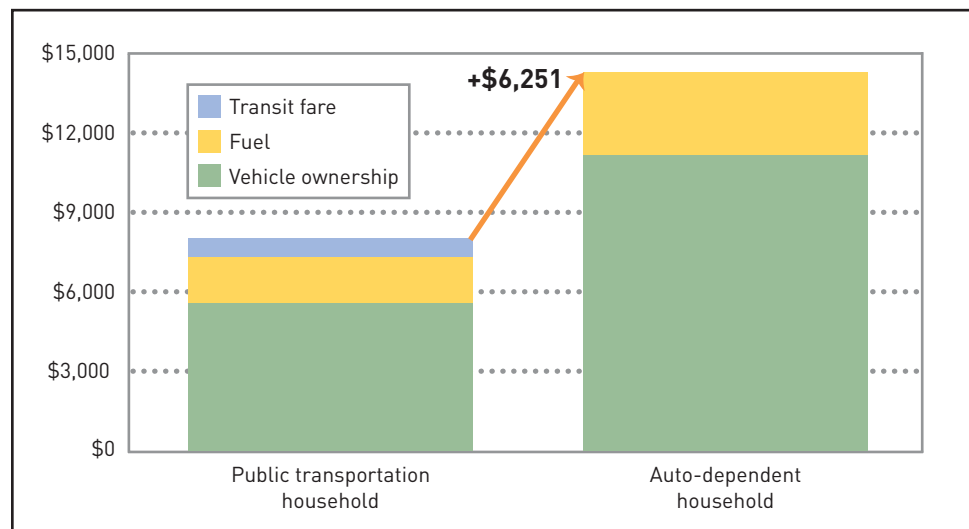
**Carbon intensity of transportation modes in the U.S.**



Taking transit is one of the most effective choices an individual consumer can make to reduce CO<sub>2</sub> emissions. Source: Federal Transit Administration, "Public Transportation's Role in Responding to Climate Change," January 2009.

FIGURE 4

**Annual transportation cost comparison for transit-using and auto-dependent households**



Auto-dependent households spend significantly more on transportation—which is typically the second largest household expense (after housing). Source: ICF International, "Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil," January 2007.

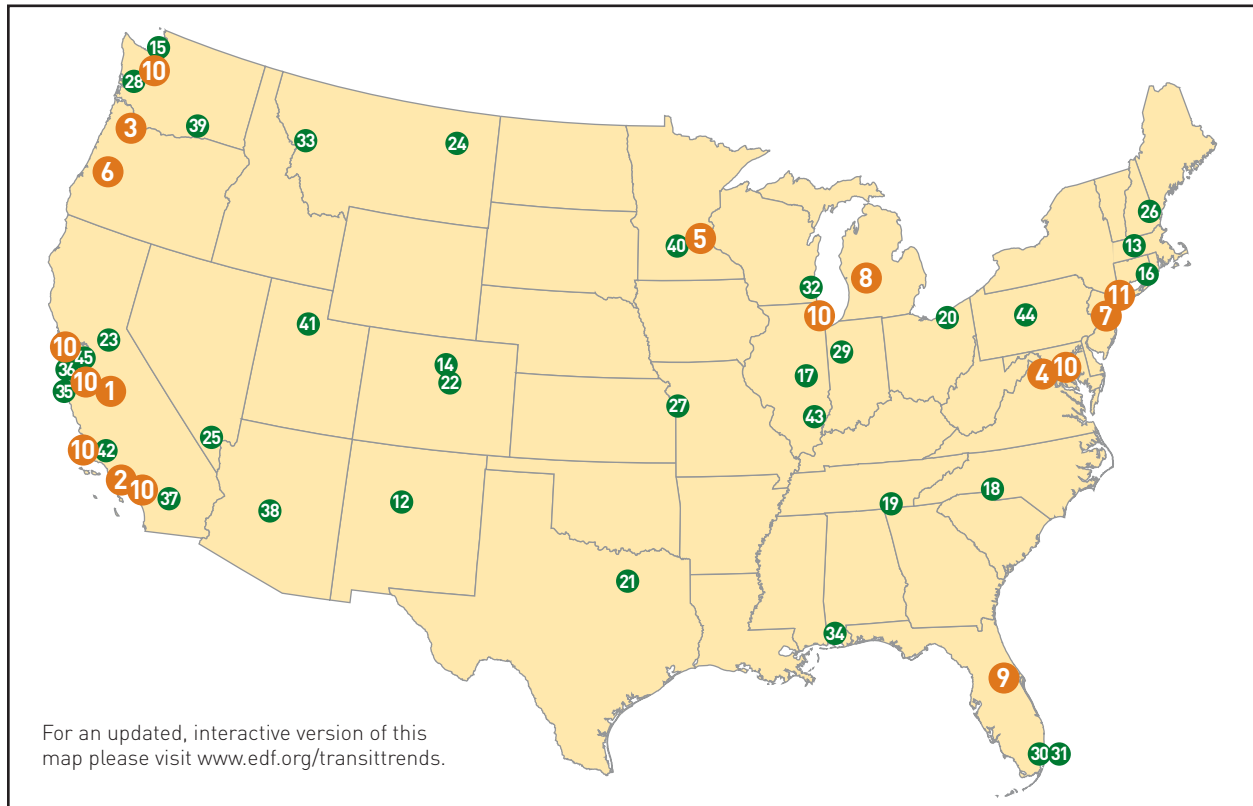
Investing in transit also promotes economic development and enhances real-estate values,<sup>10,11</sup> while providing workers with more affordable access to their jobs (Figure 4) and connecting employers to broader labor pools. Furthermore, by reducing gasoline consumption, transit projects will help to keep money in the local economy rather than sending it overseas to oil-rich nations.

## **Communities across America are leading the way forward**

The urgency of the current economic and environmental crises require solutions that have been proven to work effectively. As such, this report showcases the new generation of innovative public transit already at work in communities across America, helping to create jobs while ensuring cleaner air and healthier communities. Our goal is not to select the “best” transit projects, but rather to provide snapshots of new technologies and ideas successfully in place today. Through eleven case studies, we demonstrate that cutting edge transit can be cost-effective, flexible and implemented quickly. These case studies cover a broad cross-section of settings, including rural areas, suburbs, and cities of all sizes. They are concrete examples of how modern transit can be tailored to any community, providing greater mobility and access to jobs while making travel cheaper and more energy efficient. New forms of transit are attractive and reliable, often being met by ridership far exceeding initial projections. In addition, they offer a powerful tool for economic growth, creating jobs and private sector investments that revitalize nearby communities. If federal policy supported innovations like these at scale across America, a true new generation of transit could be realized.

