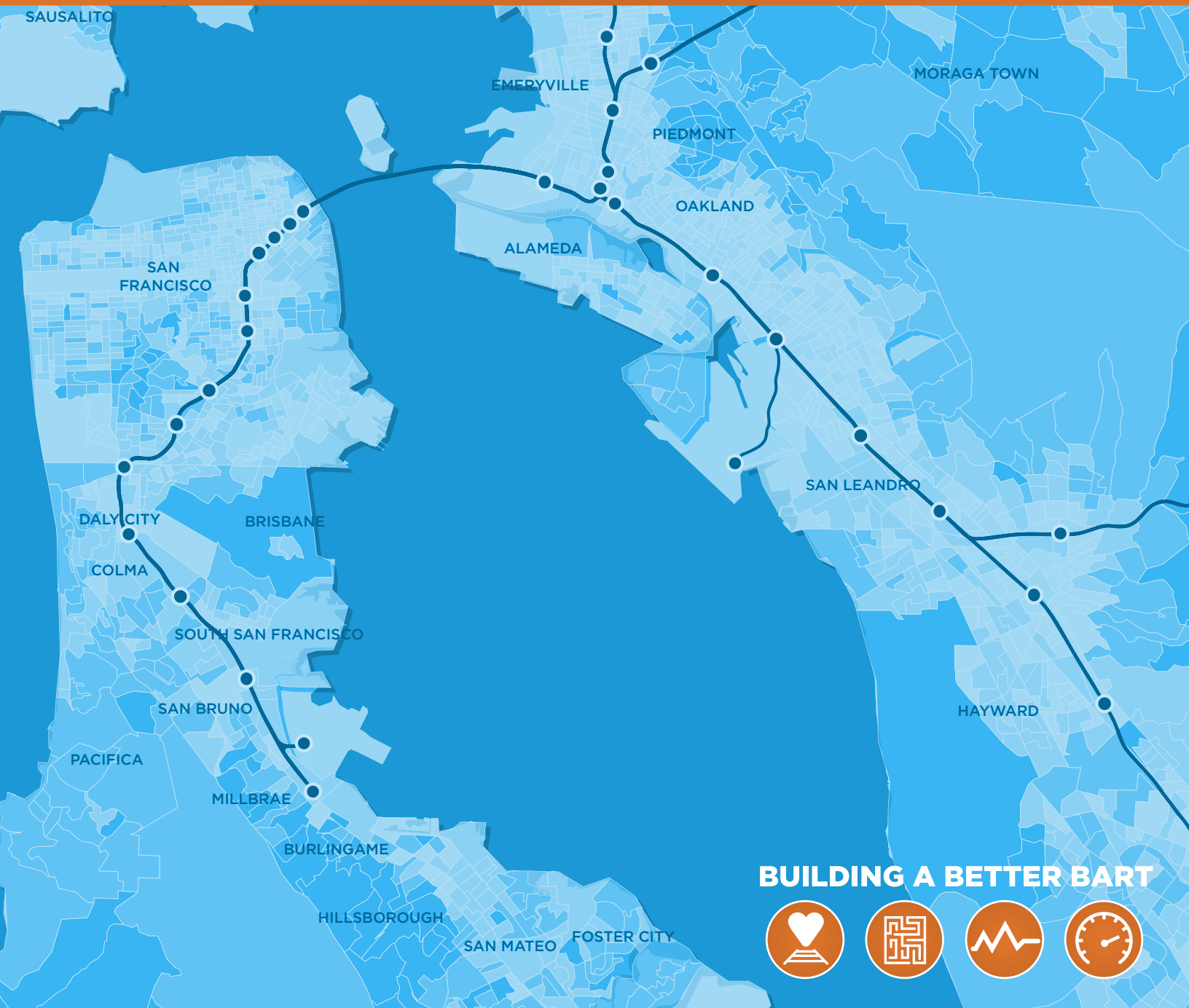


# BART'S ROLE IN THE REGION



**BUILDING A BETTER BART**



# ACKNOWLEDGEMENTS

BART's Role in the Region | October 12, 2016

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**BUILDING A BETTER BART**





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## INTRODUCTION

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BART enhances the quality of life in the Bay Area by providing rapid and reliable transportation. In this role, the system strengthens our regional economy, contributes to a cleaner and healthier environment, and keeps cars off the region's roads.

After 44 years of service to the region, BART faces major challenges. As the economy has grown and more people have chosen to ride BART, the system has grown increasingly crowded during peak commute hours. To meet the demand, BART must adapt in ways that allow it to provide more service in the highest-demand times and places. At the same time, important parts of the infrastructure that make up the BART system was installed in the early 1970's and require replacement or major overhauls. BART's best-in-the-business maintenance practices have sustained the system's original infrastructure far longer than expected, but even well-maintained equipment eventually reaches the end of its useful life and must be renewed.

Without action to address BART's aging infrastructure and crowded conditions, BART's ability to perform its important role in the region will suffer: delays will increase, crowding will grow more acute, and the risk of unsafe conditions will rise. These consequences would affect not only BART riders, but the region as

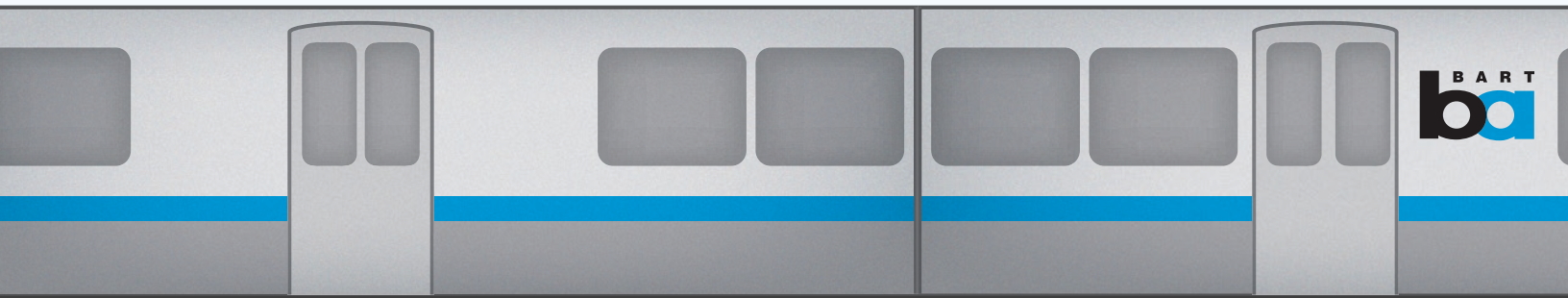
a whole. Without a reliable BART system, the region will face worse traffic congestion and reduced economic competitiveness. The available capital funding is not sufficient to meet these growing needs. BART must seek new funding sources to continue to serve its important role in the region.

In consultation with stakeholders from across the region in more than 200 meetings, BART has developed a program of investments that will take a major step toward meeting the system's needs. The major benefits of this program will be improvements in safety and reliability, as well as reduced crowding and reduced regional traffic congestion.

This report aims to help inform a regional conversation about the future of BART. It summarizes the benefits of BART for the Bay Area; reviews the system's major challenges; considers the consequences of failing to address those challenges; and finally presents the proposed investment program and the benefits that the program offers to the region.

# BART'S

## HISTORY IN THE REGION



1970s

1980s

1990s



**A. SEPTEMBER 11, 1972** - BART opens with Fremont to Oakland service including 28 miles of tracks and 12 stations.

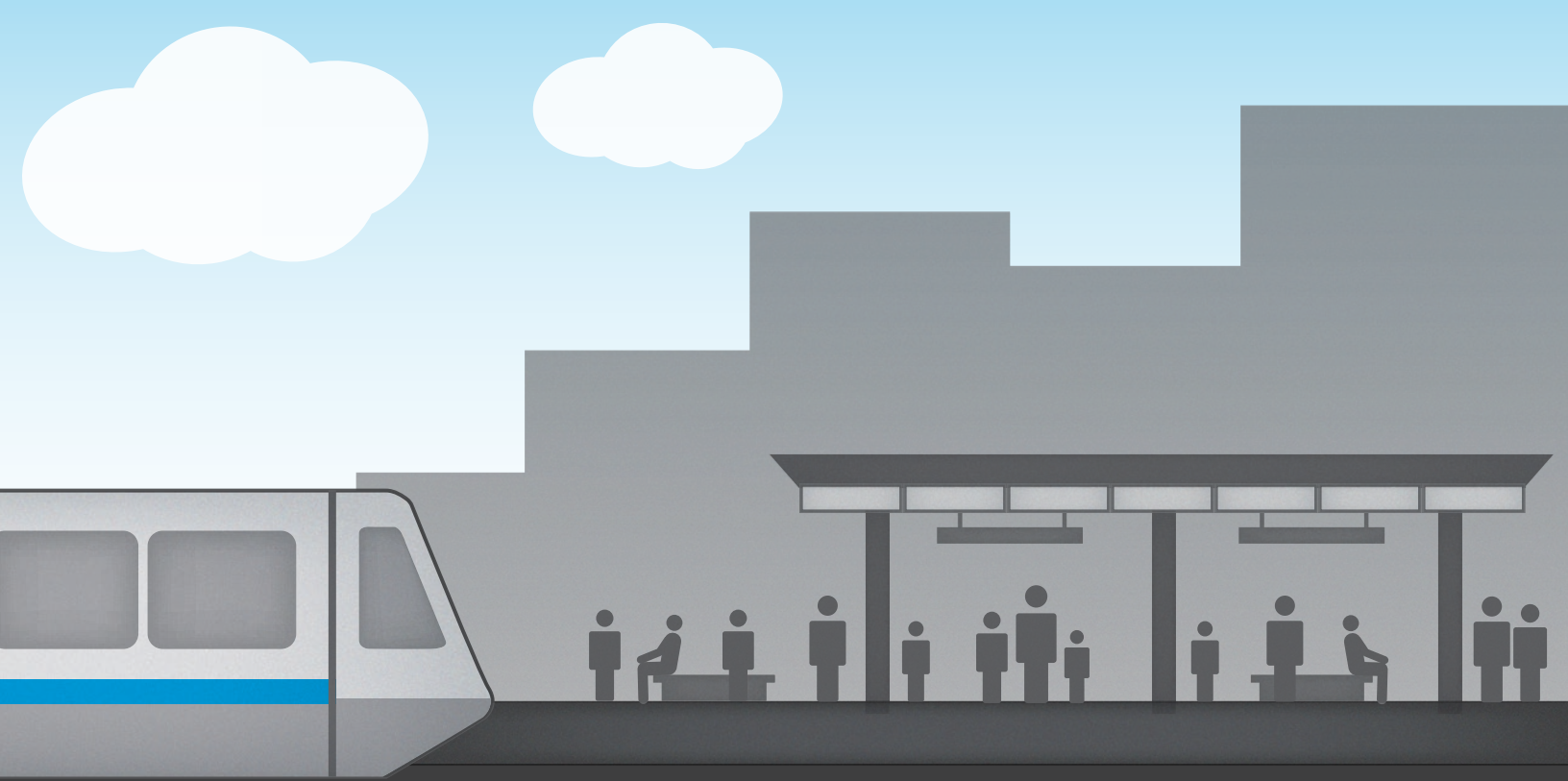
**B. 1973** - Oakland-to-Richmond service opens. This extends the operating system to 39 miles and 18 stations. Concord line opens, adding 17 miles.

**C. 1974** - Transbay passenger service begins.

**D. 1976** - Permanent night service goes into effect. Hours of train operation are extended from 6 am to midnight. Embarcadero Station officially opens for revenue service.

**E. OCTOBER 17, 1989** — The Loma Prieta earthquake rocks the Bay Area. BART continues to operate, providing critical service during Bay Bridge closure.

**F. 1991** — Projects begin to extend BART to Dublin/Pleasanton and Pittsburgh/Bay Point. The extension program adds 33 miles and 10 stations to the existing 71.5-mile, 34-station system, increasing the existing system by 46%.



**2000s** **2010s**



**G. 2001** — The peak of the Bay Area’s dotcom-era employment boom pushes BART ridership to an all-time high of 333,000 in May 2001.

**H. 2003** — BART opens a new line to the San Francisco International Airport. The line includes the South San Francisco Station, San Bruno Station, and Millbrae Station.

**I. 2004** — Bay Area voters overwhelmingly vote to pass Measure AA, approving a \$980 million bond measure to upgrade BART’s earthquake safety.

**J. 2007** — A burning tanker truck carrying 8,600 gallons of gasoline melts the MacArthur Maze. BART keeps Bay Area residents moving between San Francisco and the East Bay by offering free transit and running longer trains.

**K. 2011** — West Dublin Pleasanton Station opens.

**L. 2012** — The Giants’ World Series victory parade and Halloween fall on the same day. A record 568,061 riders use BART on October 31, 2012.

**M. 2013** — The original east span of the San Francisco Bay Bridge closes permanently to traffic. BART steps in to keep Bay Area travelers moving across the Bay until the new east span opens five days later.

**N. 2014** — Oakland Airport Connector opens.





# BENEFITS OF BART

From the opening of service in 1972 to the present day, BART has enhanced the quality of life in the Bay Area by providing rapid and reliable transportation. Today, the BART system is essential to the health of our region's economy—connecting workers and businesses, and relieving regional traffic congestion. At the same time, BART is the backbone of the region's public transit system, accommodating people of all income levels as well as youth, seniors, and people with disabilities. By reducing the need to drive, BART reduces emissions and air pollution, supporting a healthier environment.

This chapter covers the following topics:

- Moving People
- Serving Everyone
- Strengthening the Economy
- Supporting Healthy People and Places



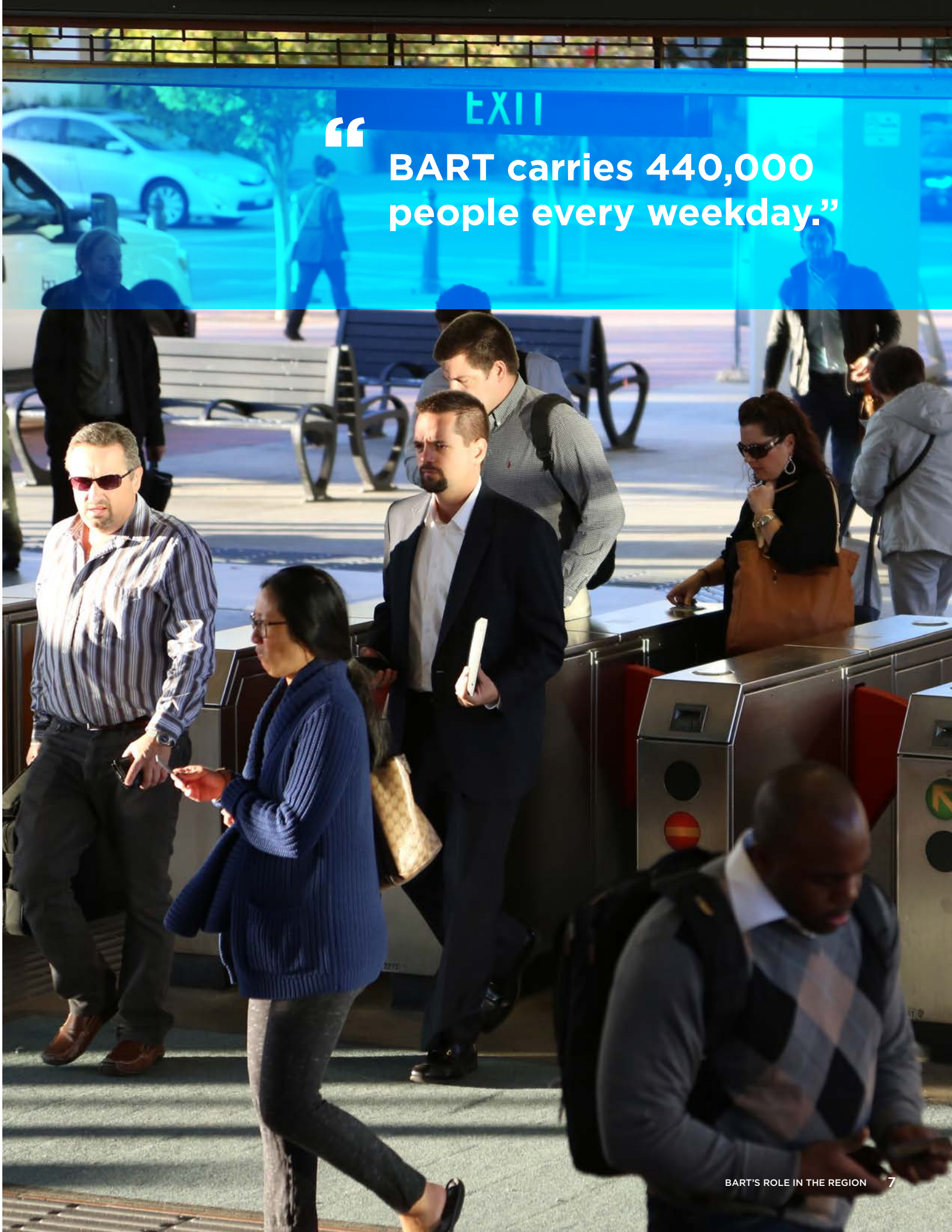
# Moving People

BART carries 440,000 passengers every weekday, providing access to many of the region's most important destinations for work, school, and recreation and serving the diverse needs of people from different parts of the region. In so doing, BART plays a critical role in supporting the economy and reinforcing the Bay Area's identity as one region.

In recent years, BART has been serving the Bay Area's diverse population in ever-increasing numbers, helping to relieve congestion on the region's roads. Forecasts suggest that demand for BART will only increase as the region grows.







EXIT

“

BART carries 440,000 people every weekday.”



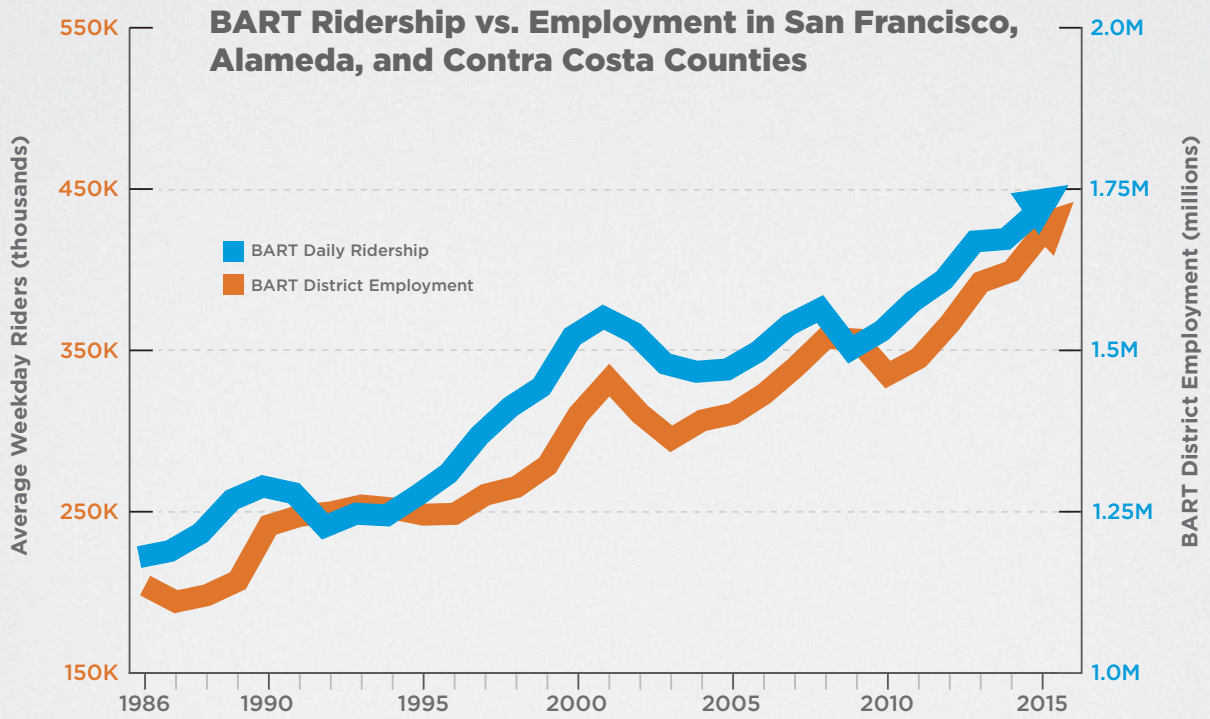
## **BART provides an essential service**

BART ridership has grown rapidly in recent years, far outpacing forecasts and accommodating more of the travel demanded by a growing regional economy.

The most common reason to ride BART is for work. A large share of work trips on BART occur during the crowded morning and evening peak travel periods, when the whole transportation system is at its most crowded. During these times, BART carries hundreds of thousands of passengers who might otherwise be crowding roads. Work trips are also the longest trips most commuters make each day: by choosing to ride BART instead of driving, commuters avoid driving an estimated 3.3 million miles on the region's roads every weekday. Without BART, the region would have needed far more expensive freeway infrastructure, and the region's major job centers could not have developed as they have.

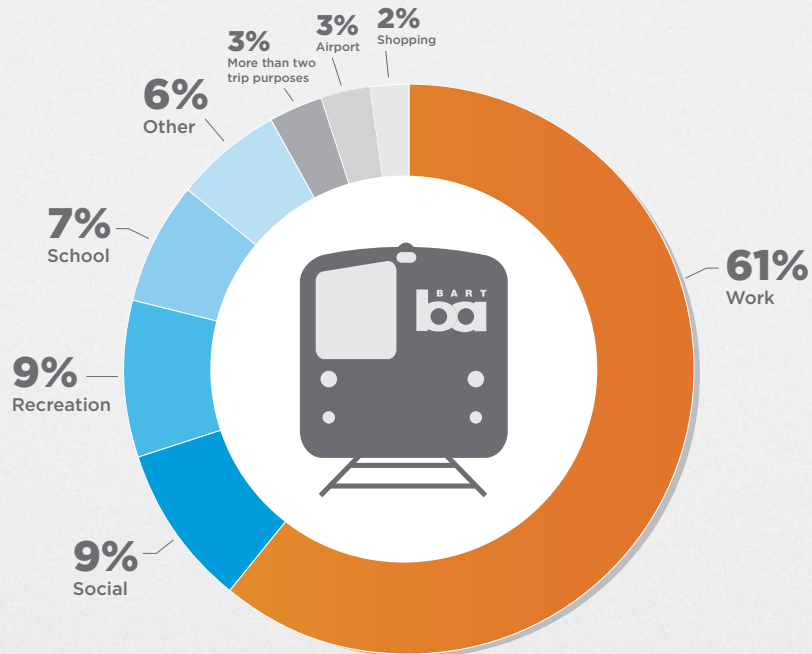
BART also enables efficient movement for hundreds of thousands of people going places for other reasons, such as school, social visits, recreation, tourism, and travel. BART connects to two of the region's major airports as well as numerous regional and local transit services, helping to support a connected region.





Source: BART Ridership Reports; US Census, Bureau of Labor Statistics Quarterly Census of Employment and Wages

### BART Trips by Purpose



Source: BART 2014 Customer Satisfaction Study.





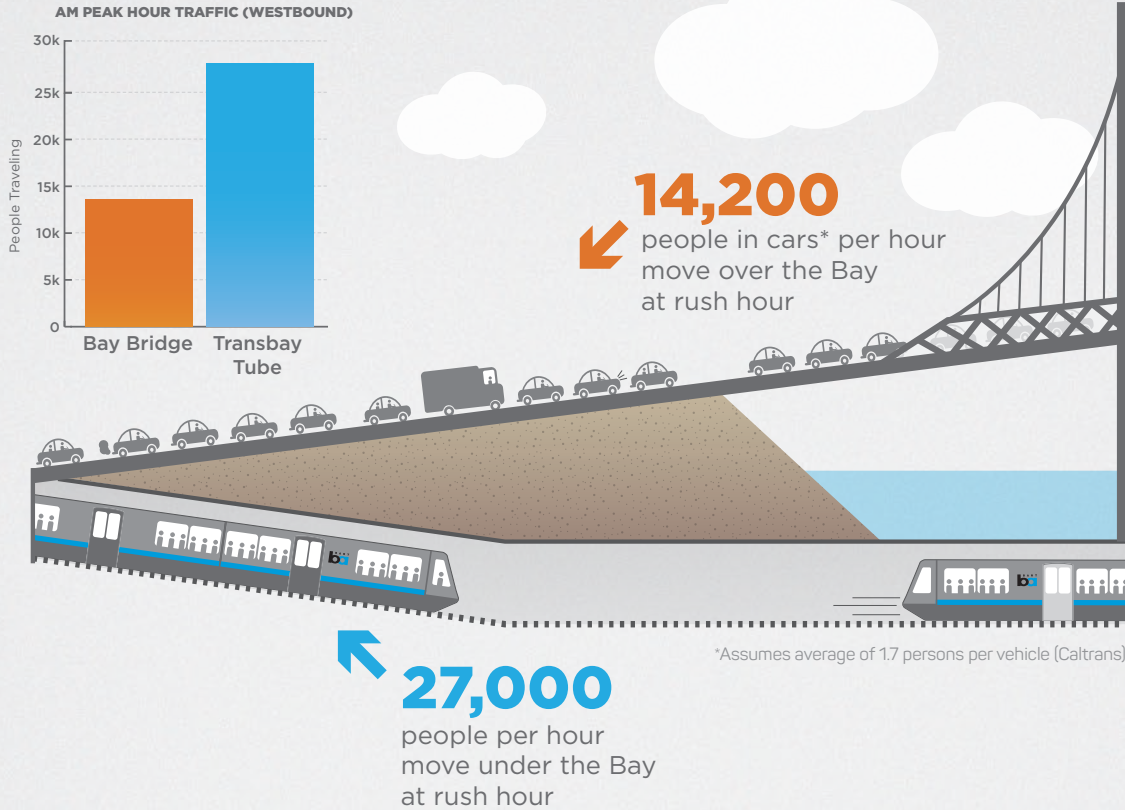
## BART service is particularly critical in key commute corridors where the **freeway system is constrained.**

### **BART ridership is comparable to auto capacity in important regional corridors**

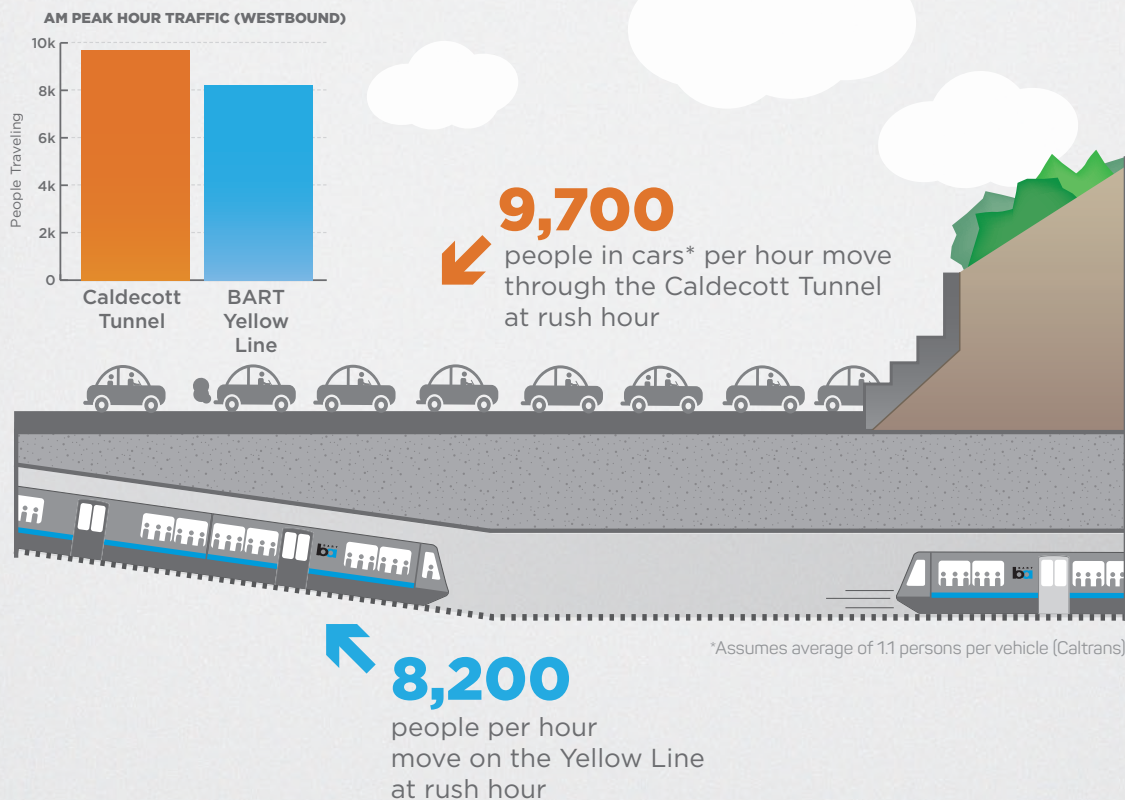
The mobility that BART provides is particularly important in key areas where vehicle congestion is commonplace.

- **In the Transbay corridor** between the East Bay and San Francisco, BART provides the main alternative to the crowded Bay Bridge, which operates at capacity during peak commute periods. Without BART, downtown San Francisco could not serve its present role as a key regional employment center. Westbound, during the three-hour morning commute period, the number of BART riders roughly equals the number of people driving across the Bay Bridge. During the crucial peak commute hour, BART carries nearly twice as many people as the bridge.
- **Highway 24 through the Caldecott Tunnel** provides the major east-west freeway link through the Berkeley Hills between Contra Costa and Alameda counties, and operates at capacity westbound during the morning peak hour. BART's Yellow Line parallel's Highway 24 through this segment, carrying nearly as many people westbound during the morning rush hour as the freeway.

# TransBay Tube and the Bay Bridge

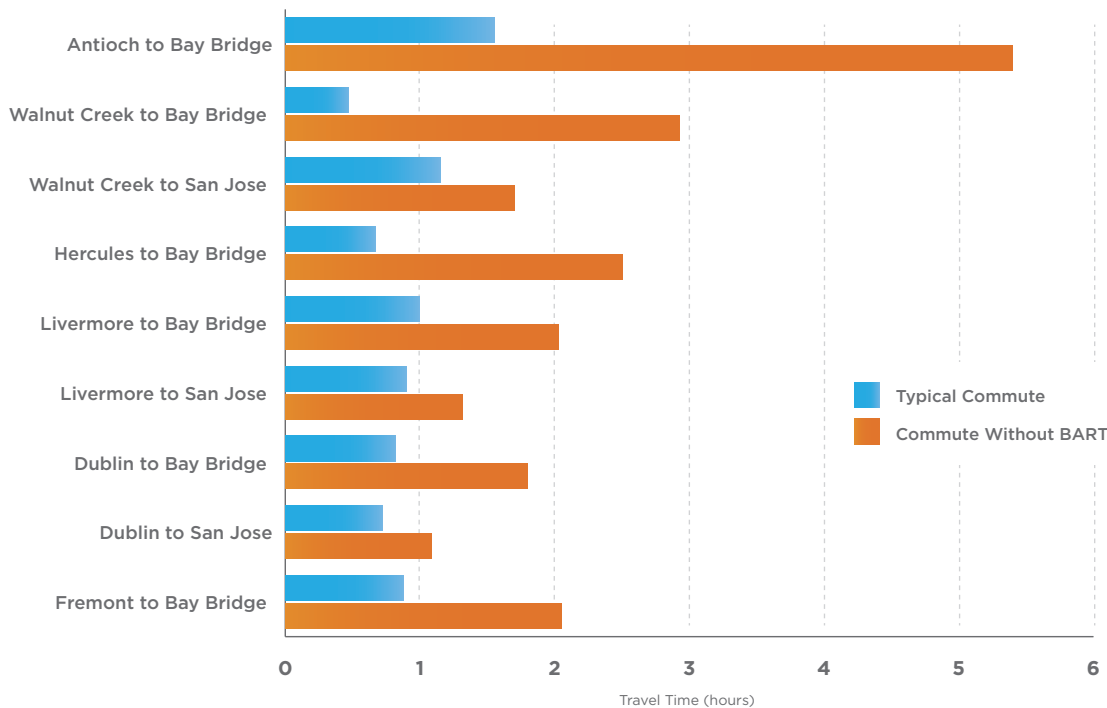


# BART's Yellow Line and the Caldecott Tunnel





## Freeway Travel Times *With* and *Without* BART



Source: Cambridge Systematics, 2016. Estimates developed using the MTC travel demand model 2010 base year with and without BART and adjusted to match 2016 conditions. Assumes all BART riders would drive on parallel freeways if BART were not available. Assumes 50% of Bay Bridge users would use other bridges or stay home.

### BART reduces traffic congestion

BART doesn't simply benefit riders: It supports the entire Bay Area transportation system and economy. On typical weekdays, hundreds of thousands of people who might otherwise need to drive take BART instead, reducing peak period traffic congestion.

In the maps on the facing page, colors represent the level of traffic congestion on Bay Area freeways. The map on the top illustrates congestion on a typical weekday morning commute period. The map on the bottom shows traffic on June 14th, 2012, when a building fire near West Oakland station forced BART to shut down all service between Oakland and San Francisco during the morning commute. The result of this disruption, severe traffic congestion throughout the region, demonstrates the importance of BART for minimizing regional traffic delay.