FIGURE 5

Examples of transit innovations already in operation around the country



- 1 Kings County, CA:** KART (demand response/van pool)
- 2 Los Angeles, CA:** Orange Line (bus rapid transit)
- 3 Portland, OR:** Portland Streetcar
- 4 Manassas/Prince William County, VA:** OmniLink (flex route bus)
- 5 Minneapolis, MN:** shoulder lane buses
- 6 Eugene, OR:** LTD EmX (bus rapid transit)
- 7 Maplewood, NJ:** NJTransit Community Shuttle (shuttle Bus to commuter rail)
- 8 Grand Rapids, MI:** The Rapid (LEED certified central station)
- 9 Orlando, FL:** LYMMO (bus rapid transit)
- 10 Bikestations:** Berkeley, CA. Chicago, IL (McDonald's Cycle Station). Long Beach, CA. Palo Alto, CA. Santa Barbara, CA. Seattle, WA. Washington, DC (SmartBike).
- 11 New York, NY:** Select Bus Service (bus rapid transit)
- 12 Albuquerque, NM:** Rapid Ride (bus rapid transit)
- 13 Amherst, MA:** UMass Transit (student employment)
- 14 Boulder, CO:** Go Boulder (bus branding)
- 15 Bremerton, WA:** Kitsap Transit (worker-driver program)
- 16 Connecticut:** EasyStreet (van pool service)
- 17 Champaign, IL:** Champaign Urbana Mass Transit District (transit technology)
- 18 Charlotte, NC:** CATS Lynx (light rail)
- 19 Chattanooga, TN:** CARTA Electric Shuttle Bus (downtown shuttle)
- 20 Cleveland, OH:** Euclid Avenue HealthLine (BRT)
- 21 Dallas, TX:** DART Flex Service (flex route bus service)
- 22 Denver, CO:** RTD Call n Ride (demand response)
- 23 Elk Grove, CA:** e-tran (flex route bus, commuter rail shuttle)
- 24 Glasgow, MT:** Valley County Transit (demand response)
- 25 Las Vegas, NV:** RTC MAX Bus (bus rapid transit)
- 26 Lebanon, NH:** Advance Transit (free transit bus)
- 27 Kansas City, MO:** KCATA MAX Bus (bus rapid transit)
- 28 King County, WA:** DART, Dial-a-ride-transit (flex route bus)
- 29 Lafayette, IN:** Citybus (transit center)
- 30 Miami, FL:** 95 Express (bus rapid transit/managed toll lanes)
- 31 Miami, FL:** South Miami-Dade Busway (bus rapid transit)
- 32 Milwaukee, WI:** Lake Express (high speed ferry)
- 33 Missoula, MT:** MRTMA/Missoula in Motion (van pool, park-n-ride, guaranteed ride)
- 34 Mobile, AL:** The Wave (neighborhood service program, downtown shuttle)
- 35 Monterey, CA:** Monterey-Salinas Transit (bus rapid transit, alternative fuels)
- 36 Mountain View, CA:** Google Shuttle (employee commuter shuttle)
- 37 Palm Springs, CA:** Sun Line (alternative fuels)
- 38 Phoenix, AZ:** Valley Metro (light rail)
- 39 Richland, WA:** Ben Franklin Transit (vanpool, dispersed service)
- 40 St. Cloud, MN:** MetroBus Dial-a-Ride (demand response bus)
- 41 Salt Lake City, UT:** UTA MAX (bus rapid transit)
- 42 Santa Barbara, CA:** MTD Downtown-Waterfront Shuttle (downtown streetcar/shuttle)
- 43 Southeastern Illinois:** RIDES Mass Transit District (demand response bus, river taxi)
- 44 State College, PA:** CATA (university partnership, event shuttles, vanpool)
- 45 Sunnyvale, CA:** Yahoo Shuttle (employee commuter shuttle)

## CASE STUDY **1**

# Rural transit that works: San Joaquin Valley, CA



KAPTA

Many farm workers use vanpools to travel to work in California's San Joaquin Valley.

### Overview

Public transportation may be an institution in California's megacities but transit for rural residents has been almost non-existent. Kings County Area Public Transportation Agency (KCAPTA) is changing that. The agency's innovative system of vanpools and rural buses ensures access to schools, jobs and medical services in the rural reaches of California's San Joaquin Valley. It provides a safe, practical way for workers at a job site to "self-organize" a vanpool, with local government providing equipment, insurance and other logistics. These vanpools now cover 4.8 million miles a year, giving rural workers a safe and sustainable lifeline to work.

### King County, CA

**County population (2008):** 154,434

**Population density:** ~100/sq mi

**Transit system:** Kings County Area Public Transportation Agency

Source: California Department of Finance

### Description

- 23 rural bus routes
- 346 vanpool services including the Agricultural Industries Transportation Services
- Population served: elderly (provides access to medical services), low-income college students, agricultural workers, corrections officers, school teachers and state workers

## Vanpool success story

“In 2007, vanpool vehicles were responsible for eliminating 373,500 vehicle commuting trips, [and] reducing 176 tons of car emissions from the atmosphere...” according to data provided by the KCAPTA.<sup>12</sup>

## How they work

- Nine people from a job site form a vanpool group. One person must qualify as the driver.
- Kings Area Rural Transit (KART) receives grant money to purchase the van and registers the driver.
- Affordable fees collected on a monthly basis according to mileage—day trips cost less than \$5 per person.
- Operationally self sustaining—fares fully cover costs.
- KART offers 24 hour on-site repair services.

Businesses including casinos and ski resorts throughout the state are turning to KART for advice as well.<sup>13</sup> Vanpools based on this model could fill the rural transportation gap in the United States.

### Annual impact of KART vanpools

**Miles traveled by vanpools**

4.8 million

**Number of at-fault accidents**

2

**Number of auto trips reduced**

404,000

**Reduction in vehicle miles traveled**

66 million

**Project indirect savings**

\$59 million

**Emission savings**

ROG: 61 tons

NO<sub>x</sub>: 62 tons

PM<sub>10</sub>: 15 tons

CO<sub>2</sub>: 413 tons

Source: “Kings County Area Public Transit’s Journey from Fixed Route Service to Vanpools” (presentation, California Association for Coordinated Transportation, November 5, 2008).

## CASE STUDY **2**

# A new image for buses in Los Angeles: Beautiful, fast and reliable



LA METRO

L.A.'s Metro Orange Line features sleek, modern buses made by North American Bus Industries, Inc. in Anniston, AL.

### Overview

Highway 101 in Los Angeles is one of the most congested freeways in the country. Providing a critical transit link and congestion relief to this route required a creative solution. Enter the Metro Orange Line, the first Bus Rapid Transit (BRT) line of its kind within LA County. The BRT line connects the residents and employment centers of San Fernando Valley with the end point of Los Angeles' main subway in North Hollywood (see Figure 6). The Orange Line has proven to be a huge success surpassing its ridership goals for 2020 within six months of opening and relieving traffic congestion on Highway 101.

### Los Angeles, CA

**City population (2006):** 3,849,378 (#2 in U.S.)

**Population density:** ~8,000/sq mi

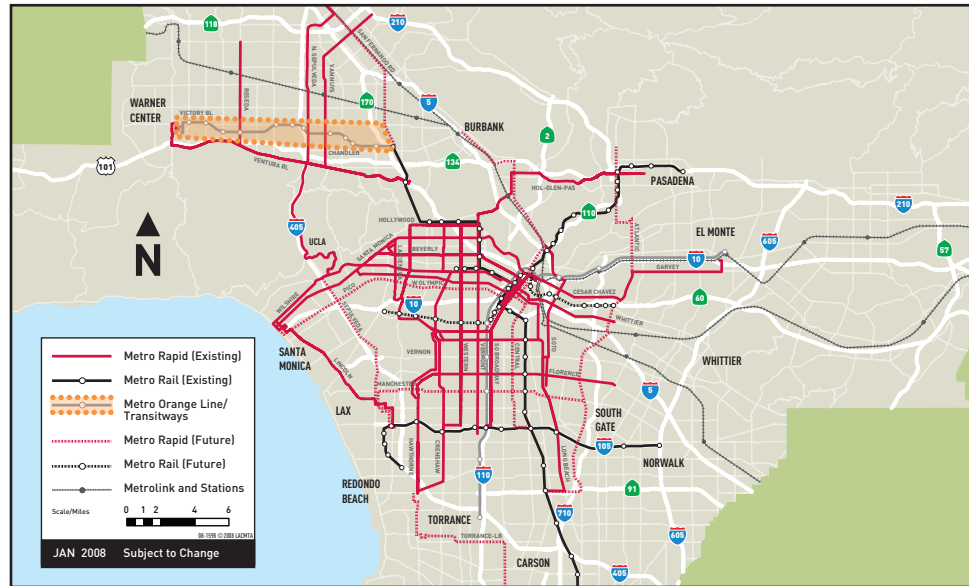
**Transit system:** Los Angeles County Metropolitan Transportation Authority

Source: U.S. Census Bureau

### Description

- Sixty-foot articulated (accordion-like) compressed natural gas-fueled buses have ample room for passengers and bicycles. Multiple wide doors and fare prepayment minimize boarding delays.
- Dedicated lane built on a former rail right-of-way. Signal priority at intersections ensures high travel speeds and minimal delay.