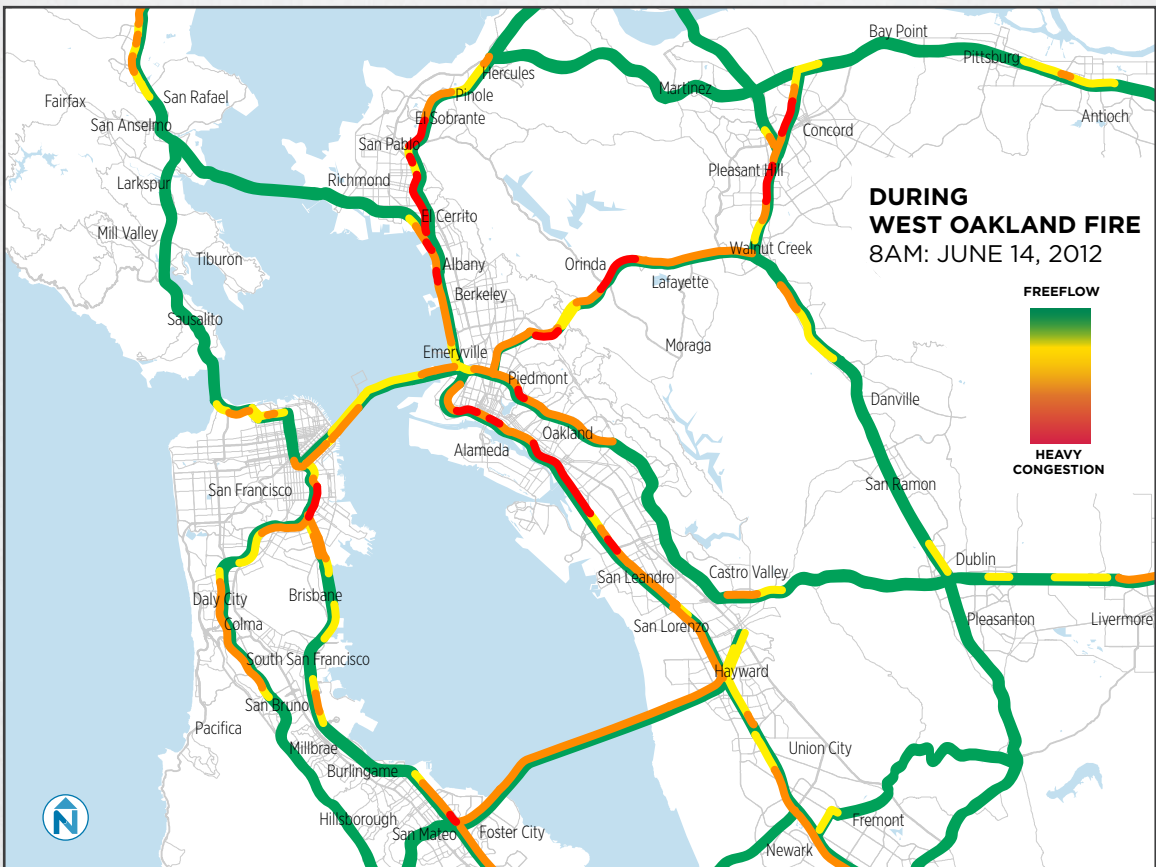
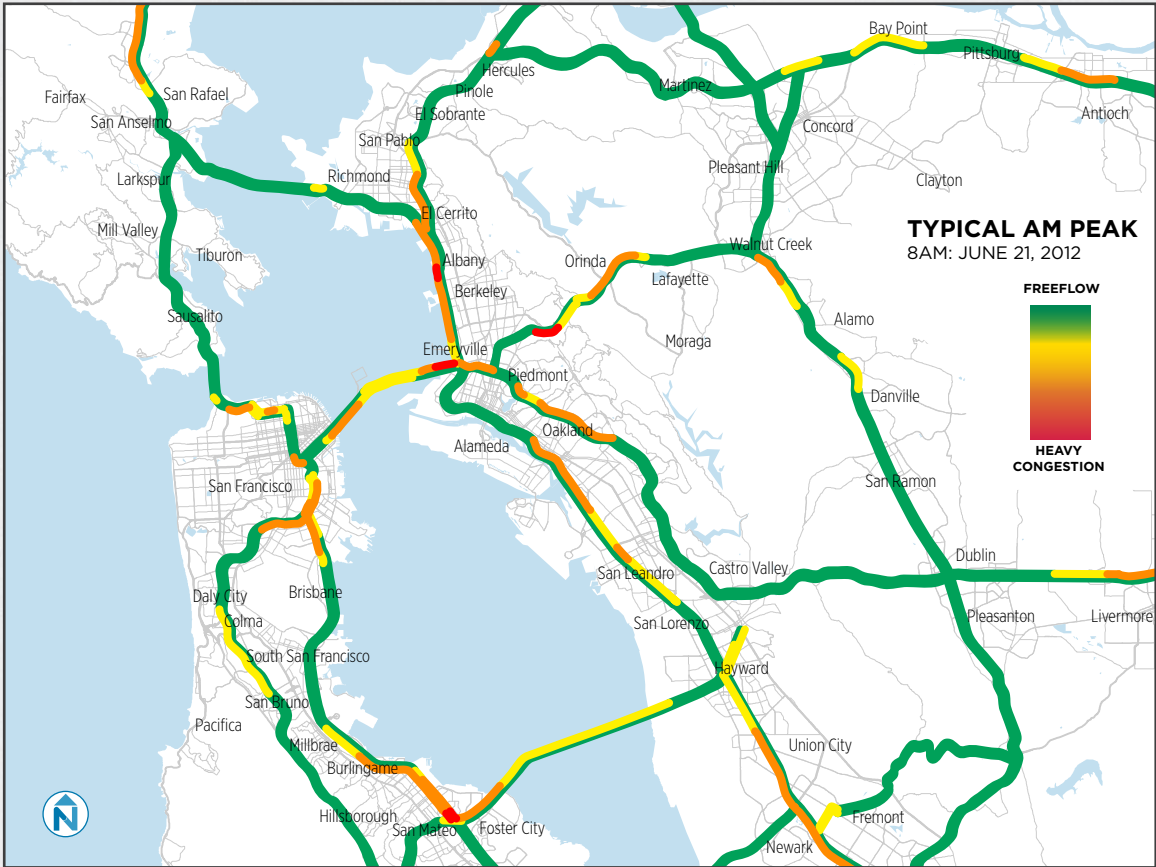
The impact of a short-term BART disruption is softened somewhat because, with notice, many people can work from home or

otherwise adjust their travel patterns for a day or two. But what if there were no BART service at all over a long period of time? When UC Berkeley modeled what Bay Area traffic would look like with no BART service, and everyone was forced to drive to work, the results were predictably disastrous.<sup>1</sup> Delay on freeways throughout the region would increase by a factor of five or more.

Another analysis looked at how specific regional freeway corridors would be impacted during the morning rush hour if BART did not exist. A software model was used to estimate the the additional traffic delay that each driver would experience if the BART system were no longer available, and BART riders all were forced to drive on the freeways that parallel BART lines. Multiple corridors would see significant increases in driving times. For example, a trip from Antioch to the Bay Bridge could take more than five hours compared to an hour and a half under typical conditions today.



# AM Peak traffic congestion on a typical day vs. when BART Transbay service is unavailable



Source: MTC, 511.org



# Serving Everyone

By offering travel times competitive with driving in major commute corridors, BART attracts riders who might otherwise drive, reducing regional traffic congestion. At the same time, BART is the backbone of the region's public transit system, accomodating people of all income levels as well as youth, seniors, and people with disabilities. For all riders, time and cost savings offered by BART help to make transportation in the region more affordable.





“

BART accomodates people of all income levels, as well as youth, seniors, and people with disabilities.”





## BART makes the Bay Area **more affordable.**

### **BART serves the whole community**

BART riders come from across the income spectrum and from the full diversity of the region's racial and ethnic groups in rough proportion to their representation in the population of the BART district as a whole.

For all households, BART offers travel times competitive with driving at a good value, attracting riders who may have the option of driving and thereby reducing traffic congestion.

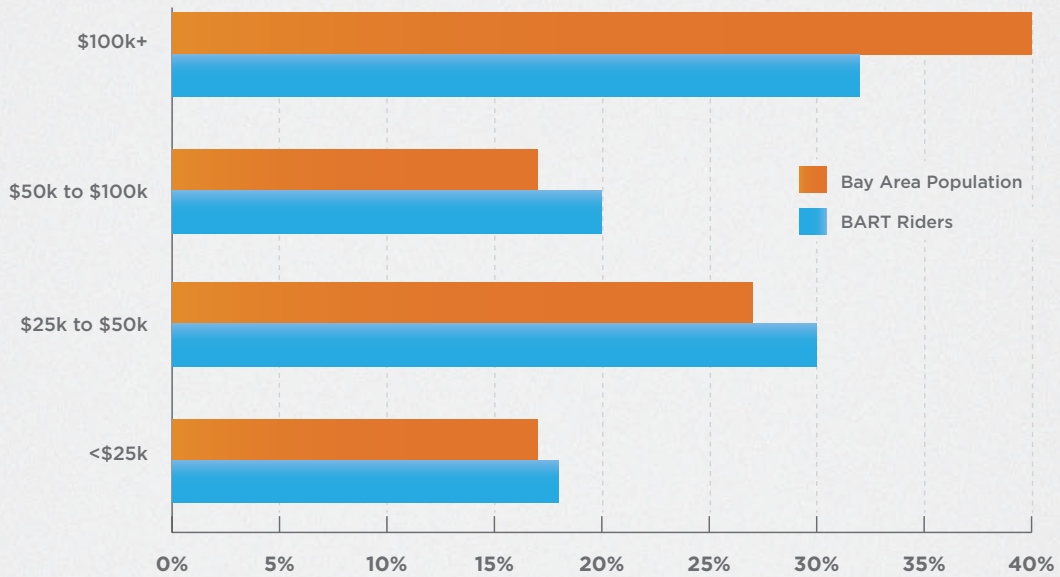
At the same time, BART offers an essential travel option for people with disabilities, for youth and seniors, for those living in households without access to a car, or for whom daily driving would be an unaffordable expense. As the spine of the regional transit system, BART helps to make the Bay Area more affordable for lower-income households and accessible to all.

Likewise, riders are as racially and ethnically diverse as the Bay Area's population. By serving everyone equally, BART helps to knit the region together as one community.

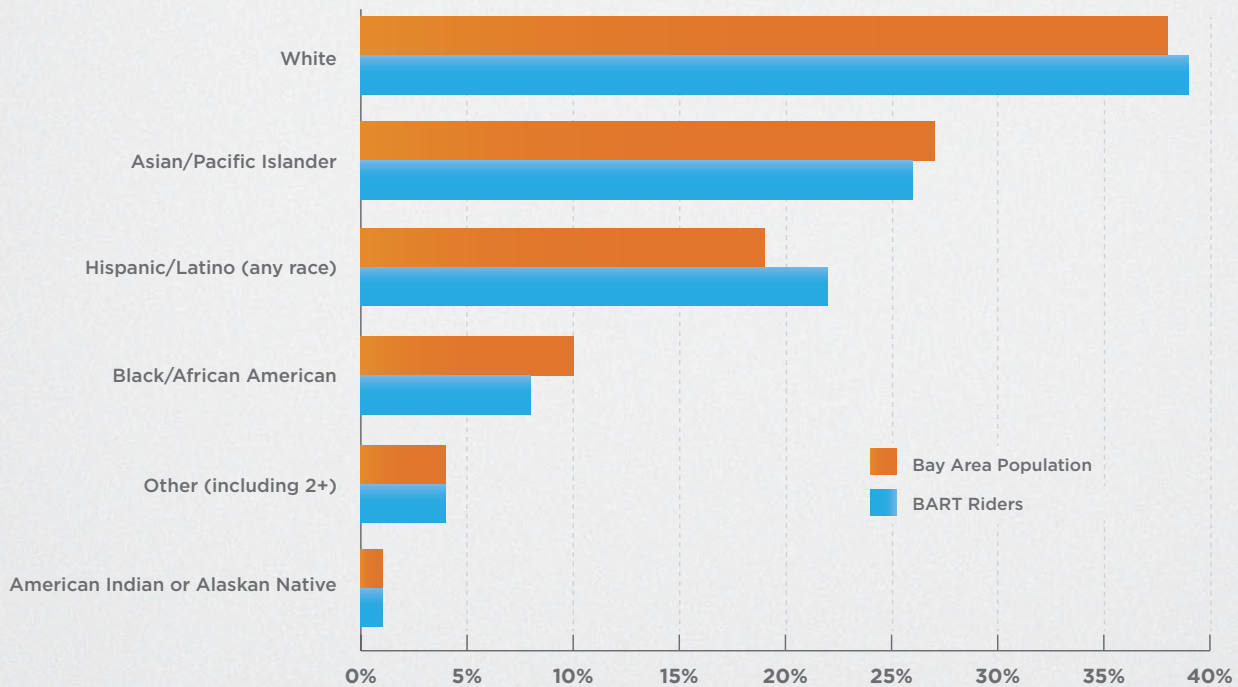


# EVERYBODY RIDES BART!

## BART riders and district population by income





## BART riders and district population by race/ethnicity





# **BART keeps transportation costs low** where housing and transportation costs are a heavy household burden

## **Taking BART vs. Driving** Orinda to Downtown San Francisco (Montgomery) Annual Cost (2014 dollars)

	
<b>\$2,100</b> BART fare	<b>\$2,300</b> Gas, maintenance, oil changes, and depreciation
<b>\$700</b> BART Park and Ride fee	<b>\$6,800</b> Parking and bridge tolls
<b>\$2,800</b> Annual cost	<b>\$9,100</b> Annual cost

Assumption: Commute distance of 10 miles and 228 workdays per year. BART parking \$3/day. BART fare \$8.80/day round trip.

Sources: AAA Daily Fuel Gauge Report 10/10/2014, CA Metro Average, Oakland Regular Average; US EPA Fuel Guide ([www.fueleconomy.gov/feg/](http://www.fueleconomy.gov/feg/)), 2011 family sedan (Toyota Camry); Sears.com; BART.gov; and ALH Urban & Regional Economics.

## **BART reduces transportation costs for riders**

**BART saves riders money:** A commuter traveling daily from Orinda to Downtown San Francisco, for example, saves \$6,300 per year by taking BART instead of driving. This savings has increased by 15 percent since 2005.

The value that BART offers means that, even though rents and home values are higher near BART stations, these station areas are actually more affordable than the region as a whole when total household costs are taken into account.

The map on the right illustrates household transportation costs as a percentage of household income (as calculated by the Center for Neighborhood Technology). It shows that those living in BART station areas tend to have more affordable transportation costs than those who live elsewhere.<sup>2</sup>

As a result of lower transportation costs, overall affordability improves as well: combined housing and transportation costs also tend to make up a lower share of household income for living near BART stations than for those living elsewhere.







# Strengthening the Economy

BART supports the Bay Area's growing economy. Hundreds of thousands of commute trips are made on BART every weekday, saving commuters time and money, and connecting business with a larger pool of workers. Because of the value BART provides, the land around BART stations sells and leases at a substantial premium, increasing property tax revenue to local government. At the same time, the money that the region invests in building and maintaining BART is reinvested in the Bay Area economy, further contributing to growth. Over the next 25 years, BART is expected to take on an even larger role in the Bay Area's economy by helping to accommodate the region's growth.





“

60% of BART riders are making commute trips.”

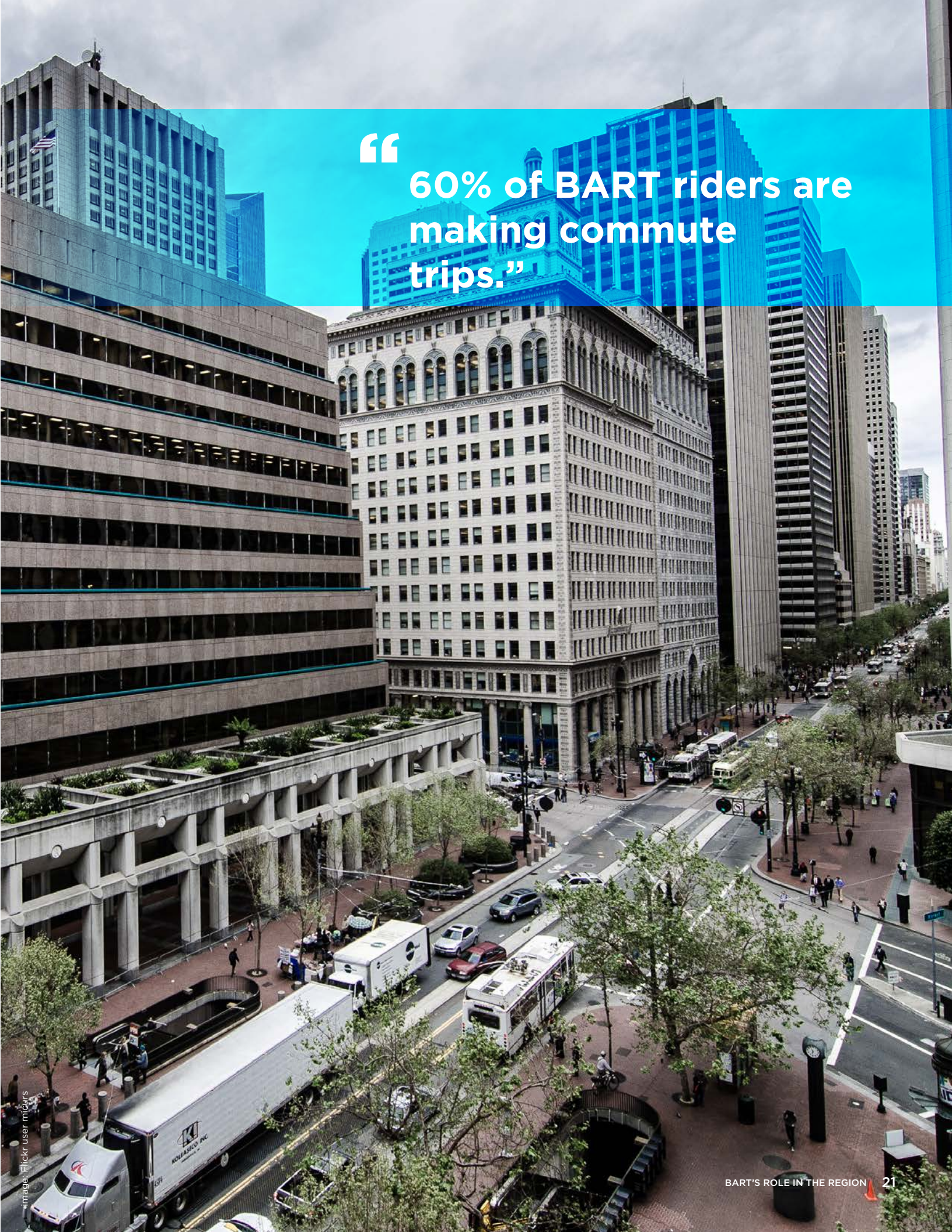


image: Flickr user micuys





## BART connects workers with businesses and **supports major regional economic centers**

### **BART Generates Value**

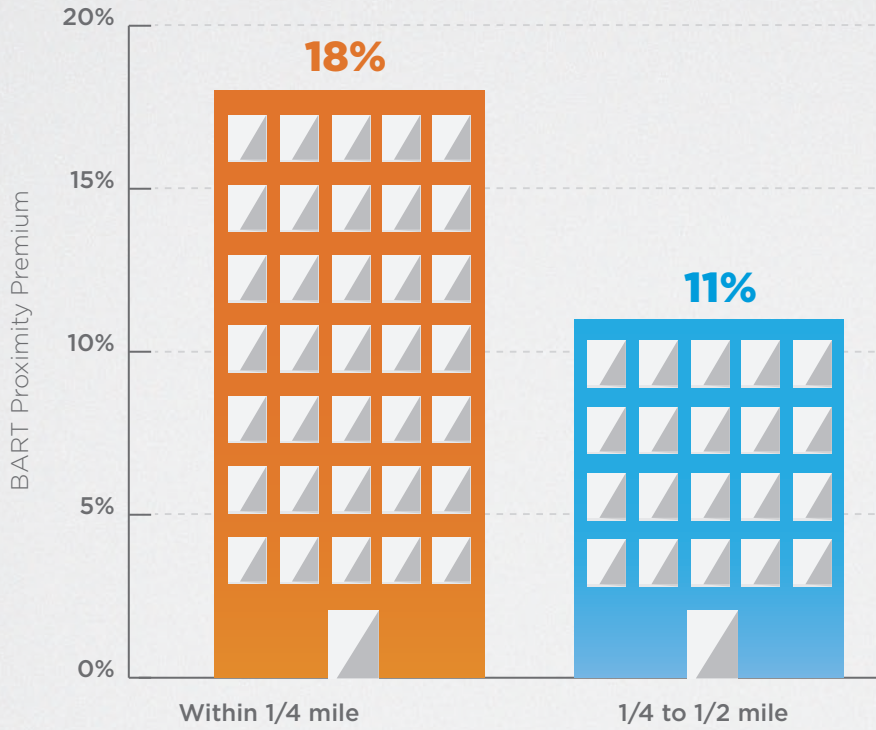
BART adds  
**\$750**  
million annually  
to property tax  
revenue

**15%**  
Condos near  
BART stations  
sell for up to  
15% more

**18%**  
East Bay  
offices near  
BART rent for  
18% more

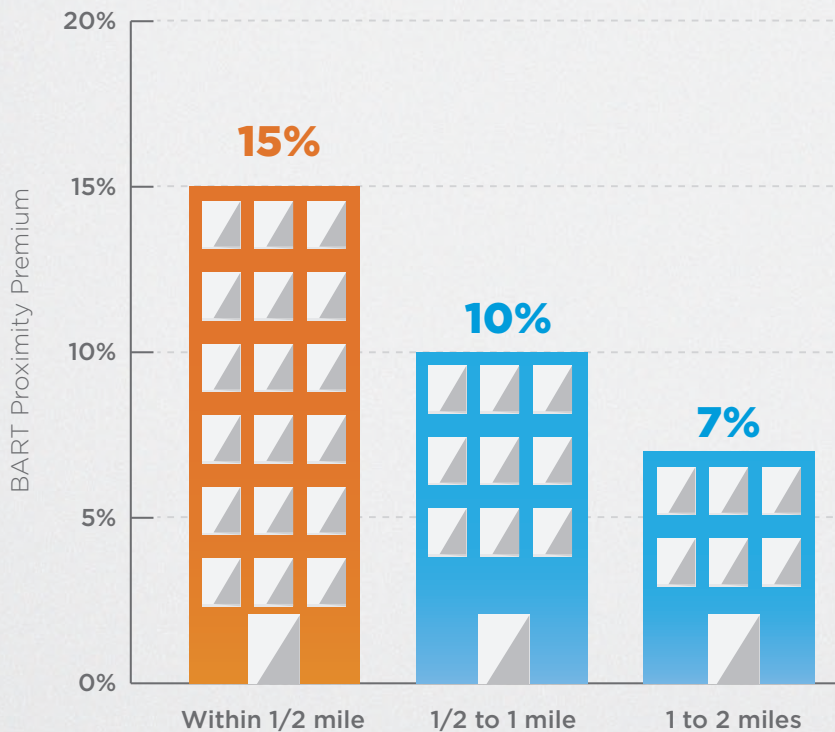
- Properties within a half mile of BART stations represent about 2 percent of the taxable land area in the BART District, but 13 percent of the total assessed value. The higher property values generated by BART contribute over \$750 million each year in general property tax revenues for local governments.<sup>3</sup>
- Bay Area home buyers place a high value on proximity to a BART station: In Alameda, Contra Costa, and San Mateo counties, all else being equal, a condominium located within a half mile of a BART station sells for 15 percent more than one located more than five miles from BART (a single family home near BART sells for an 11 percent premium.)<sup>4</sup>
- Despite higher home values, BART proximity actually improves overall affordability for families. Because they spend less money commuting, combined housing and transportation costs tend to be lower for families living near BART than for those living farther away.<sup>5</sup>
- All else equal, office rents in the East Bay are 18 percent higher within a quarter mile of a BART station, compared to rents of properties located more than a half mile from the station. In aggregate, BART contributes an estimated \$80 million per year in added lease revenues for office property owners in the East Bay.<sup>6</sup>
- BART allows Downtown San Francisco to support the highest concentration of jobs per square mile in the region.<sup>7</sup> Local brokers report that prospective office tenants in San Francisco usually prefer to locate within a 10- to 12-minute walking distance (i.e., a half mile) from Embarcadero or Montgomery stations in order to more easily access workers and clients in the East Bay.<sup>8</sup>

### BART Office Rent Price Premiums in East Bay\*



\*Percentage difference in annual average rental rate, compared to locations more than 1/2 mile from a BART station.  
Source: CoStar, 2014; Strategic Economics, 2015

### BART Price Premiums for Condominiums by Distance from BART Station\*



\*Percentage difference in property value, compared to locations more than 5 road miles from a BART station in Alameda, Contra Costa, and San Mateo counties.



Every weekday, nearly 254,000 commute trips are made on BART, representing 60 percent of the system's ridership.<sup>9</sup> Compared to driving, the average time savings for a commuter to San Francisco in one direction is approximately 30 minutes each way. To downtown Oakland, the average time savings is 7 minutes. To Pleasant Hill, the average time savings is 30 minutes.<sup>10</sup>

In addition to benefitting workers, BART's travel time savings help support the region's major economic centers by connecting businesses with the workers they need. About **a quarter of all workers in downtown San Francisco and Oakland use BART for their daily commute.** BART makes 12 percent more workers available within an hour commute of Downtown San Francisco and 28 percent more within an hour commute of West Dublin/Pleasanton station.<sup>11</sup>

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## **BUSINESS PROFILE**

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### **SUFFOLK CONSTRUCTION, SAN FRANCISCO HEADQUARTERS WITH REGIONAL OPERATIONS**

Suffolk Construction office workers rely heavily on BART for both commuting to work in San Francisco and attending meetings in Oakland. While the company's operations workers are solely dependent on highways and roads to transfer materials and tools on trucks, BART's ability to take drivers off of roads and move them onto trains helps to alleviate traffic congestion that would otherwise cost the company valuable time and money.

-Bay Area Council Economic Institute Interview

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# 60% OF ALL BART RIDERS ARE COMMUTERS

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## BART SAVES COMMUTERS TIME

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### OAKLAND

Commuters save **7 min. per trip** by using BART instead of driving



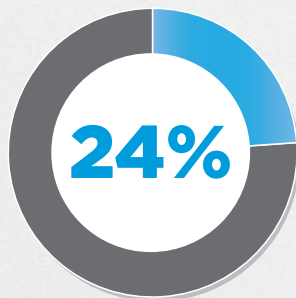
### SAN FRANCISCO

Commuters save **30 min. per trip** by using BART instead of driving

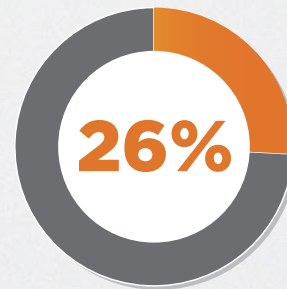
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## A QUARTER OF ALL COMMUTERS USE BART

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Commuters in **DOWNTOWN OAKLAND** use BART to commute



Commuters in **DOWNTOWN SAN FRANCISCO** use BART to commute



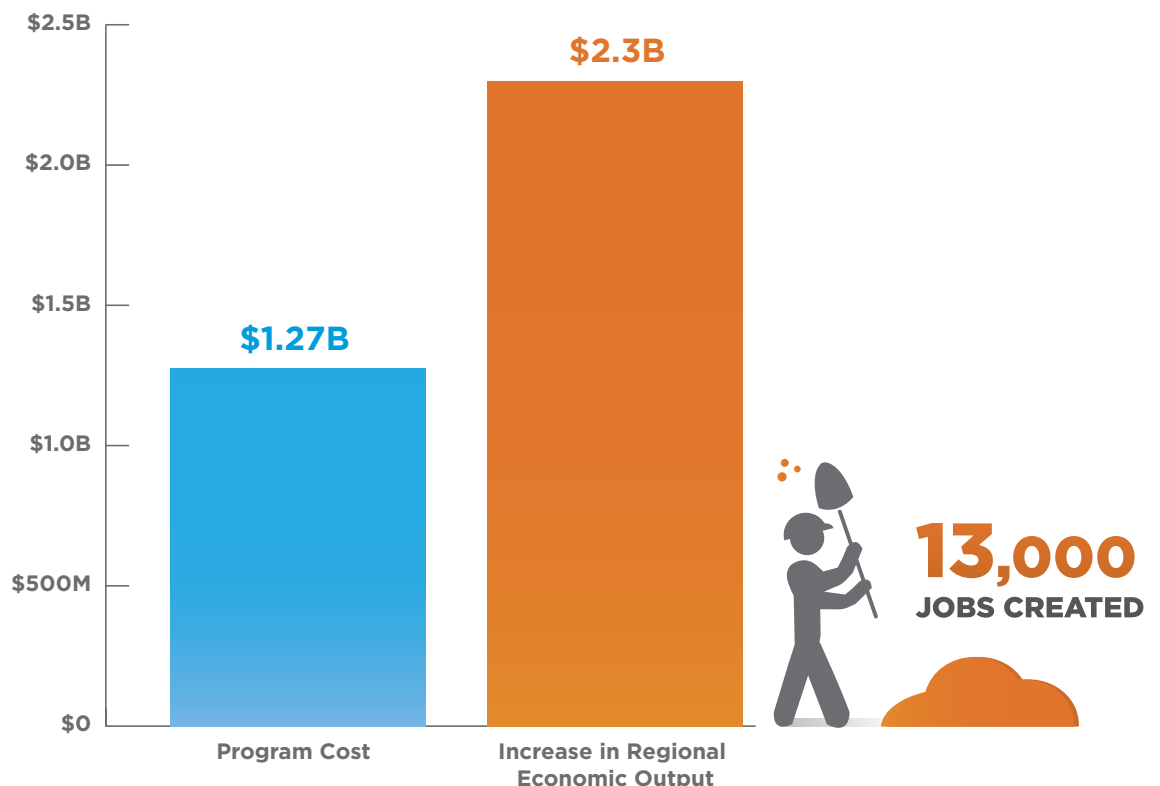
## **BART spending is reinvested in Bay Area communities**

Most of the money that the region spends to build, maintain, and operate BART is reinvested in the region's own economy.

An analysis of BART's last major capital reinvestment effort, the Earthquake Safety Program (ESP), shows that the program not only improved safety but is also helping to grow the region's economy.

**The investment of \$1.27 billion over 18 years (2004-2022) to upgrade the Transbay Tube as well as aerial structures, stations, and buildings throughout the BART system will yield \$2.20 billion in total economic activity in the Bay Area and create nearly 13,000 direct and indirect jobs.** On average, for every \$1 million of program expenditures, an additional \$890,000 in economic activity is generated at local businesses in the Bay Area, including construction suppliers and establishments where supported workers make purchases.

### **Cost and Economic Impact of BART Earthquake Safety Program 2004-2022**



Source: Economic Impacts of BART Operations, ALH Urban & Regional Economics, September 2015





Contra Costa Centre Transit Village, adjacent to Pleasant Hill/Contra Costa Centre BART station, provides 2.4 million square feet of office and commercial space and 2,700 homes with easy access to transportation.

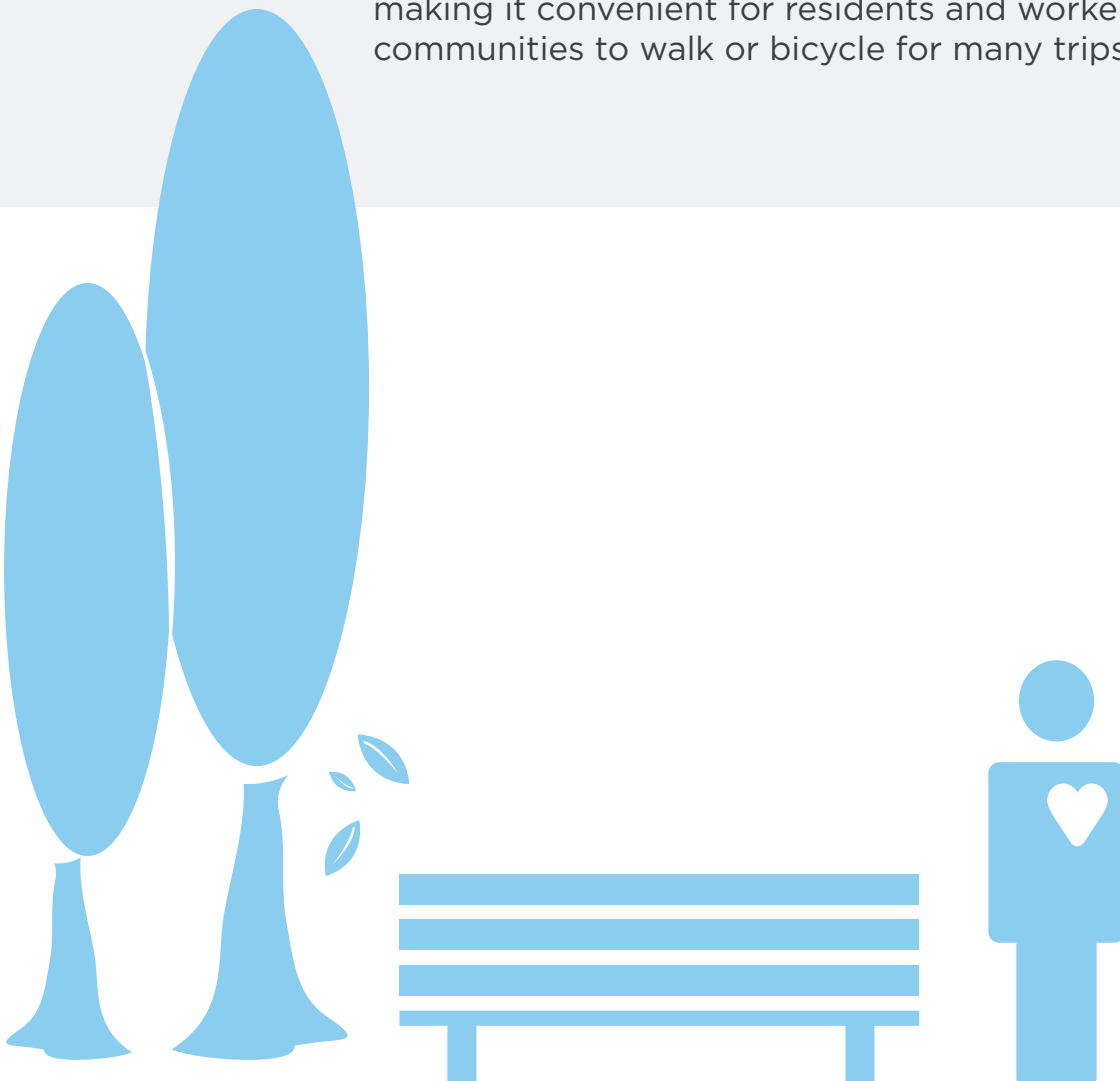
## **BART is accomodating regional growth**

Over the next 25 years, BART's role in the region will become more important than ever before as the region develops around transit stations. The region's integrated transportation and land use plan, Plan Bay Area, sets a vision in which public transportation forms the backbone for the next several decades of regional growth. By 2040, Plan Bay Area anticipates 2 million additional residents. It seeks to accommodate this growth by concentrating future population and employment around major transit hubs—many of which are centered on BART stations.<sup>12</sup>



# Supporting Healthy People and Places

BART helps support a healthier, cleaner Bay Area. BART is good for the environment because it reduces the need for driving, lowering regional air pollution and greenhouse gas emissions. The compact, walkable communities made possible by BART also further reduce driving and support healthy lifestyles by making it convenient for residents and workers in those communities to walk or bicycle for many trips.