FIGURE 6  
**Map of the Orange Line's location in the L.A. Metro bus network**



Source: LA Metro

- Station improvements: ticket vending machines that enable fare pre-payment. Well-designed boarding platforms, with public art installations, real-time information displays, bike storage, shade canopies and convenient parking make the service attractive and easy to use.
- Service: bus arrives predictably every six minutes during peak commute hours and every ten minutes throughout the rest of the day. Frequent service reinforces strong positive brand identity for the Orange Line.
- Time savings: A January 2006 survey showed that 85% of riders save time by leaving their car at home and using the Orange Line every day.
- Comprehensive approach: A 14-mile bike path and an eight-mile pedestrian walkway accompany the Orange Line with 79% of riders utilizing these options to get to their local bus stop.<sup>14</sup>

### Expansion and job creation

- Expansion of the Orange Line is one of the priority transit projects slated for funding with the passage of Sales Tax Measure R in the November 2008 elections. As a package, Measure R will create 210,000 new jobs and \$32 billion in economic output over the next 30 years.
- Transit-oriented development is beginning to sprout up at several stations along the BRT line.

The success of the Orange Line in one of the United States' most traditionally car-oriented cities illustrates the ability of BRT to fill the gap between urban and suburban transportation options.

## Creating a new American industry: the Portland streetcar



PORTLAND STREETCAR, INC.

The Portland streetcar has encouraged downtown business and housing development.

### Overview

Offering a convenient way to get around downtown, the Portland Streetcar has helped spur extensive development and is a central part of the city’s transportation network. Together with Portland’s light rail and bus system, the streetcar is one reason why automobile use (measured in vehicle miles traveled per capita) in Portland has actually declined by 6 percent since 1990, in contrast to the average for U.S. cities which has grown by 10 percent. In fact, the Portland Streetcar is estimated to prevent 70 million miles of vehicle travel annually, thereby avoiding more traffic and pollution. Now Portland is poised to become the center of a new industry as local manufacturers have become the first in decades to build U.S.-made modern streetcars.

#### Portland, OR

**City population (2007):** 568,380

**Population density:** ~4,000/sq mi

**Transit system:** TriMet

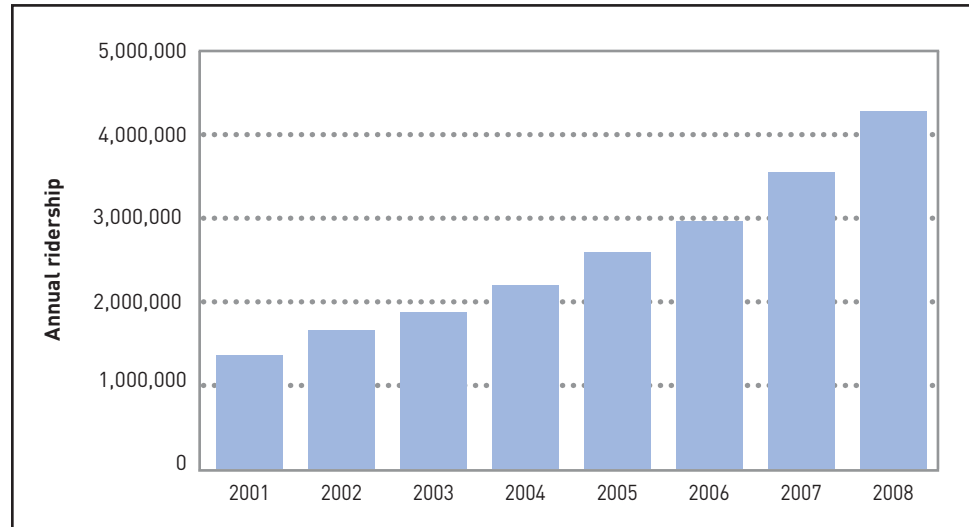
Source: Portland State University, Population Research Center

### Portland’s Streetcar facts<sup>15</sup>

- Portland Streetcar ridership has grown steadily since opening in 2001 and currently serves 13,000 riders per weekday (Figure 7).
- The service began with a 2.4 mile line initially costing \$54 million and has expanded three times since, adding 1.6 miles, bringing the total capital investment to \$103 million.



FIGURE 7  
**Portland streetcar ridership**



Source: Portland Streetcar, Inc.

- A new east side expansion has been proposed for construction in June 2009 to be opened in the fall of 2011.

### **New manufacturing jobs**

Streetcar manufacturing is creating a new source of local jobs. Building upon the Portland Streetcar’s success, United Streetcar (a subsidiary of Oregon Iron Works, Inc.) began manufacturing the first U.S.-built modern streetcar in 2008. Previously, all the Portland streetcars were manufactured in the Czech Republic, but now the cars can be manufactured locally in Portland. With the help of congressional representatives from Oregon and Washington, the City of Portland (with help from Oregon Iron Works) secured a \$4 million contract for a prototype modern American streetcar.<sup>16</sup> This contract allowed the company to hire over 20 new employees for streetcar design and production and they plan on hiring additional employees as new orders for streetcars are secured. Additionally many local and US suppliers are now supplying American-made parts for this streetcar, creating additional jobs and a new product market for many small businesses. Besides manufacturing and construction jobs, the Portland Streetcar also supports over two dozen full-time train operators.

### **Economic development<sup>17</sup>**

In addition to creating new jobs directly, the Portland Streetcar has helped stimulate \$3.5 billion in new development in downtown Portland and revitalized old neighborhoods that were in decline. Within a three block distance from the streetcar, real estate investment has surged, with density increasing over 40% in just a few years. The subsequent development surrounding the streetcar represents over 5 million square feet of new construction including 10,000 housing units.

## CASE STUDY **4**

# Flexible bus routes make transit work in the suburbs: Prince William County's OmniLink bus



PRTC

**Bus drivers and dispatchers use a real-time GPS system to schedule and coordinate trips.**

### Overview

The sprawling suburbs surrounding our nation's capitol present a challenge to developing public transportation that works. But local authorities in Prince William County, Virginia devised a clever solution: flexible bus routes that can drive off-route to pick up passengers a short distance away from the main line. This provides transit access to a much larger area (see Figure 8) and is more cost effective than the traditional method of running both fixed route and curb-to-curb paratransit services (ADA). Modern GPS technology keeps the buses running in sync, creating a timely option for residents traveling to work or just around town.

**Prince William County, VA**  
**County population:** 425,000  
**Population density:** 1,500–3,000/sq mi  
**Transit system:** Potomac and Rappahannock Transportation Commission  
Source: PRTC

### Description of service

- OmniLink buses travel along a local fixed route.
- Passengers can board regularly scheduled stops, or reserve a stop up to ¾-mile off-route.
- Trips are scheduled from two hours up to two days in advance through a real-time reservation system.

FIGURE 8

**OmniLink bus service coverage for Dale City, a suburban community in northern Virginia**



Source: PRTC.

- Off-route service is available to the general public for a surcharge (\$1) or free for qualified individuals (60+, disability, Medicare).
- Bus stops are coordinated through advanced GPS tracking, route guidance and dispatching systems.

**Performance and economic benefits<sup>18</sup>**

In October 2008, ridership was up 12% over the previous year, even after gas prices fell precipitously. Many of these riders rely on OmniLink to reach their jobs. In 2006, 59% of riders used the service to get to work, and 23% said they would not be able to get to their destination otherwise. OmniLink employs

## Reinventing Transit

45 people including drivers, dispatchers, customer service agents, mechanics, administrative staff and managers.

### **Funding sources**

- OmniLink is primarily funded by a 2% motor fuel tax in Prince William County.
- Other funding sources: federal and state formula and grants funds

### **Potential expansions:**

Though adequate funding is a perennial limitation for local bus services like OmniLink, skyrocketing demand has the Potomac and Rappahannock Transportation Commission (PRTC) eyeing several possible expansions to their existing eastern and western routes:

- Increased weekend service along both western and eastern routes, including a connection to Washington Metrorail
- New routes to Montclair and Innovation at Prince William (a technology-focused business and employment center).
- Route extension to Fort Belvoir
- Increased frequency on western routes (currently peak service operates only every 30 minutes for eastern route buses and 60 minutes for western route buses).