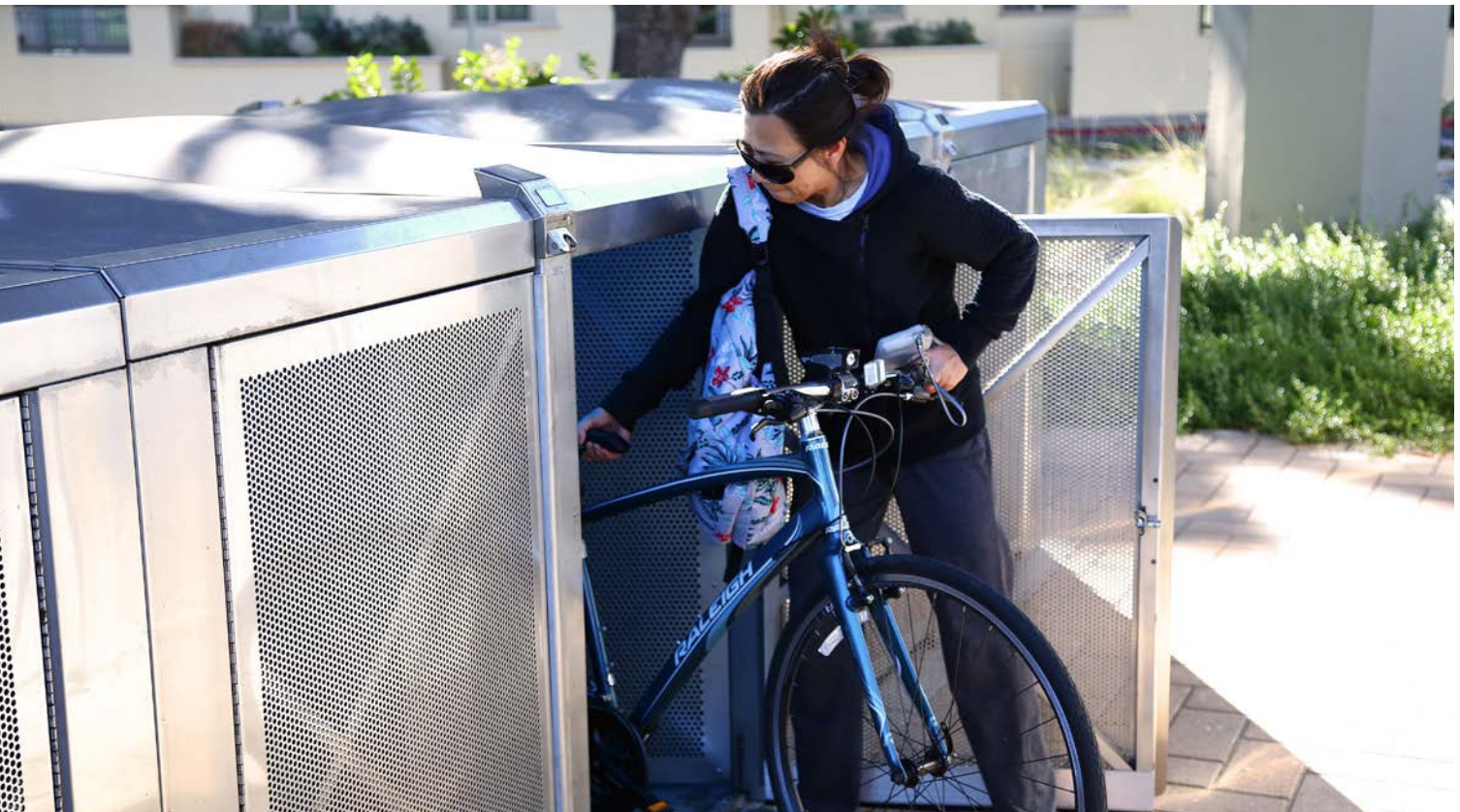


“

The compact, walkable communities made possible by BART further reduce driving and support healthy lifestyles.”







Secure, long-term bicycle storage lockers help commuters choose bicycling as a viable option for arriving at BART stations to finish their trip via transit.

## **BART Promotes Public Health**

**BART reduces injuries and fatalities.** By reducing the need to drive, BART reduces the incidence of vehicle-related crashes and crash-related injuries and fatalities.<sup>13</sup>

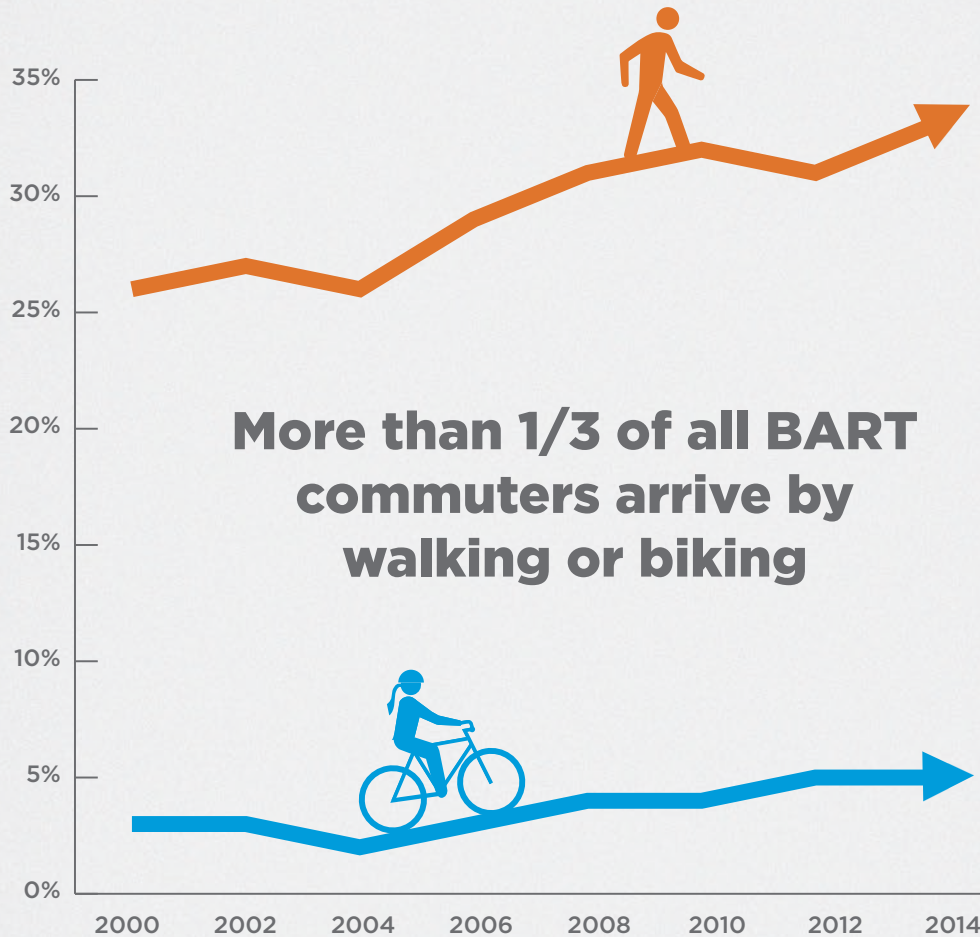
**BART reduces the health impacts of pollution.** In California, about 40 percent of greenhouse gas emissions come from transportation, and of those, about 70 percent are from personal driving. Less driving, combined with BART's reliance on clean hydro- and renewable power, help reduce exposure to air pollution, which means less pollution and fewer cases of asthma, lung disease, and lung cancer.<sup>14</sup>

**BART encourages daily exercise.** The Center for Disease Control and Prevention (CDC) recommends at least 150 minutes of moderate exercise per week to reduce health risks. Most BART trips involve walking or cycling on either the origin or destination end, helping riders to increase physical activity. Transit riders walk an average of 130 minutes per week—moving people well on their way to meeting the CDC's recommended level of physical activity.<sup>15</sup>





# BART IMPROVES PUBLIC HEALTH



**More than 1/3 of all BART commuters arrive by walking or biking**

**WALKING BETWEEN STOPS**  
Public transit users walk an average of **130 minutes per week** getting to and from transit stops. The CDC recommends 150 minutes of activity per week



## **BART reduces air pollution and greenhouse gas emissions**

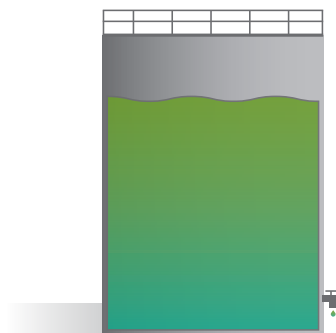
BART trains are 100 percent electric, and 26 percent of the power used to run the trains is generated from clean renewable and hydroelectric power. While these benefits are substantial, BART's biggest environmental benefits come from how the system shapes regional travel behavior. BART saves 250,000 gallons of gas and reduces CO2 emissions by 4.5 million pounds per weekday.

 **BART trains are 100% electric**



**26% of power comes from clean hydro and renewable sources**

**EVERY WEEKDAY  
BART SAVES:**



**250,000**  
gallons of gas



**4.5 million**  
lbs of CO2



## Endnotes

1. UC Berkeley Traffic Study. Laval, Cassidy, and Herrera 2004. Cited in Deakin, et al, "A State of Good Repair for BART: Regional Impacts Study," 2012.
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# **BART FACES MAJOR CHALLENGES**

Now in its 44th year of service, BART faces three major challenges. First, as more people choose to ride BART, the system has grown increasingly crowded. To meet growing demand, BART must adapt in ways that allow it to provide more service in the highest-demand times and places.

Second, important parts of the infrastructure that make up the BART system are aging, and have begun to negatively affect system performance. Many of these components require replacement or major overhauls.

Finally, the available capital funding through federal, state, and existing local sources is insufficient to meet these growing needs. BART must seek new funding sources to continue to serve its important role in the region.

This chapter covers the following topics:

- System Crowding
- Aging Infrastructure
- Doing More with Less

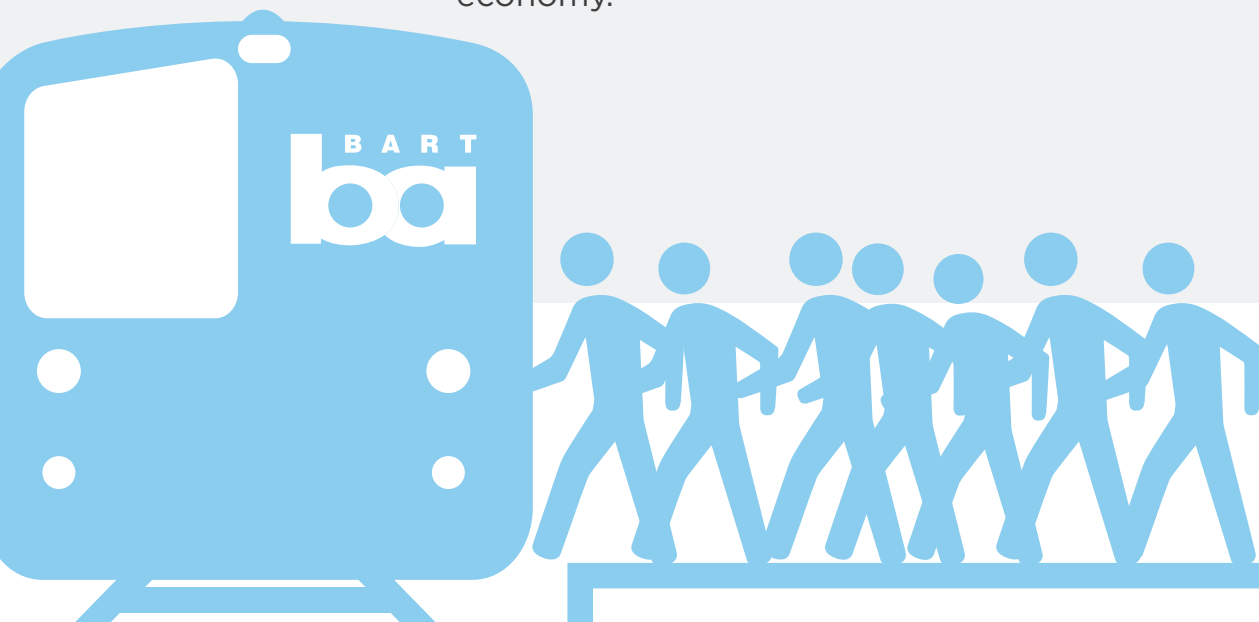




# System Crowding

Growing ridership has already begun to place extraordinary demands on the BART system. Over the last decade, daily ridership on BART has increased 36 percent, outpacing official forecasts. As a result, trains between Oakland and San Francisco today exceed BART's standards for crowding during commute hours, and Embarcadero and Montgomery stations are approaching their safe capacity.

Responding to this trend, BART has used all available resources to relieve crowding. However, rapid growth in demand is expected to continue. Based on Plan Bay Area growth projections, BART estimates daily ridership of nearly 500,000 by 2025 and 600,000 riders by 2040. Demand may soon exceed the system's resources. Without new system capacity, BART would be unable to accommodate its share of future growth in the region's travel demand, pushing more commuters onto the roads, reducing access to jobs, and limiting the regional economy.



“

Growing ridership has already begun to place extraordinary demands on the BART system.”





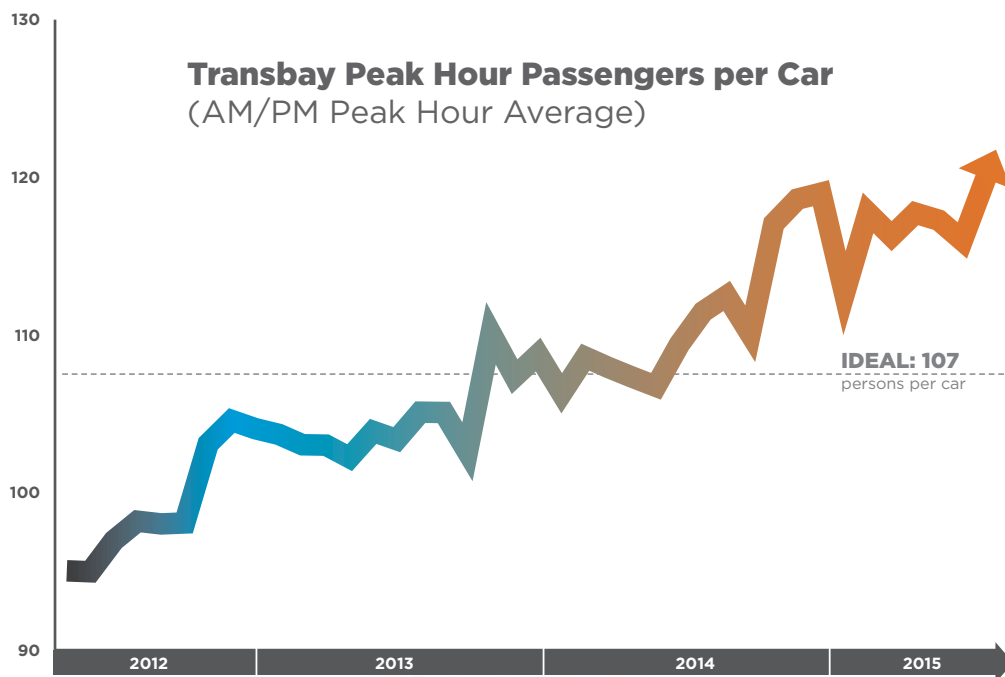
## Train cars are over-capacity

A typical BART car has 68 seats. BART's standard is to accommodate 107 people per car, including both standing and seated passengers. However, after years of growing ridership, passenger loads today routinely exceed 115 passengers per car during the peak hour, and regularly go as high as 140 during the highest-demand parts of the peak commute period.

Responding to this demand, BART is working hard to provide as much train capacity as possible.

- BART has begun adjusting schedules to make more trains available in the busiest corridors.
- Through a diligent maintenance program, BART is able to keep more than 89 percent of its vehicle fleet on the tracks every day, more than any other transit agency in the nation.
- Through its Fleet of the Future program, BART has also begun to acquire new, higher-capacity rail cars. The first new cars will be phased in beginning in 2017.

BART also has plans to reconfigure and expand its maintenance facility in Hayward so that it has enough capacity to store and maintain a larger fleet of vehicles, and to install a new, higher-capacity train control system to allow more trains to move safely through the Transbay Tube. However, these crucial programs are not fully funded.







Entries to Embarcadero Station on weekdays are at an all-time high. The station platforms are increasingly overcrowded during the AM and PM peak hour.

## Embarcadero and Montgomery stations are approaching capacity

Crowding at Montgomery and Embarcadero stations has become a major challenge. With soaring ridership, Embarcadero station has nearly reached its safe capacity limit during normal operations. If the trend continues, Montgomery Station will approach its limit within a few years. Crowding and train delay magnify each other: crowds can slow down delayed trains, and delayed trains lead to larger and larger crowds gathering on the platforms.

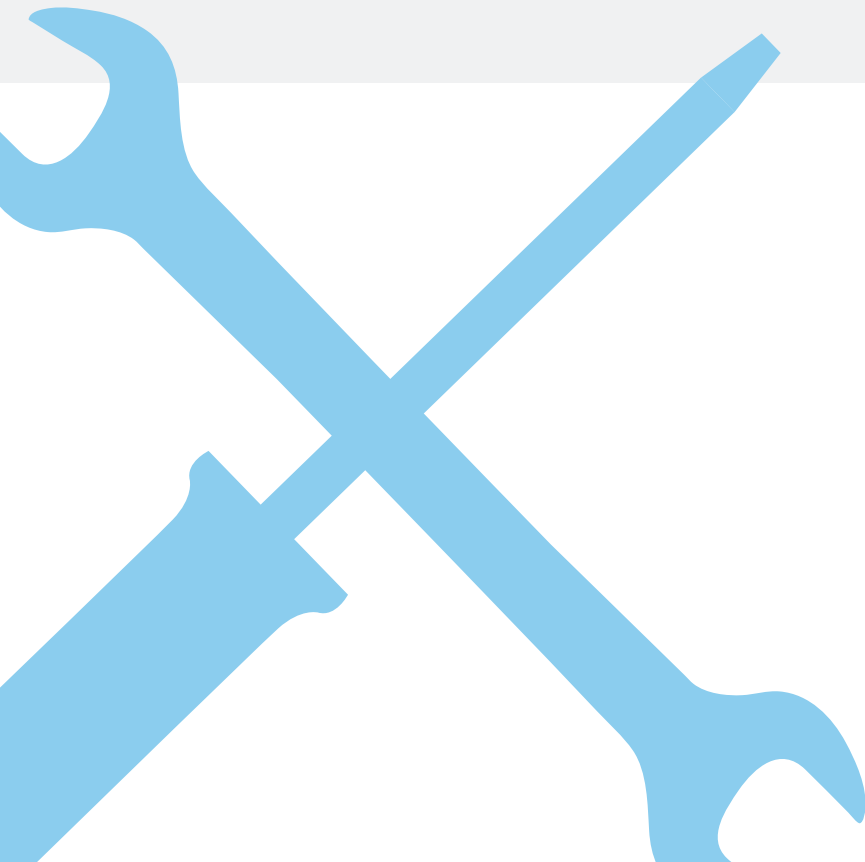
BART will complete a plan to expand capacity at Montgomery and Embarcadero stations in 2016, but funding has not yet been identified to implement this important project.



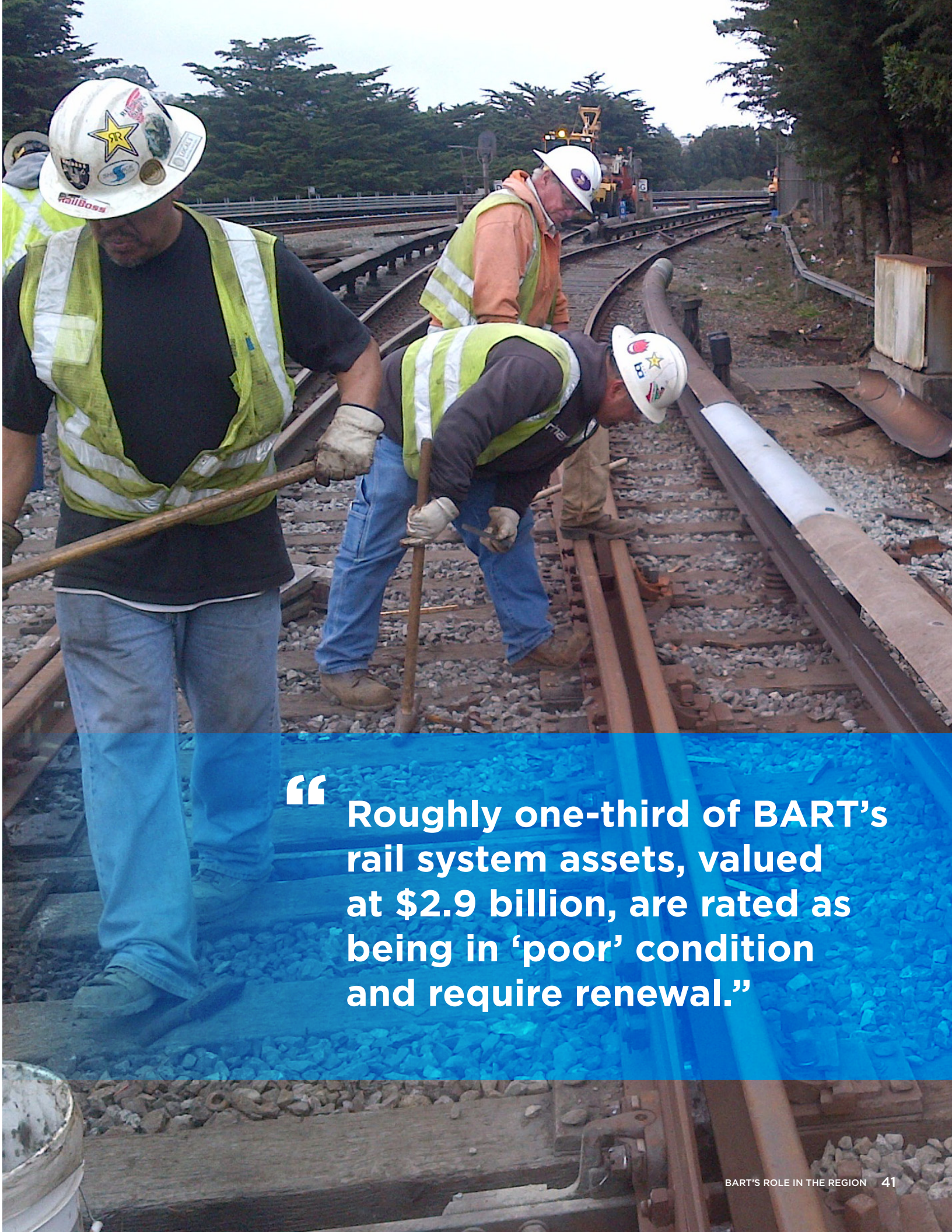
# Aging Infrastructure

BART was the first system of its kind in the US. Construction began in 1968 and the system has been in operation since 1972.

Through the dedicated efforts of BART maintenance staff, many system components have already lasted far longer than expected. BART's maintenance staff has worked tirelessly to maintain components beyond their useful lives, but even "best in the business" maintenance cannot keep obsolete equipment functioning forever. Other elements were never built to handle the level of capacity that is required to serve BART's future needs. The time has come for a major overhaul. The pages that follow present examples of BART infrastructure that is in need of renewal.







**“ Roughly one-third of BART’s rail system assets, valued at \$2.9 billion, are rated as being in ‘poor’ condition and require renewal.”**



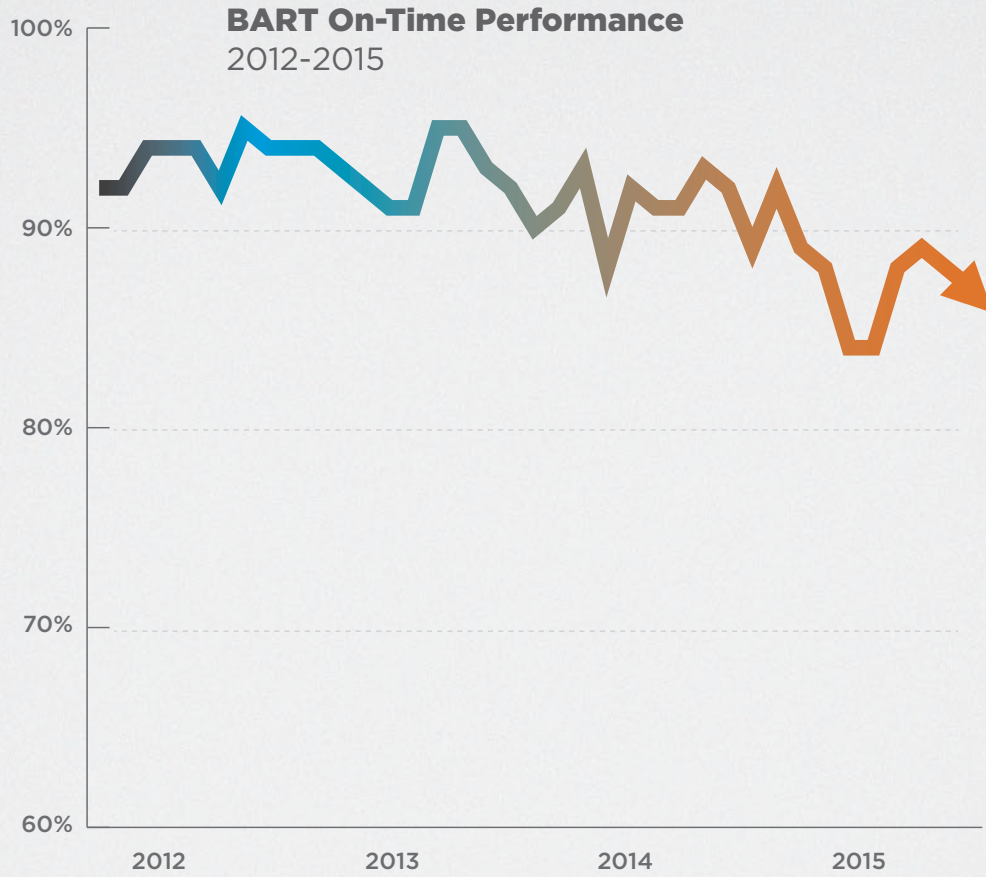


## **Asset condition and delay**

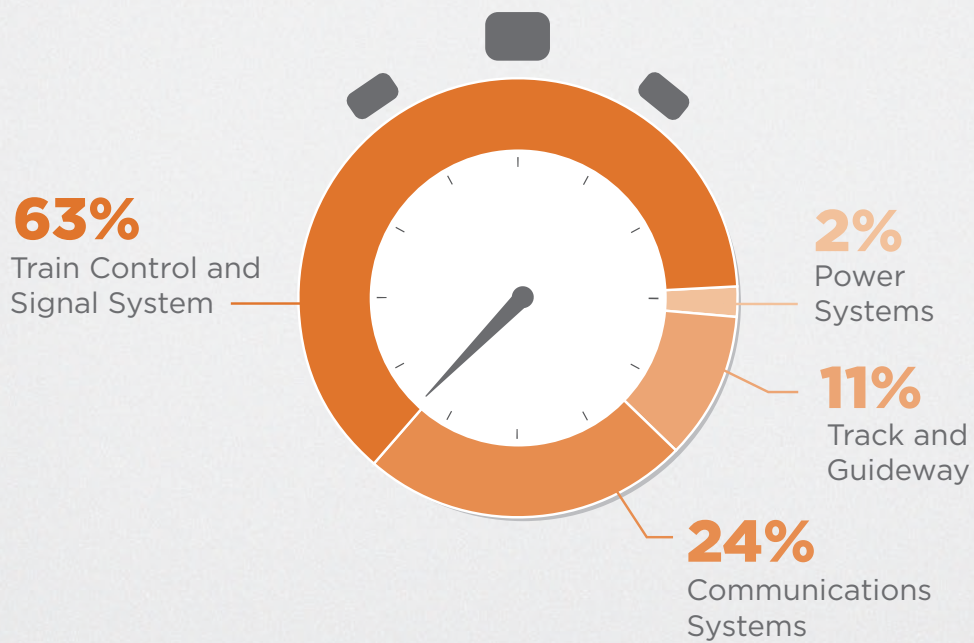
Roughly one-third of BART's rail system assets, valued at \$2.9 billion, are rated as being in 'poor' condition and require renewal. System components are kept in working order only through best-in-the-business asset management and preventative maintenance work by BART staff.

However, as rail system components age, they inevitably fail more frequently. Currently, aging infrastructure is responsible for a total of more than 530 incidents of delay each year, leading to more than 800 hours of train delay. (These mechanical delays represent roughly 40 percent of total train system delays—the rest of the system delays are caused by incidents not directly related to the performance of the rail system, such as police actions, severe weather, and medical emergencies.) By far the most frequent mechanical cause of delay at present is the aging train control system. Track failures cause a much smaller number of delays, but these tend to be the most severe.

BART has always maintained a stellar record of on-time performance. However, over the last three years, the interaction of aging infrastructure and increased crowding has begun to affect on-time performance. While most trains still arrive on-time, performance has dipped under 90 percent. To reverse this trend, it will be important to renew aging infrastructure and relieve crowding.



### Percentage of Train Delay (Mechanical Only) 2014





## Track requires renewal

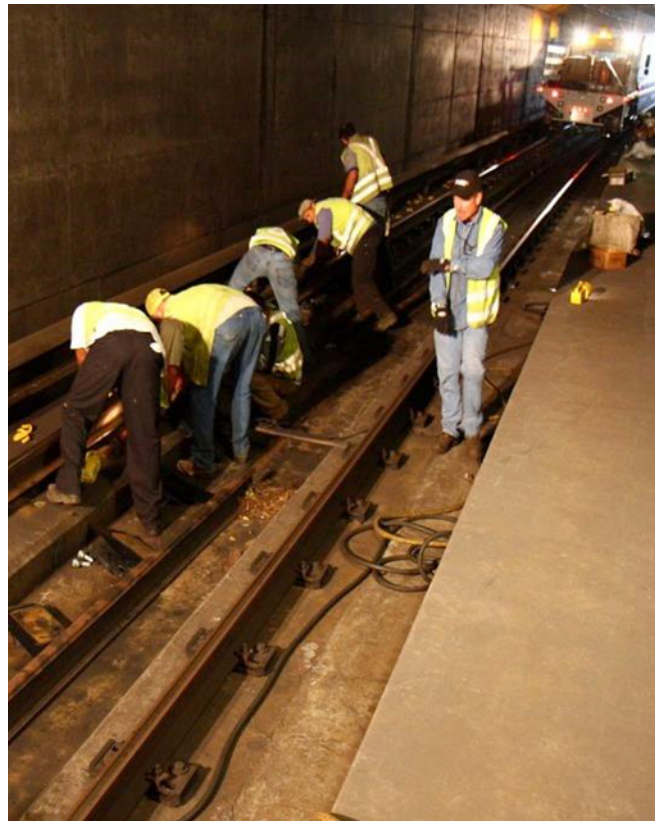
Even basic systems like BART tracks and rail structures are worn down from 44 years of use and require major repairs. Eventually, for safety and performance reasons, 90 miles of original track will need to be replaced.

While track failures make up a small share of delay incidents, the track failures that do occur can be severe. The 20 most severe track-failure incidents that occurred in 2014 delayed an average of 50 trains, with each train delayed between 5 and 25 minutes. BART is working aggressively to address

issues with tracks and structures. For example, crews are now replacing 6 to 7 miles of worn track each year. During summer 2015, BART also undertook a major effort to renew the tracks and structures west of West Oakland Station.

While track repair work continues, the scale of the work required is greater than available resources: BART will need to identify additional funding to complete this work in a timeframe that maintains the safety and performance of the system.

*Top-Left: Original rail ties from the 1970's can be found throughout the core system. These must be replaced. Bottom Left: 90 miles of original rail is worn down from 40 years of use. Right: BART crews work to repair worn tracks in the Transbay Tube.*







*Left:* BART structure workers complete repairs to the trackway near West Oakland Station in May 2015. *Right:* There is significant water intrusion in the Market Street Tunnel.

## Tunnels and structures require renewal

BART's Market Street Tunnel and Berkeley Hills Tunnel have suffered significant damage as a result of water intrusion. Over time, these leaks damage the tunnels themselves as well as the rails inside. If left unaddressed, they could also create safety hazards for workers.

Other BART structures, including the platforms and trackways at many above-ground BART stations, have also been damaged by water intrusion over decades of service. These structures require significant reinvestment.



## Aging train control system needs an upgrade

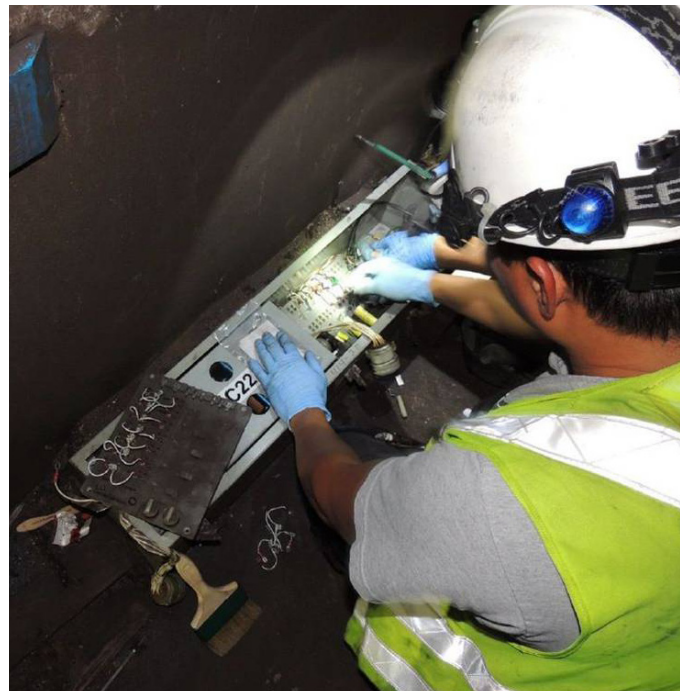
BART's train control system controls movement and speed on the rail network, keeping trains running smoothly while eliminating any possibility of a collision. The train control signal system BART uses today is essentially the original system in place 44 years ago. There are two major limitations with this system.

First, errors in the aging system are a major cause of train delay. Currently, 63 percent of BART's infrastructure-related delays are due to errors in the train control system, causing BART patrons to suffer from more than 400 hours of delay during 2014. BART modeling suggests that without any repairs in the coming years, train control-related delay would

increase by 280 percent. By contrast, a modern system could decrease delays by 60 percent.

Second, the system was not built to handle the demands of 2015 and beyond: it can safely accommodate no more than one train every 2.5 minutes. A more capable modern train control system, which can allow trains to safely run closer together, is needed before BART could increase service between Oakland and San Francisco.

BART has a plan to upgrade and modernize the train control system, but this vital project is not yet fully funded.



*Left:* BART's train control system includes both software and hardware, like these "loops," which transmit speed signals to the train. The original core system has 1970's loops, all of which must be replaced. *Right:* A train control technician at work.





*Left: Equipment in 42 of BART's 56 electrical substations require rehabilitation. Right: Traction power cables throughout the system require upgrades.*

## Power systems require renewal

The electrical systems that keep BART trains moving are aging and in need of major repairs.

For example, reinvestment is required to maintain BART's electrical substations. The 'rectifiers' in these substations convert the electricity BART gets from PG&E to the proper voltage to supply power to the rails throughout the system. BART currently has 60 original rectifiers, which are at an increased risk for failure.

BART has a program underway to replace the rectifiers at the nine highest-priority substations. To keep the other 33 substations operating on a temporary basis, BART staff

works continuously to rebuild the aging equipment. However, they must eventually be replaced entirely, and funding has not yet been identified for this important work.

In addition, many of the traction power cables that carry PG&E electricity to BART substations require replacement. Several cables at key locations in the system lack redundancy: should any of them fail, long delays could result. Finally, there's a limit on how much power the existing cables can deliver in the Transbay corridor. If BART is to increase service between San Francisco and Oakland, these systems must be upgraded.





## BART stations need renewal

BART has 44 stations: 16 at ground level, 12 elevated, and 16 subway stations. Every station has buildings, fare gates, fare collection equipment, elevators and escalators, plazas, waiting areas, and many other features that serve the public. Stations are a rider's introduction and entry point to the BART system. Ensuring that stations provide a high quality arrival and waiting experience, function properly, are easy to navigate, and are welcoming and safe places is critical to customer satisfaction, and supporting increasing ridership on the system.