## CASE STUDY **5**

# Building transit infrastructure without building new lanes: Metro Transit's bus-only shoulders



MN DOT-TEAM TRANSIT

Minnesota's bus-only shoulder lanes have an excellent safety record and have helped boost ridership.

### Overview

Twin Cities drivers know the pain of traffic congestion all too well. Congestion wastes time and fuel, while adding to frustration and worsening pollution. Fortunately, the local authorities worked with the Minnesota Department of Transportation to devise a simple tool for commuters to avoid congestion. By reconstructing highway shoulders for bus use, Metro Transit riders can safely zip past stop-and-go traffic, saving people time and frustration. Repaving shoulder lanes also provides an opportunity for infrastructure investment that can readily be replicated across the country.

**Minneapolis-St. Paul, MN**  
**Metro population (2006):** 3,175,041  
**Population density:** ~500/sq mi  
**Transit system:** Metro Transit

Source: U.S. Census Bureau

### Description of service

- When traffic speeds are slow (<35 mph), authorized transit buses are permitted to drive on shoulder lanes, thus bypassing congestion.
- Due to safety concerns, buses can only travel 15 mph faster than mainline traffic.
- Shoulders are only used at the driver's discretion and only on segments indicated with proper signage.
- Physical improvements, including shoulder widening, pavement strengthening and catchment basin reinforcement must be made before shoulders are suitable for bus use.

### Performance and benefits<sup>19</sup>

- An excellent safety record: Only one crash injury has occurred in the entire 16-year history of Minneapolis shoulder lane buses
- Time savings: Passengers save 5–15 minutes on an average trip depending on the level of congestion. Trip reliability has also increased as buses encounter less traffic.
- Public perception: 95% of riders believe they are saving time and 65% recommend the service to others.
- Alternative to new roads: Bus shoulder lanes are a speedier and more cost-effective alternative to building additional highway lanes.



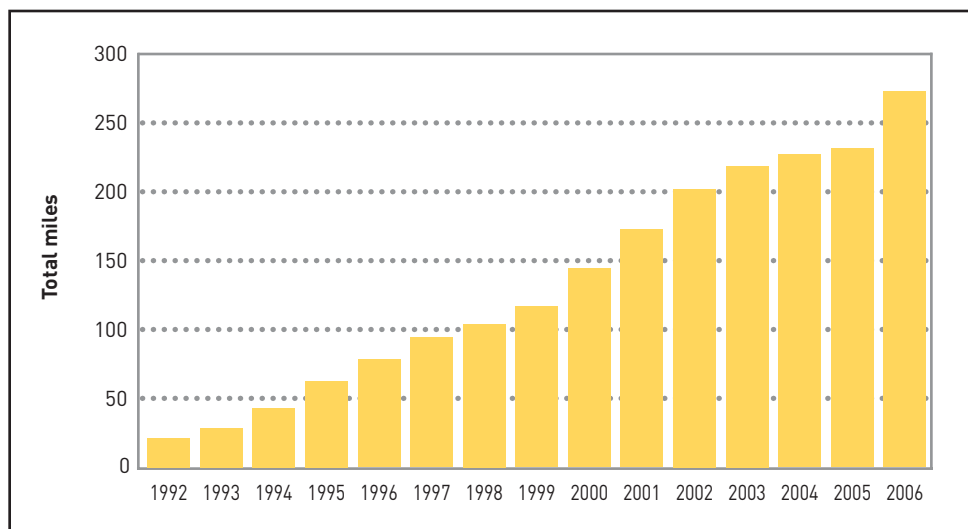
- Increased ridership: A study of nine bus-only shoulder routes showed a 9.2% increase in ridership over a two-year period when system-wide bus ridership was down 6.5%.<sup>20,21</sup>

### Jobs and economic stimulus:

The need to refurbish shoulder lanes before bus use provides a steady stream of local construction/maintenance projects. Construction costs for upgrading shoulder lanes range from \$1500 to \$200,000 per mile, with an average estimated at about \$125,000 per mile

FIGURE 9

**Miles of bus shoulder lanes built or rebuilt each year in Minneapolis-St. Paul**



Source: Metropolitan Council 2007 Transit System Performance Evaluation.

## Reinventing Transit

which includes the rebuilding of drainage grates and paving. Since the first implementation in 1992, bus shoulder lanes have been continuously added each year and currently total nearly 300 miles throughout the Minneapolis-St. Paul metro area (Figure 9).

### **Funding sources**

After initially splitting the cost with Metro Transit, MnDOT began including \$2 million in their annual budget for bus shoulder construction and maintenance, thus adding about 20 miles to the system annually. For a time, Metro Transit also received federally matched funding for bus maintenance and operation, but those funds have been discontinued.

### **Potential expansion**

Shoulder lane buses have now been successfully tried in ten states including Ohio, Florida, Washington, California, Kansas and Virginia. State DOT's around the country can look to these as examples of infrastructure that can increase mobility without needing road expansion.

## CASE STUDY **6**

# Rapid Transit—not just for big cities anymore: Eugene, Oregon’s EmX bus



LANE TRANSIT DISTRICT

**Bus Rapid Transit offers a cost-effective opportunity for infrastructure investment and job creation.**

### Overview

After considering several options, including light rail, the city of Eugene decided upon Bus Rapid Transit (BRT) as the best solution for its growing transportation needs. The new BRT line, called EmX, replaced an existing bus route and immediately led to a dramatic increase in ridership. This success is attributed to key features such as dedicated bus lanes and state-of-the-art hybrid buses. The bus system is well integrated into the fabric of Eugene’s daily life, partnering with local universities and schools to provide low-cost service to students. EmX also created local jobs by hiring local contractors to design and construct key infrastructure components including bus shelters. EmX provides a valuable example to other medium-sized cities looking for effective ways to invest in their infrastructure and develop a sustainable transportation system.

### Eugene, OR

**City population (2003):** 149,004

**Population density:** ~3,500/sq mi

**Transit system:** Lane transit system

Source: U.S. Census Bureau

### Description of service<sup>22,23</sup>

EmX offers Bus Rapid Transit service along two major corridors, totaling almost 12 miles featuring:

- Exclusive right-of-way along ~60% of the route
- Signal priority gives buses a green light more often



## Reinventing Transit

- Low-floor buses making boarding easier and quicker
- Passengers pay their fare before boarding, thus reducing the time spent at the station and speeding travel.
- Improved stations including eight new shelters built along original route
- Higher service frequency: peak service every ten minutes, off-peak service every 20 minutes
- Integrated with local network of bike paths

## Ridership and performance<sup>24</sup>

- System-wide, Eugene bus ridership has increased 35-40% in the last three years, exceeding 20-year projections.
- Despite falling gas prices, ridership is up 10.5% in October 2008 versus 2007. EmX hit a record a record of 6,600 passengers on October 1—nearly 4,000 more than a typical day on the pre-EmX route.
- A rider survey revealed that almost 64% of riders choosing EmX had a car available to them.

## Local partnerships

Lane Transit District (LTD), which operates EmX, coordinates a group transit pass system with the University of Oregon. An incidental fee allows free bus rides with a University ID, thus providing service to 70,000 students, faculty and staff.

## Funding

Construction of the first EmX line cost approximately \$24 million. The primary source of funding was \$19.2 million from the Federal Transit Administration. Local payroll taxes contribute to about 80% of operating funds. Recently, a transfer from the local general fund was needed to maintain operation. Yet, despite this action, fare increases are planned for this year and next year and further funding may be needed to help prevent layoffs (potentially up to 10% of the train district's employees).