However, like other elements of the system, BART stations are aging and many are crowded at rush hour. Through intensive use over decades, many have

become dirty and cluttered. BART's Station Modernization program is working actively to make stations cleaner, safer, less crowded, and more efficient, but with limited resources, and many other reinvestment needs, the program can only address a few stations at time.

In particular, elevators and escalators are vital both for moving people through the station quickly to prevent crowding, and for providing crucial access for people with disabilities. BART's elevators and escalators are aging and require renewal. A program is underway to overhaul elevators and escalators, but additional funding is required to complete this important project.



*Left: Escalators at Embarcadero Station are crowded during peak periods. Escalators throughout the system require renewal. Right: Elevators provide access for people with disabilities. Aging elevators throughout the system require reinvestment.*





**Left:** Secure bicycle parking fills to capacity during peak periods at many BART stations. **Right:** Vehicle parking facilities fill to capacity during peak periods at most BART stations, and bus transfer facilities require renewal.

## **BART station access facilities require renewal**

As BART ridership has grown, crowding has also increased for those trying to access the system. Parking for both vehicles and bicycles reaches capacity early in the morning at many BART stations. At the same time, aging and out-of-date facilities at stations limit many riders who might like to get off the road if they could have better access to BART. Improved access could also help reduce rush hour crowding by offering riders more flexibility as to when they arrive at a station through better access choices.

Some stations predate the Americans with Disabilities Act, so people with disabilities do not always have convenient

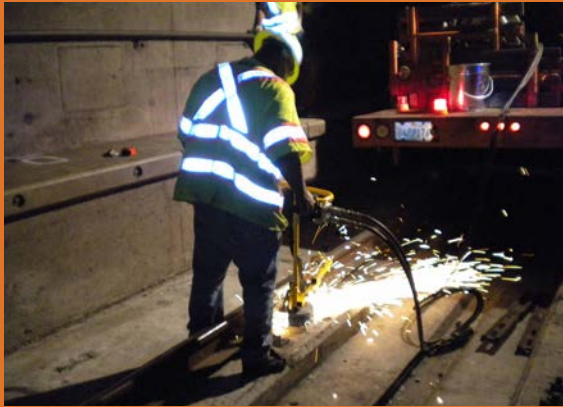
access to platforms. Many of BART's bus transfer facilities were built decades ago, and improvements to these facilities are needed to make them feel safer and more comfortable, and to better fit into surrounding communities.

BART is working to address these challenges through its access programs. The goals of BART's access programs include: a healthier, safer, and greener BART system; more riders, a more efficient and productive system, a better experience, equitable services, and the use of strategies that encourage innovation and partnerships.



## CASE STUDY

BART's staff has worked tirelessly to maintain components beyond their useful lives. As systems age, doing so requires carefully coordinated effort by many different parts of the agency.



## Summer 2015 track work: BART's best-in-the-business maintenance in action

For two weekends during summer 2015, rail service between Oakland and San Francisco was halted to allow workers to carry out a vital renovation of rail and station infrastructure between West Oakland and Embarcadero stations. Multiple BART teams working around the clock carried out a record amount of work: they replaced 3.5 miles of track and 532 rail ties; they replaced 771 insulators that protect the third rail supplying power to trains; they repaired cables vital to the train control system; and they used a rail grinding machine to smooth the rails and provide an improved ride through the Transbay Tube and into Embarcadero Station. Separate crews carried out a major renovation of West Oakland Station, repairing and renovating lights, tiles, escalators, and other station facilities to improve passenger experience. The effort included specialists in track and structures; electricians, welders, mechanics, train control technicians, engineers, buildings workers, and many more.

To maintain Transbay transit service during this essential renovation, BART partnered with other regional transit agencies to provide a “bus bridge” between 19th Street and Embarcadero stations.







# Doing More With Less

High demand and aging infrastructure are placing increasing pressure on the BART system. At the same time, BART has finite resources available to meet the challenge. Half of BART's \$9.6 billion in capital needs over the next 10 years is currently unfunded. The shortfall is made even more challenging by restrictions placed on the use of certain available funds. Many of the most important system renewal projects have no dedicated funding source.

In the context of scarce resources, BART must decide very carefully how to distribute available capital funds. BART's asset management program is designed to allow strategic decision-making about how and where to invest, with an eye towards risks to both the BART system and the region as a whole. While careful planning can help maximize available resources, deferring investment increases both costs and risks over time.





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Roughly half of BART's \$9.6 billion in capital needs over the next 10 years is currently unfunded.”







## **BART is using all available funds to invest in system renewal**

BART pays its own way. In fact, at 74 percent of operating costs, BART fare revenue covers more of its costs than any transit agency in the country.

With federal and state transportation funding sources dwindling, most transit agencies have to work hard to keep operations running, and BART riders help the system run by paying for the services they use.

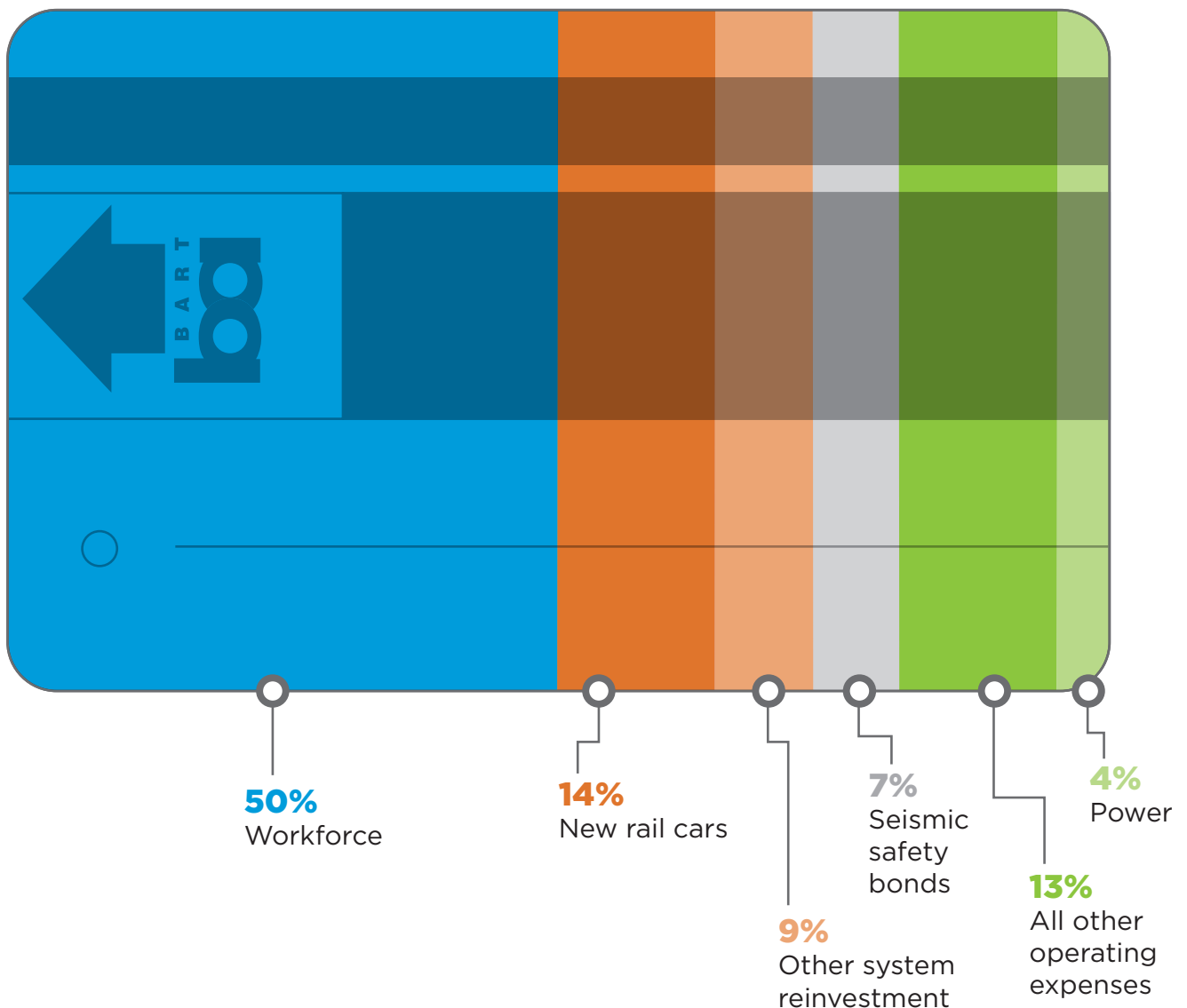
Riders are also doing their part to help keep the system safe and on time through their daily fares. While funding critical operating needs, BART operating revenue is also used to reinvest in aging infrastructure - an unusual step for a transit agency. Transit agencies almost always depend on other federal, state, and regional capital funding sources to cover infrastructure costs, but because of the great need for reinvestment and a shortfall in available funds, BART has directed operating revenue toward capital needs. In 2015, 23 percent of operating revenues went to capital spending: 14 percent was used to fund the purchase of new rail cars, and 9 percent was used for other critical system reinvestment needs.

Despite this ongoing reinvestment, BART faces a major shortfall in funding for repairing and replacing critical, aging infrastructure in the coming years. The following pages illustrate and describe the shortfall in capital funding projected over the next 10 years.

**BART riders invest in keeping the system safe and on time:** between 20% and 30% of operating revenues—including ticket sales—are spent to repair and replace aging infrastructure.

### Anatomy of a BART fare.

Here's how operating revenues were spent in 2015







“BART works hard to secure capital funding from a variety of sources, **including federal, state, local, and regional.**”

## **BART understands its needs**

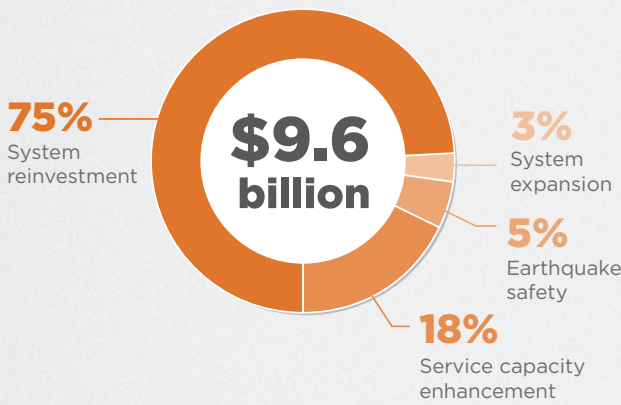
BART has identified \$9.6 in capital spending that will be needed over the next 10 years to maintain the system’s essential role in the region. Three quarters of the need is for renewal of BART’s core infrastructure. Most of the rest is for the strategic capacity investments required to reduce crowding and accommodate the region’s growth. Just 3 percent of the identified spending is for system expansion, most of which will be contributed by Santa Clara County’s VTA to finance the planned extension to Silicon Valley.

Today, given the scale of the overhaul required, half of BART’s capital spending need is unfunded. This funding shortfall is further complicated by the restrictions placed on the use of certain available funds. For example, federal funds are available to pay for renewal of BART’s rail car fleet, and the Santa Clara Valley Transportation Authority will use county sales tax proceeds to fund the Silicon Valley extension. But many of BART’s most crucial infrastructure renewal projects lack dedicated funding.

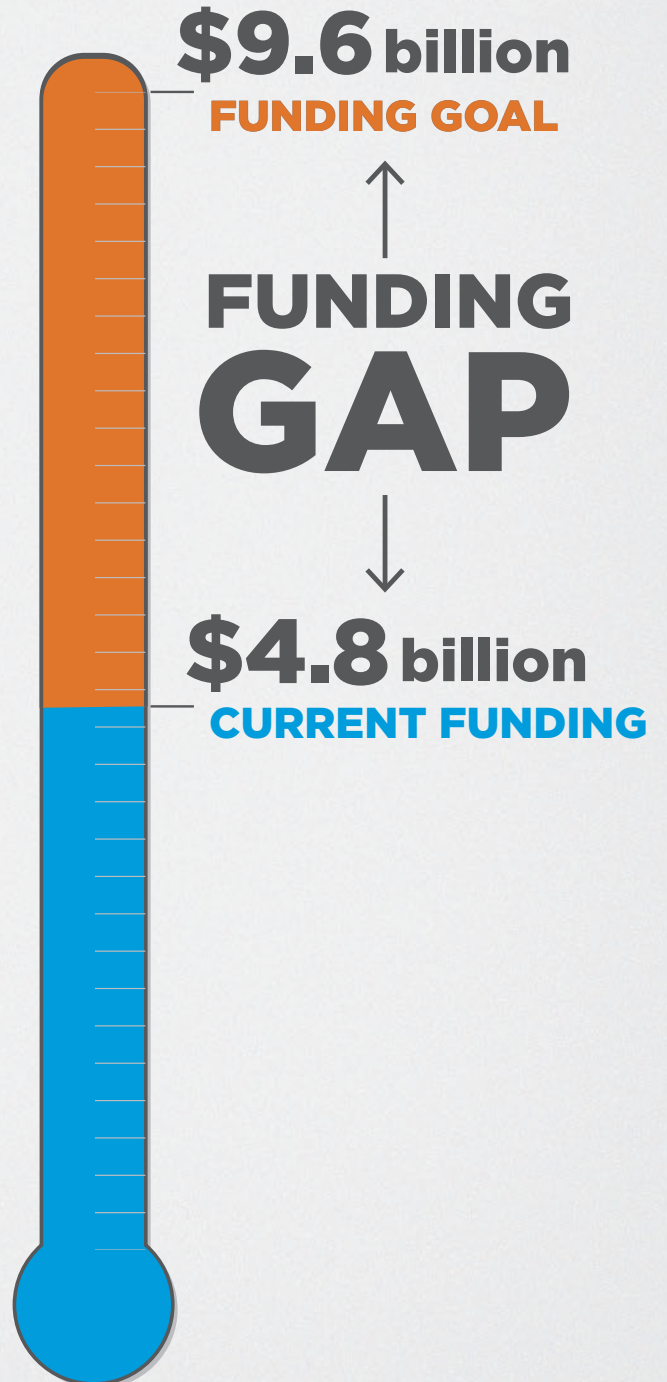
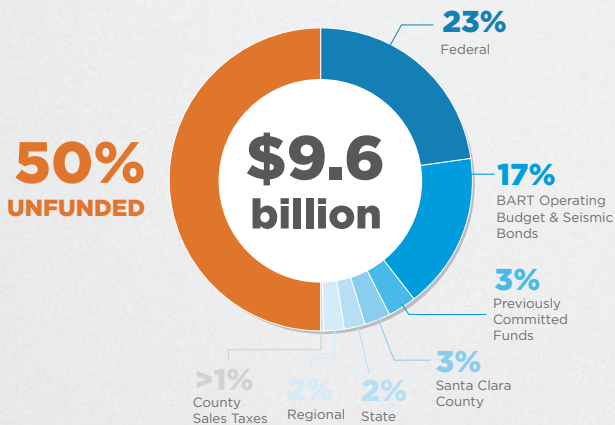
BART works hard to secure capital funding from a variety of sources, including federal, state, local, and regional. However, because additional funds are unlikely to be provided by federal or state governments, BART must identify new funding sources to renew the system.

# BART HAS A CAPITAL FUNDING GAP

**BART Capital Needs**  
2015-2024



**Available Funding**  
2015-2024







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## CHAPTER 3

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# CONSEQUENCES OF INACTION

Without action to address BART's aging infrastructure and crowded conditions, BART's ability to perform its important role in the region will suffer. Over time, the system will not perform as well: delays may increase, crowding will grow more acute, and the risk of unsafe conditions may increase. These consequences would affect not only BART riders, but the region as a whole. Without a reliable BART system, the region could face increased traffic congestion and negative impacts on economic competitiveness.

This chapter covers the following topics:

- Impacts on the BART System
- Impacts on the Region





# Impacts on the BART System

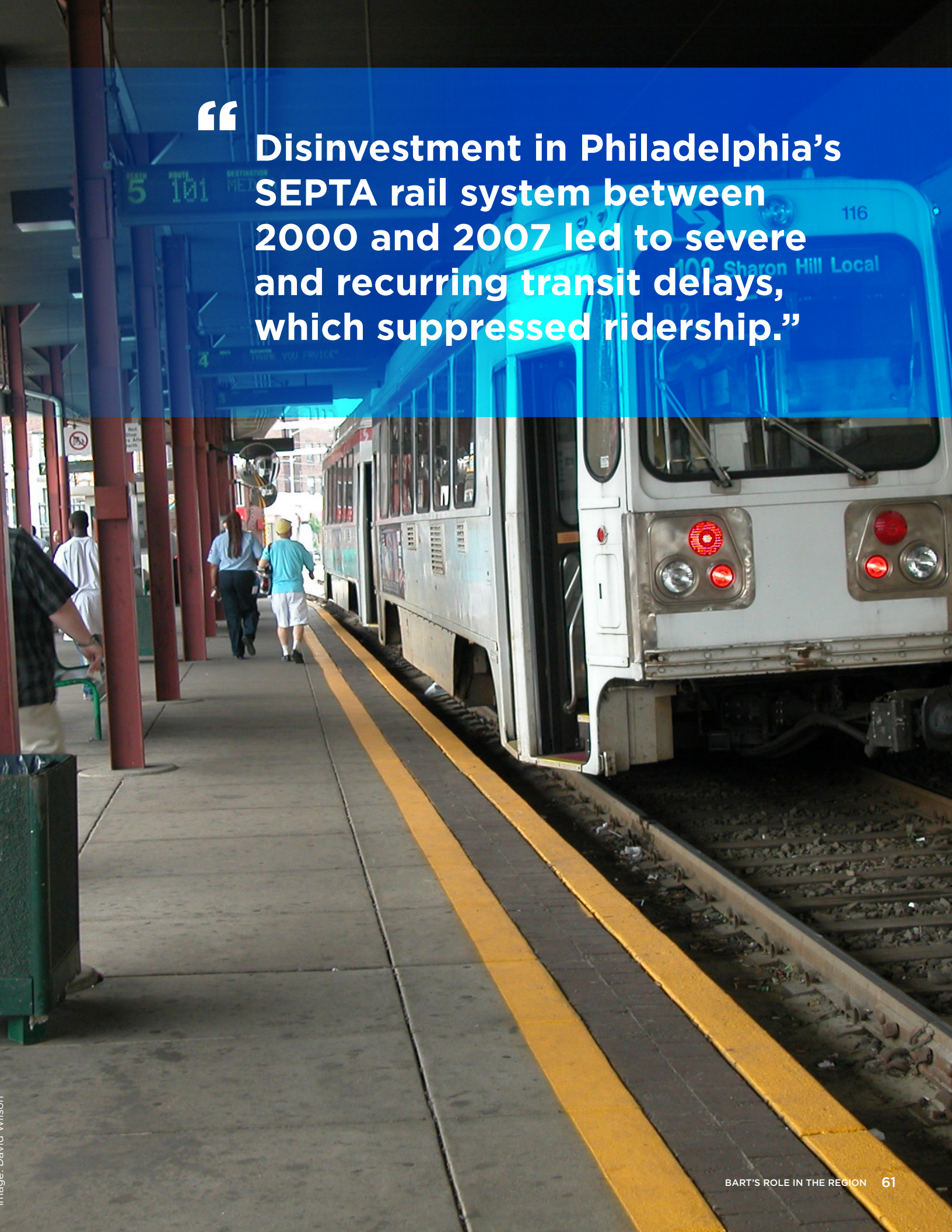
The previous section described the major challenges facing BART: increasing crowding, aging infrastructure, and limited resources to address these needs. Left unaddressed, these challenges will grow more serious over time: infrastructure will continue to age, becoming more expensive to maintain; delays and risks will increase; and growing crowds will further delay trains.