## Jobs and economic stimulus

Construction on the first corridor included:

- undergrounding utilities
- tree pruning and landscaping
- curb realignments
- station construction

## **Reinventing Transit**

Local experts were utilized in every phase of the project including arborists and urban foresters, concrete specialists, traffic engineers, architects and landscapers. LTD also worked with New Flyer, a U.S. bus manufacturer with factories in St. Cloud and Crookston, Minnesota, to design a vehicle specifically for EmX. Each specialized vehicle costs \$960,000 and features a GM Allison hybrid engine.

## **Future expansions**

Capital projects are under way for extending service, building more bus lanes and shelters, and purchasing additional New Flyer buses. LTD began construction of the Gateway EmX Extension in February 2009, which will continue through 2010. The project is estimated to cost \$41 million and create 400 local jobs. Of this amount, \$38 million, or 93%, is funded by federal and state capital grants. LTD will invest a local match valued at nearly \$3 million.

## CASE STUDY **7**

# Extending commuter rail's reach: shuttle buses in New Jersey



MARY BARBER

Shuttle buses in New Jersey have helped eliminate the need for driving to and from commuter rail stations.

### Overview

The New York City metro area has one of the most extensive transit networks in the country, with commuter rail services that reach into suburbs in Long Island, Connecticut and New Jersey. But getting to commuter rail stations can be a challenge without a car. Now NJ TRANSIT and several municipalities have developed a creative solution to this problem: the shuttle bus. During peak commute times, these buses travel along local routes, usually within a few blocks of commuters' homes. For a small fee, the bus takes passengers to the nearest station in time for the next NJ

TRANSIT train or bus to New York's central business district. With additional funding assistance for new shuttle buses and seed funding for operations, communities nationwide could establish or expand shuttle systems, thus enabling people to drive less and making properties more valuable by connecting them with urban centers.

### Maplewood, NJ

**Town population:** 24,000

**Daily jitney ridership:** 7,800

**Jitney fares:** Single trip, \$1. Ten-trip, \$5. Yearly pass: \$80.

**Annual cost to operate:** \$114,000

**Typical distance to a jitney stop:** 5-6 blocks

Source: Ed Bolden, Maplewood Transit

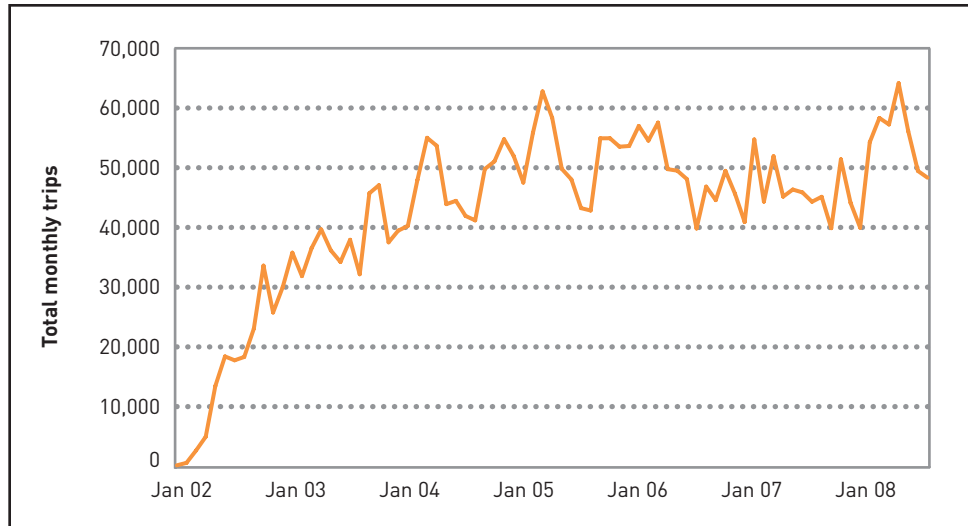
### Maplewood's success story

One of the first NJ TRANSIT shuttles started in Maplewood, NJ and still serves as a successful model to this day. In 1996, Maplewood was advised to build a new parking

**Reinventing Transit**

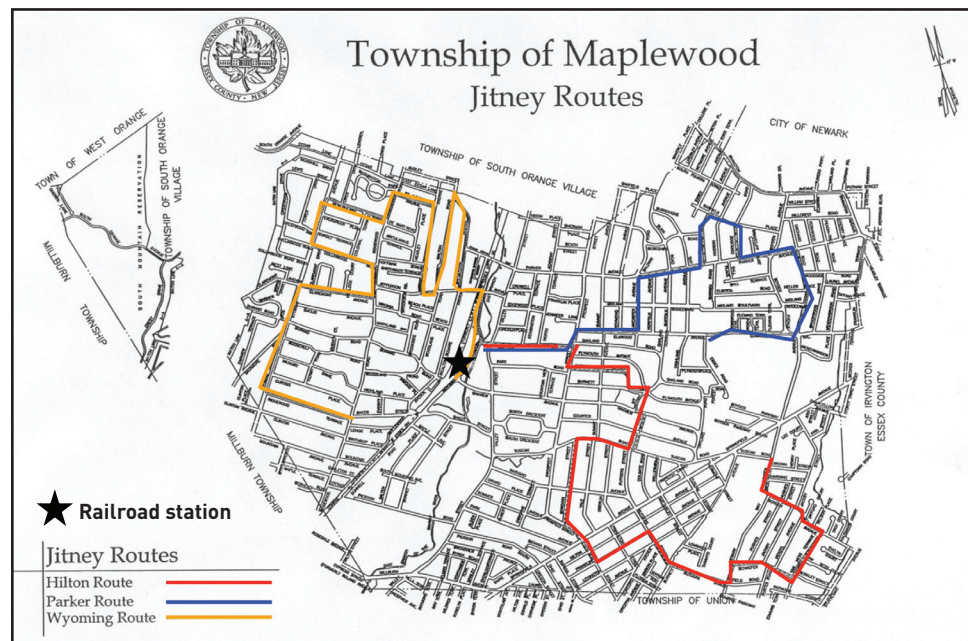
lot at their train station to handle the new Midtown Direct service. Protesting this idea, the town opted to set up a shuttle service instead. The Maplewood Shuttle was so successful that NJ TRANSIT expanded upon the idea in other communities through their Community Shuttle Program. Now the shuttle is seen as a major benefit to the community and has played a role in increasing property values.

**FIGURE 10**  
**NJ Transit shuttle ridership (2002–present)**



Source: NJ TRANSIT

**FIGURE 11**  
**Maplewood, NJ community shuttle routes**



Source: Ed Bolden, Maplewood Township

**NJ TRANSIT seed funding**<sup>25</sup>

NJ TRANSIT's Community Shuttle Program has allowed communities to provide shuttle service to and from a rail station, major bus corridor or a light rail station, during peak hours. The program was designed as a competitive process, open to any municipality or county. NJ TRANSIT used federal funds to purchase 20-passenger minibuses that are leased, at no cost, to municipalities for use in providing the service. In addition, NJ TRANSIT offers initial "seed" funding in partial support of the operating costs for the shuttle service, during the first three years of operation. To date, three rounds of seed funding have been awarded—the most recent of which is currently in the process of delivering vehicles. Thanks to seed funding shuttle services now operate in 20 communities throughout New Jersey, serving more than 50,000 monthly riders (Figure 10).<sup>26</sup>

## A network of transit options in Grand Rapids, MI



THE RAPID

The Rapid's LEED-certified central station has created new green jobs and nearby development.

### Overview

Just a short trip from Detroit, the mid-sized city of Grand Rapids, Michigan is not the first place one might think to find a modern public transit system. But cutting-edge technology, infrastructure and planning have brought Grand Rapids national recognition as a leader in small transit operations<sup>27</sup> and ridership growth consistently above the national average.

Known locally as The Rapid, the system's success is due to its large menu of transit options, tailored to community needs. Routes have been retooled to focus on job creation and economic development, while suburban areas are served by less intensive forms of transit like vanpools and shuttles. Today, the system is a vital piece of Grand Rapids' economy with 80% of riders using The Rapid for work-related trips (up from 54% a few years ago).<sup>28</sup>

#### Grand Rapids, MI

**City population (2007):** 193,627

**Population density:** ~4,500/sq mi

**Transit system:** Interurban Transit Partnership ("The Rapid")

**Employees:** 262

**Operating budget:** \$28 million

Source: The Rapid, U.S. Census

### Innovative connectivity

- **PASS:** PASS provides a shuttle service to connect suburban residents with The Rapid's regular bus routes. Passengers living 1/3 of a mile off a bus line can have PASS pick them up at the curb then deliver them to the nearest bus stop for \$3.00,

### Michigan transit creates jobs

A recent study by Michigan DOT for the Governor's Transportation Funding Task Force analyzed the return on various investments in Michigan's transportation system.<sup>29</sup> Their final report estimated the following:

- More than 300 jobs are created or sustained for every \$10 million spent on transit capital investment
- 570 jobs are created or sustained for every \$10 million spent on transit operations
- In contrast, about 142 jobs are created per \$10 million spent on highway projects

which includes transfer to the main bus line. PASS travel must be arranged a day in advance but is available whenever the bus is in service.

- **County Connection:** County Connection is a curb-to-curb service that takes passengers from or to anywhere in Kent County. The cost is \$14 per trip, with same day service available for \$19.
- **GVSU Shuttle:** Partnering with Grand Valley State University, The Rapid offers free shuttle service for students and faculty between GVSU's Downtown and Allendale Campuses. From 1997 to 2007 ridership grew from 5,000 to 275,000 trips per month.
- **Carpool and vanpool program:** Carpool and vanpool services have been developed in conjunction with the Grand Rapids business community. The Rapid recently introduced an online rideshare matching service (GreenRide) which has increased carpool and vanpool participation ten times over the old phone-based service.<sup>30</sup>
- **Rapid Central Station:** In 2004, The Rapid completed construction of a brand new, LEED-certified, transit hub. Since opening, the station has helped spur \$74 million in new development within a three block radius.<sup>31</sup> To attain LEED status, the station was constructed with environmentally-friendly features such as a green roof, storm water collection tanks, recycled construction materials and low-emissions paints and adhesives.

### Future expansions

Grand Rapids has received federal funding to expand their transit system with a new Bus Rapid Transit line. This project will create a variety of construction jobs both short term (e.g. facility and roadway construction) and long term (e.g. future development near stations). Construction associated with the project will create an estimated 1,200 jobs some of which are temporary.<sup>32</sup> However, to a greater extent than highway projects, the BRT system will also generate permanent jobs through transit operations, retail trade and food services. The total permanent job equivalent created by the rapid transit project will be 405, with an average annual wage of \$37,000. The total annual wage creation will be \$14,985,000. Total project capital cost will be \$40,144,000 (\$32,115,200 federal, \$8,028,800 state). High demand for vanpool service also presents another opportunity for investment, however additional state funding is needed.

## CASE STUDY **9**

# Free, fast and focused in downtown: Orlando's LYMMO bus rapid transit



Orlando's downtown bus ridership increased dramatically after switching to the BRT-style LYMMO service.

### Overview<sup>33,34</sup>

A decade ago, Orlando became one of the first cities in the United States to experiment with a Bus Rapid Transit-style system. Originally the city operated a free downtown circulator bus known as the "Freebee." This system was developed to reduce car travel and congestion in the downtown area, allowing people to park only once per day then ride the bus to different destinations in the city. In 1997 using a federal grant, Orlando converted the Freebee bus into the LYMMO Bus Rapid Transit system. The LYMMO operates seven days a week and remains a free service, its operations funded through proceeds from downtown parking garages. The initial capital cost of the system was \$21 million, the majority of which went towards purchasing vehicles and creating infrastructure such as street reconstruction, shelters and an automatic vehicle tracking system.

#### Orlando, FL

**City population (2003):** 227,907

**Population density:** ~2,000/sq mi

**Transit system:** Central Florida Regional Transportation Authority ("LYNX")

Source: U.S. Census Bureau

### LYMMO service features

- Exclusive lanes for the entire route (2.3 miles), including physical barriers from general traffic



## Reinventing Transit

- Signal priority
- Stations with large shelters and route information
- Automatic vehicle location (AVL)
- Next bus arrival information at kiosks
- Clean-diesel, low-floor buses manufactured by Gillig
- Distinct marketing and image development through vehicle graphics, stations, advertisements and business tie-ins
- Free fare, so no fare collection delay
- Transit TV network

## Benefits and performance

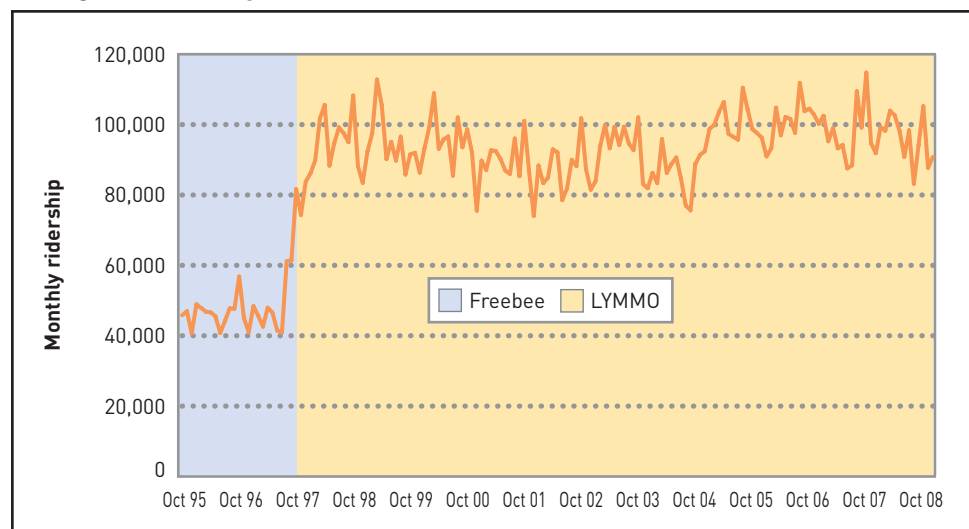
LYMMO currently carries an average of 4000 riders per weekday, connecting people to major downtown employment centers including an arena and a courthouse. Ridership increased dramatically after converting the Freebee to the LYMMO (see Figure 12)

In addition to increased ridership, a Florida DOT evaluation<sup>35</sup> of LYMMO cited the system's many community benefits for downtown Orlando including:

- reduced congestion (i.e. vehicular trips)
- lessened demand for parking
- encouraged transit use and walkability

FIGURE 12

### Change in ridership after LYMMO service was introduced



Bus ridership doubled after LYMMO service began. Source: Federal Transit Administration, "Bus Rapid Transit: Orlando, FL," [http://www.fta.dot.gov/assistance/technology/research\\_4370.html](http://www.fta.dot.gov/assistance/technology/research_4370.html) (last updated June 2006, accessed November 2008).

## Reinventing Transit

- increased mobility and accessibility to major downtown destinations
- allowed for additional development capacity

Economic benefits are also evident. The City of Orlando has cited LYMMO as part of a development strategy that led to five new downtown office buildings (each 1 million square feet) and six new apartment communities.<sup>36</sup>

## Future plans and investment opportunities

LYNX is looking to replace their current LYMMO bus fleet with more fuel-efficient hybrid electric buses. As demand for the service continues to increase, the City of Orlando also wants to expand LYMMO to connect to hospitals, new entertainment venues that are under construction and nearby residential communities. Orlando is seeking New Starts funding for this. Nationwide, expansion of transit services like LYMMO comprise a valuable opportunity for infrastructure investment.

## Building new ways to commute: Bike-transit centers



BIKESTATION, INC.

**Bikestations connect transit with bike parking and other travel services to create a new kind of transportation hub, dramatically expanding transit's market reach in an environmentally friendly way.**

### Bikestation overview

A key obstacle that has prevented more widespread use of bicycles has been the lack of safe or convenient places to park a bike. But now, companies like Bikestation are changing the equation. Bikestation offers a new kind of transportation hub that not only provides parking for cyclists but helps transit providers expand their reach to a wider market. Because cyclists can travel farther and faster than pedestrians, Bikestations enable access to transit over an area 35 times larger than pedestrian access<sup>37</sup> would allow. They also require only a fraction of the cost to build and operate as park-and-ride lots do.

Bikestation has partnered with local communities, businesses and governments to provide parking and a full suite of services to cyclists. With 9 facilities built and more than 36 in the planning stages, Bikestation provides a scalable new form of infrastructure that can expand local commute options beyond driving. Bikestation has experienced enormous success in recent months (August through November 2008) showing a 64% increase in usage over the same period in 2007.

### Spotlight on Long Beach

- Location: First Street Transit Mall, a hub connecting light rail, buses, local shuttles, pedestrians, and 30 miles of bike paths.
  - In June 2008, Long Beach had 2,500 bikestation users, a 39% increase over 2007.
  - The City of Long Beach provides \$48,000 (about a third) of the Bikestation's operating budget
- Source: Long Beach Press-Telegram, 7/21/08

### Description of service<sup>38</sup>

Bikestation aims to develop one-stop personal transportation centers. Though each is slightly different, a Bikestation might include some of the following features:

- Twenty-four-hour bicycle parking
- Bicycle repairs, rentals and retail sales
- Personal showers, lockers and changing rooms
- Snack bar/Café
- Car-share service
- LEV Sharing/Electric vehicle charging station
- Transit and bicycling information and/or ticket sales

### U.S. bikestation locations

Facility	Year opened	Est. square footage	# of parking spaces	Car miles reduced
Long Beach	1996/2006	1200	70	39,000
Palo Alto	1999/2007	2000	94	62,400
Berkeley	1999	1000	77	120,120
Seattle	2003	2100	67	62,400
Embarcadero	2004	1200	142	70,200
Santa Barbara	2007	1360	78	46,800
Washington DC	2008	2500	140	No data
<b>Totals</b>			<b>668</b>	<b>400920</b>

Source: Andrea White, Executive Director, Bikestation, personal communication, November 2008.

### How does it work?

Bikestation works by developing partnerships with local groups including:

- Municipalities
- Transit agencies
- Private developers
- Air quality management districts
- Parks and Recreation departments
- State DOTs
- Other private organizations, including local bike shops and nonprofits

Bikestation’s role in partnerships varies, but typically includes consulting on needs assessments and facility design, facility operation, developing a partnership with a local operator, providing membership access to 24/7 parking, providing affordable liability insurance, banking and merchant systems, and marketing and other collateral materials.

**Bike parking and rentals are available at the McDonald's Cycle Center in Millennium Park, Chicago, IL**



MICHAEL REPLOGLE

### **McDonald's Cycle Center—Chicago, IL**

The McDonald's Cycle Center in Chicago is another excellent example of innovative bike parking. With over 300 secure indoor parking spaces for bicycles, showers, lockers, bike repair services and solar panels, the Cycle Center is state of the art. The Cycle Center is an essential component of famed Millennium Park—a newly renovated public space renowned for its' unique public art displays and modern amphitheater facilities. The Cycle Center is not only close to public transit and cultural activities, but it has rental bikes and offers bike tours all throughout Chicago. The Cycle Center was first built utilizing federal transportation funds and as of 2006, McDonald's created a \$5 million endowment for operations and fitness workshops over the next decade. During the Center's first two years, the facility met its 500-member capacity.

# Subways on the streets: New York City's Select Bus Service



TOM ELSON

**New York's Select Bus Service operates more like a "surface subway" with fewer stops, prepaid boarding, and dedicated right-of-way.**

## Overview

New York City has the highest bus ridership of any transit system nationwide, but those buses are also notorious for being slow. Crippled by high levels of traffic congestion and long boarding lines, buses in New York frequently show up late and easily get stuck in traffic. But now, the city's Department of Transportation (NYCDOT) and Metropolitan Transit Authority (MTA) are working together to create a revolutionary approach to bus travel that is more suitable for New York's crowded streets. Called the Select Bus Service, this new service employs many of the features seen in Bus Rapid Transit (BRT) systems elsewhere like L.A.'s Orange Line or Eugene's EmX. These have already yielded significant improvements.

**New York City**  
**City population:** 8,274,527 (#1 in U.S.)  
**Population density:** 27,147/sq mi.  
**Transit system:** Metropolitan Transportation Authority (MTA)  
 Source: U.S. Census Bureau

## Service improvements

Select Bus Service offers many features not seen on normal city buses.

- Designated bus lanes
- Having passengers pay their fare in the station before boarding significantly reduces the time spent at bus stops
- Transit signal priority (gives buses a green light more often)
- Specialized bus branding and stations

## Reinventing Transit

- Boarding through any door on the bus further reduces time spent at stops and maximizes travel speed
- More frequent service

These additional features are also very flexible, allowing operators to tailor each additional line to the specific needs of neighborhoods in New York City.

FIGURE 13

### Future bus corridors in New York City



Current and future corridors for improved bus service (Select Bus Service or Bus Rapid Transit) in New York City. Source: Metropolitan Transportation Authority.

Passengers pre-pay while waiting for Select Bus Service to arrive in the dedicated lane (painted red).



### Performance and benefits

While Select Bus Service debuted only recently in June 2008, preliminary results show some remarkable improvements. On the new Fordham Road Select Bus Service in the Bronx (which replaced the existing limited stop service) the following changes have been observed:

- 14–24% decrease in trip time—the average rider saves over 5 minutes on each trip<sup>39</sup>
- 4,000-person increase in daily passengers—a 25% increase
- 98% of riders are satisfied or very satisfied with Select Bus Service. 96% of riders report that the new fare machines are easy to use.

### Future expansions

Select Bus Service is the first step towards a full-fledged network of priority bus corridors. Figure 13 shows a map of current bus corridors and ones planned for the future.



# Conclusion

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The examples in this report are just a handful of projects picked to illustrate the variety of transit innovations happening around the country. But there are many other places finding success too:

- In **Mobile, AL**, a newly rebranded transit system called, “The Wave” offers services such as neighborhood pick-ups, electronic fare payment, and downtown trolley service. Together, these have boosted system ridership over 40% in the last few years.
- Vanpool networks like EasyStreet in **Connecticut** provide service to more dispersed areas. EasyStreet now has over 300 routes across the state helping thousands of people in Connecticut get to their jobs.
- Bus rapid transit systems (like those in L.A., Eugene, and Orlando) have recently been constructed in cities as far apart as **Las Vegas, Kansas City, Cleveland, and Miami**.
- **Charlotte and Phoenix** have both opened brand new light rail systems whose ridership has far exceeded initial projections and have been a boon to nearby businesses and real-estate values.

More and more people across the country are turning to transit despite falling gas prices. As these case studies have shown, this recent trend has coincided with a growing supply of innovative transportation ideas to suit individual community needs. Whether riders live in the suburbs of Washington D.C., rural California or the Minneapolis-St. Paul metropolis, options exist to make public transportation work effectively, no matter the size or shape of the community.

However, creative thinking and local initiatives can only go so far. Projects like these are nearly all dependent on aid from federal and state agencies which have historically favored new highway expansion rather than innovative transit improvements. Now, as local and state governments work on plans to invest in our nation’s infrastructure, there is an unparalleled opportunity to transform our country’s transportation network for the better. Lawmakers and authorities at all levels of government must seize the moment to prioritize innovative and market-responsive transit investment that will reduce greenhouse gas pollution, create permanent new jobs and revitalize our national economy. The construction of the interstate system was the first major national transportation initiative in the United States and was a project well-suited for the 1950s. Now is the time to use the existing road network more efficiently while we build the other half of our transportation network—a 21st century modern transit system that connects employment and housing opportunities, ensures cleaner air, speeds our commutes, and creates good jobs.

## What’s next?

To find out more about other transit innovations, or to provide information about projects we missed, please visit: [www.edf.org/transit](http://www.edf.org/transit).

# Notes

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- <sup>1</sup> “Setting the Record Straight: Transit, Roads and Bridges Offer Greatest Job Gains,” Surface Transportation Policy Project 2004.
- <sup>2</sup> FTA Traffic Volume Trends, October 2008. <http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.cfm> (accessed January 2009).
- <sup>3</sup> National Transit Database, October 2008. <http://204.68.195.57/ntdprogram/data.htm> (accessed December 2008).
- <sup>4</sup> Haidong Kan, Gerardo Heiss, Kathryn M. Rose, Eric A. Whitsel, Fred Lurmann, and Stephanie J. London, “Prospective Analysis of Traffic Exposure as a Risk Factor for Incident Coronary Heart Disease: the Atherosclerosis Risk in Communities (ARIC) Study,” *Environmental Health Perspectives*, available via <http://dx.doi.org/> [Online 8 July 2008].
- <sup>5</sup> Gauderman, W. James, Hita Vora, Rob McConnell, Kiros Berhane, Frank Gilliland, Duncan Thomas, Fred Lurmann, Edward Avol, Nino Kunzli, Michael Jerrett and John Peters, “Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study,” *The Lancet*, Volume 368, February 2007.
- <sup>6</sup> S. Franco Suglia, A. Gryparis, R. O. Wright, J. Schwartz, and R. J. Wright, “Association of Black Carbon with Cognition among Children in a Prospective Birth Cohort Study” *American Journal of Epidemiology*, 167:280–286, February 1, 2008.
- <sup>7</sup> Ewing, et al. “Growing Cooler,” Urban Land Institute, 2007.
- <sup>8</sup> Noland, Robert B. and Lewison L. Lem (2002), “A review of the evidence for induced travel and changes in transportation and environmental policy in the US and the UK,” *Transportation Research Part D*, 7 p. 1–26.
- <sup>9</sup> “Setting the Record Straight: Transit, Roads and Bridges Offer Greatest Job Gains,” Surface Transportation Policy Project 2004..
- <sup>10</sup> Robert Cervero. Rail transit and joint development: Land market impacts in Washington, DC and Atlanta. *Journal of the American Planning Association*. V60n1 (Winter, 1994) pages 83-94.
- <sup>11</sup> Robert J. Armstrong, Jr. Impacts of commuter rail service as reflected in single-family residential property values. *Transportation Research Record*. (no. 1466) pages 88-98. Transportation Research Board, Washington DC, 1994.
- <sup>12</sup> Eiji Yamashita, “Denting those travel costs,” *Coalinga Record*, October 26, 2008, <http://www.coalingarecord.com/articles/2008/10/26/news/doc490402bc86329521084849.txt> (accessed December 5, 2008).
- <sup>13</sup> Ron Hughes, personal communication, September 2008.
- <sup>14</sup> Gomes, Gabriel and Hamed Benouar, “Short-Term Impacts of the New Orange Line Bus Service on Peak Hour 101 Traffic,” California Center for Innovative Transportation, December 2005, [www.calccit.org/news/](http://www.calccit.org/news/) (accessed December 8, 2008). Callaghan, Lisa, and William Vincent, “A Preliminary Evaluation of the Metro Orange Line Bus Rapid Transit Project,” *Journal of the Transportation Research Board* 2034, (2007): 37–44.
- <sup>15</sup> Julie Gustafson, Portland Streetcar Inc., personal communication, November 2008.
- <sup>16</sup> “Oregon Iron Works gets contract for streetcar,” *Portland Business Journal*, January 26, 2007. <http://portland.bizjournals.com/portland/stories/2007/01/22/daily45.html> (accessed January 2009).
- <sup>17</sup> Portland Office of Transportation and Portland Streetcar Inc., “Portland Streetcar Development Oriented Transit,” April 2008, [http://www.portlandstreetcar.org/pdf/development\\_200804\\_report.pdf](http://www.portlandstreetcar.org/pdf/development_200804_report.pdf) (accessed November 14, 2008).
- <sup>18</sup> Eric Marx, Potomac and Rappahannock Transportation Commission, personal communication, November 2008
- <sup>19</sup> Transit Cooperative Research Program, “TCRP SYNTHESIS 64: Bus Use of Shoulders” Transportation Research Board, 2006.
- <sup>20</sup> Douma, Frank, “Bus-only Shoulders in the Twin Cities,” University of Minnesota/USDOT, June 2007. <http://www.dot.state.mn.us/metro/teamtransit/docs/BusOnlyShouldersReportFINAL.pdf> (accessed January 2009).

## Reinventing Transit

- 21 Jennifer Conover, Team Transit, Mn/DOT Metro District, personal communication, January 2009.
- 22 Lane Transit District, “EmX FAQ,” <http://www.ltd.org/search/showresult.html?versionthread=6d517154d17fc3e09be84a0ee196bd7b> (accessed November 2008).
- 23 Lane Transit District, “History of EmX,” <http://www.ltd.org/search/showresult.html?versionthread=45a4b83927fba5cb751c741bf4ac81e3> (accessed November 2008).
- 24 Andy Vobora, Lane Transit District, personal communication, November 2008
- 25 NJ TRANSIT, “Community Shuttle Program,” [http://www.njtransit.com/tm/tm\\_servlet.srv?hdnPageAction=ShuttleTo](http://www.njtransit.com/tm/tm_servlet.srv?hdnPageAction=ShuttleTo) (accessed January 2009).
- 26 Sally Stocker, NJ TRANSIT, personal communication, January 2009.
- 27 American Public Transportation Association, news release, October 13, 2004, [http://www.apta.com/media/releases/awards\\_04/interurban.cfm](http://www.apta.com/media/releases/awards_04/interurban.cfm) (accessed January 2009).
- 28 Peter Varga, The Rapid, personal communication, January 2009.
- 29 Michigan DOT, “Report of the Transportation Funding Task Force,” November 10, 2008. [http://www.michigan.gov/mdot/0,1607,7-151-9623\\_31969-202856--,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9623_31969-202856--,00.html) (accessed December 2008).
- 30 The Rapid, news release, “Ridesharing Growing Dramatically,” January 9, 2007, <http://www.ridetherapid.org/news?newsID=99&pager=4> (accessed December 2008).
- 31 Washtenaw Area Transportation Study, “Michigan Transit Vision,” October 2008. [http://www.miwats.org/index\\_info/Statewide\\_Vision\\_Summary\\_10.08.pdf](http://www.miwats.org/index_info/Statewide_Vision_Summary_10.08.pdf) (accessed January 2009).
- 32 The Rapid “Great Transit Grand Tomorrows—Division BRT Project,” <http://www.ridetherapid.org/about/great-transit> (accessed January 2009).
- 33 Lisa Darnall, Central Florida Regional Transportation Authority (“LYNX”), personal communication, November 2008.
- 34 LYNX, Lymmo Communications Outreach Program, “Lymmo,” 22 September 1999.
- 35 National Bus Rapid Transit Institute (prepared for Federal Transit Administration and Florida DOT), “LYNX Lymmo Bus Rapid Transit Evaluation: Final Report,” July 2003, <http://www.nbrti.org/media/evaluations/lymmo-7-03.pdf> (accessed December 2008).
- 36 Federal Transit Administration, “Characteristics of Bus Rapid Transit for Decision-making” August, 2004. <http://www.fta.dot.gov/documents/CBRT.pdf> (accessed December 2008).
- 37 Michael Replogle, *Bicycle and Pedestrian Policies in Asia, Australia, and New Zealand*, U.S. Federal Highway Administration, Washington DC, 1993; and Michael Replogle and Harriet Parcels, *Linking Bicycle/Pedestrian Facilities with Transit*, U.S. Federal Highway Administration, Washington DC, 1993.
- 38 Bikestation, “Frequently Asked Questions,” <http://www.bikestation.org/FAQS.asp> (accessed January 2009).
- 39 New York City Department of Transportation, November 2008.



## ENVIRONMENTAL DEFENSE FUND

finding the ways that work

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