The experience of other transit systems vividly illustrate these risks. When metropolitan areas from Washington DC to Chicago to Philadelphia have failed to invest in maintaining their transit systems in a state of good repair, system performance has suffered.



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**Disinvestment in Philadelphia’s SEPTA rail system between 2000 and 2007 led to severe and recurring transit delays, which suppressed ridership.”**



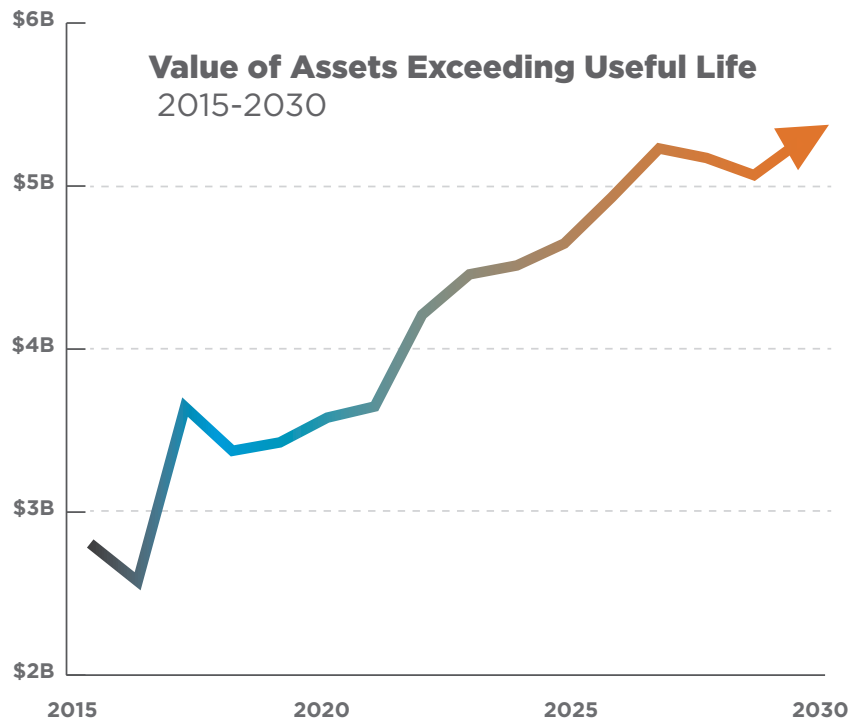




## Further asset deterioration

While careful planning allows BART to maximize its available resources, deferring maintenance has both costs and risks. BART modeling shows that without additional resources, BART assets will continue to age. The share of assets in ‘poor’ and ‘very poor’ condition is expected to increase by 90 percent by 2030. As assets age, both the cost of maintenance and risks to the system would steadily increase.

To help guide decisions about system maintenance and reinvestment in the context of scarce resources, BART staff closely monitors the state of its infrastructure, and uses this data and international best practices in asset management to make strategic decisions about where to invest. This process involves a careful assessment of risk, including both the probability that a particular system component could fail, as well as the impact that a failure would have on the system and the region.







This train collision on Washington, DC's Metrorail system in 2009 was determined to be partially a result of a failed train control system.

## Potential Problems

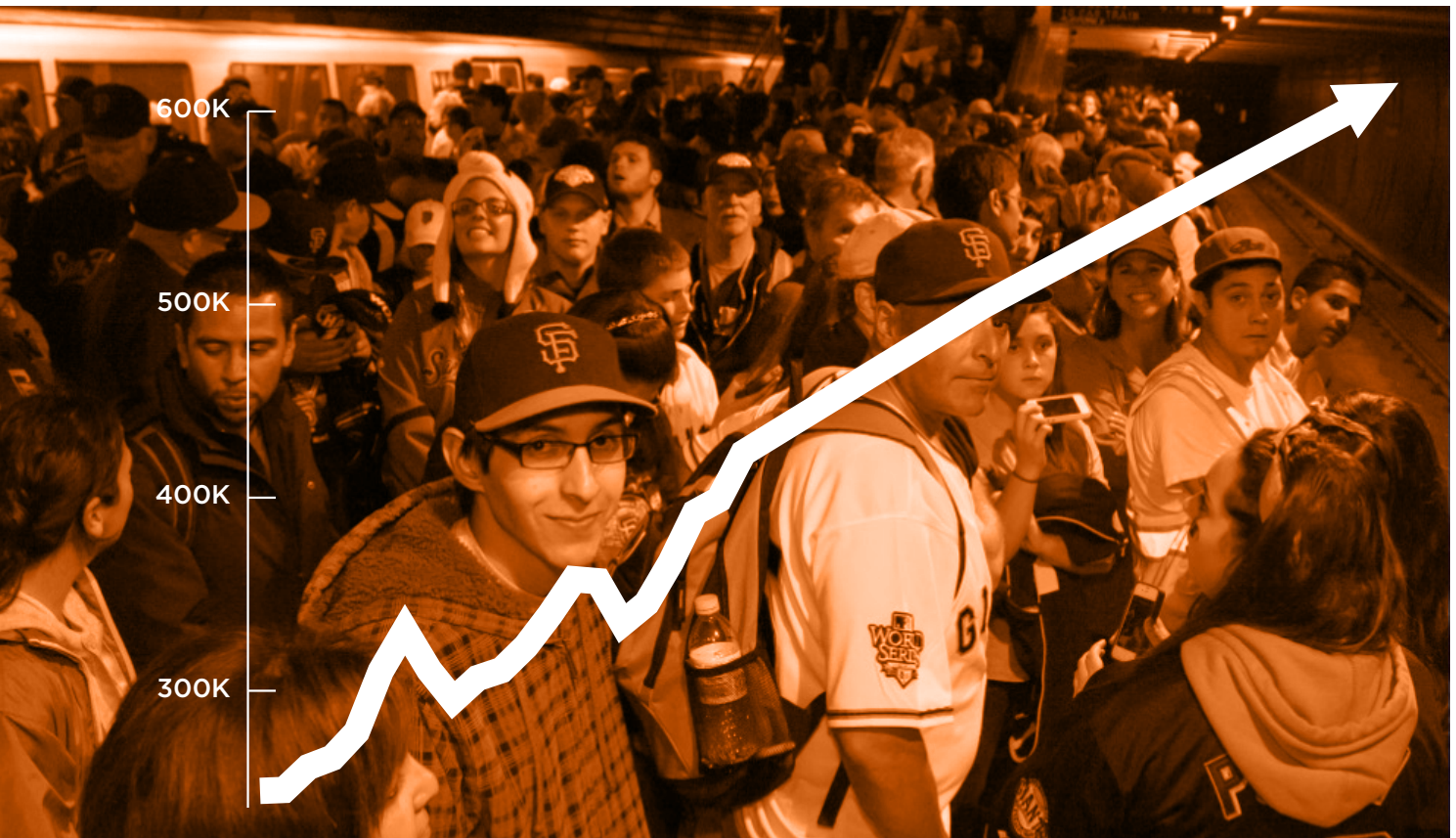
**Service delays.** Without significant investment in BART's state-of-good repair, service delays will increase, and on-time performance will suffer. For example, problems with track infrastructure led to a total of 34 delay incidents in 2014, each causing approximately 130 minutes of train delay. BART modeling suggests that without major reinvestment, track failures would increase 50 percent by 2035.

**Safety Risks.** Other transit systems of similar age have already started to encounter serious safety issues as a result of track problems and malfunctioning train control systems. For example, in 2009, Washington DC's WMATA Metrorail system suffered a train collision that resulted in part from a malfunctioning train control system. BART's superior maintenance has so far avoided similar problems, but vigilance is required.



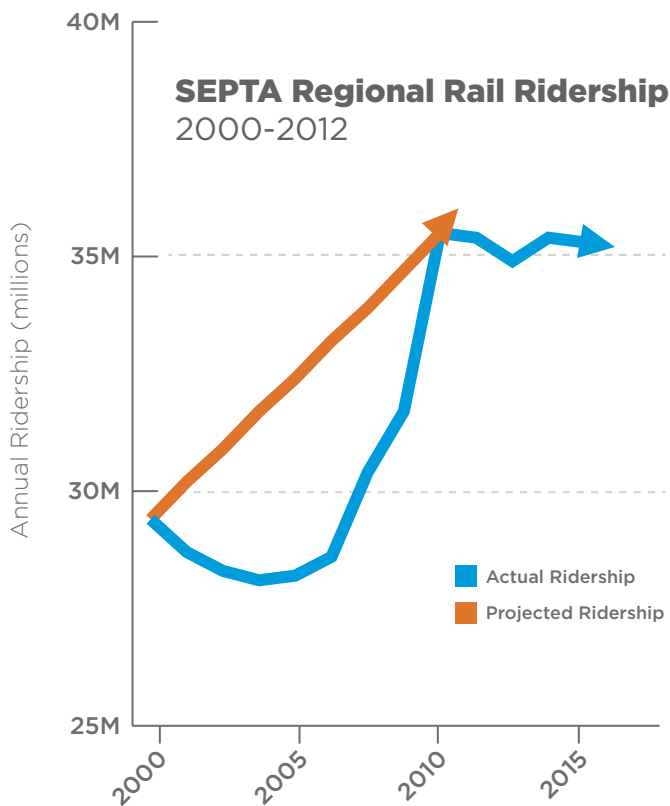
**Increased crowding.** Rapid growth in demand for BART is expected to continue. Based upon Plan Bay Area growth projections, BART estimates daily ridership of nearly 500,000 by 2025 and 600,000 daily riders by 2040. That means future daily riders would be more people than rode BART during the 2014 Warriors or 2012 Giants championship celebrations. More system capacity will be required to safely and comfortably accommodate this many passengers on a daily basis.

Without new system capacity, BART would be unable to accommodate its share of future growth in the region's travel demand, pushing more commuters onto the roads, reducing access to jobs, and hindering regional economic growth.



If ridership grows as predicted, daily ridership would be more people every day than rode BART during the 2012 Giants championship celebrations.

“Without new system capacity, BART would be unable to accommodate its share of future growth in the region’s travel demand. **A 9% loss in ridership for BART in 2035 would equal a loss of 56,000 passengers – many of whom would drive instead.**”



**Suppressed ridership.** Even as BART struggles to deal with the crowding caused by soaring ridership, an aging system increases the risk of the opposite challenge in the long term: depressed ridership growth, or even falling ridership.

The experience of peer operators demonstrates that when reinvestment is inadequate and system performance suffers, riders look elsewhere. This risk is particularly concerning for BART and the Bay Area’s transportation system, because 85 percent of riders have an auto alternative.

An analysis of Philadelphia’s SEPTA system shows that between 2000 and 2007, a period of disinvestment led to severe and recurring system delays. These problems suppressed ridership by approximately 9 percent, resulting in an overall decrease in ridership even as the regional economy grew. Ridership only recovered after a major reinvestment program restored system performance.

A 9 percent loss in ridership for BART in 2035 would equal a loss of 56,000 passengers – many of whom would drive instead.



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## CASE STUDY

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# When delay incidents become more frequent, regional transportation system performance suffers

### Washington DC's: WMATA Metrorail System

WMATA's Metrorail system began service just four years after BART opened, and offers similar services using similar technology. In recent years, worsening state-of-good-repair has been a factor in recent problems on Metrorail, including slow-zones, other delays, and two derailments. Over the same period, Metro's ridership fell by 40,000 riders. A recent WMATA report acknowledged "preliminary evidence" that "concern by customers over service quality and reliability" has contributed to the decline in ridership. Over the same time period, traffic delay in the Washington Metro Area has increased by 3.5 percent. Falling transit ridership has reduced fare revenue, making it more difficult to maintain the system and raising the potential need to increase fares.





Image: H. Michael Miley

## Chicago Transit Authorities 'L' Rail System

Due to ongoing funding shortfalls over several decades, the Chicago Transit Authority has seen severe deterioration of its infrastructure. Today, 22 percent of rail right-of-way, 40 percent of rail stations, 45 percent of substations, and 49 percent of escalators are past their useful life. This issue of deferred maintenance came to the forefront in 2006 when the last car of northbound a CTA Blue Line train derailed in the subway between the Clark/Lake and Grand/Milwaukee stations, injuring 152 people. Deferred maintenance has resulted in the need to create “slow zones” in 13 percent of the CTA rail system, where trains must reduce their speed—sometimes to as low as 15 mph depending on the condition of the track.



# Impacts on the Region

Increasing problems with the BART system would affect not only riders, but the whole transportation system and the region it serves. First, without BART functioning smoothly, the region's traffic congestion will get worse: nearly half of BART riders report that if BART were not available, they would use a car to make their trip. These reports are borne out by real world events: when BART has encountered major delays in the past, travel times on the region's highways have increased substantially, delaying commuters, freight movement, and other travelers.

Second, BART ridership has historically grown nearly in lockstep with regional employment. BART, now close to capacity during peak commute hours, has limited capacity to help absorb demand generated by future growth. Unless BART can expand its capacity, future demand growth will be forced onto the region's crowded highways, and the region's economic competitiveness will suffer.





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**Problems with the BART system would affect the whole transportation system and the region it serves.”**





## Traffic delays

A smoothly-functioning BART system is vital to mitigating the Bay Area's traffic congestion: nearly half of BART riders report that if BART were not available, they would use a car to make their trip.

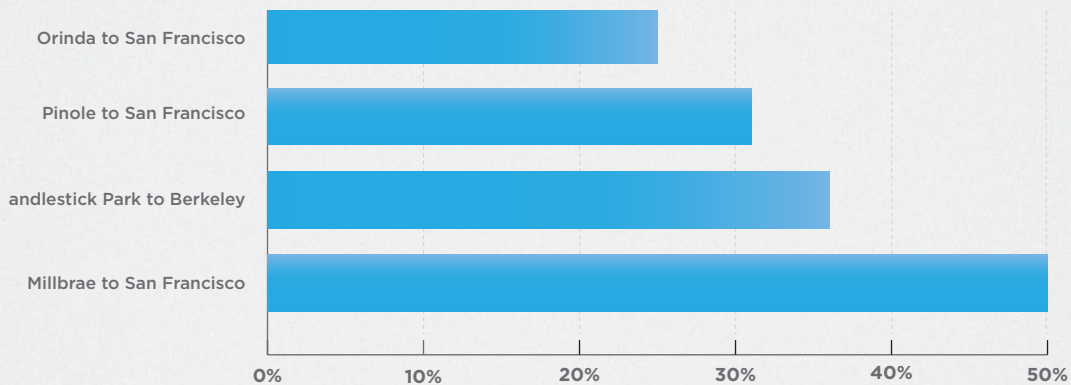
Recent events have reinforced that when infrastructure problems cause disruptions to BART service, traffic gets substantially worse throughout the region. For example, at 9:20 AM on May 6th, 2015, a fracture emerged in a 10-inch segment of track between the 16th Street Mission and Civic Center stations in San Francisco. Service was delayed for more than six hours systemwide.

Since the incident occurred after the end of the morning rush, its affect on regional traffic was far from the worst-case scenario. However, as BART delays lingered, traffic delays spread through the regional freeway system. As a result, drivers faced significantly longer afternoon commutes: Those traveling from the Candlestick park area to Berkeley saw their commute times increased by 35 percent. The trip from Milbrae to San Francisco took 50 percent longer.

BART modeling suggests that if the system continues to age, such incidents will grow significantly more common over time: by 2035, track failures will increase by 50 percent. With the additional pressures of growing crowds on BART and the region's highways, this increase would have unacceptable impacts on regional traffic.

# BART service disruptions mean more cars on the road

**Percent Increase in Travel Times During January 2015 BART Civic Center Track Failure**



**When current BART riders were surveyed about how they would make trips without BART, they indicated:**



**48%**  
would drive or carpool



**34%**  
would take the bus or other transit



**13%**  
would not make the trip



**3%**  
do not know how they would make the trip



**2%**  
would bicycle





Without added BART capacity, **six more lanes would need to be added to the Bay Bridge** to meet demand.

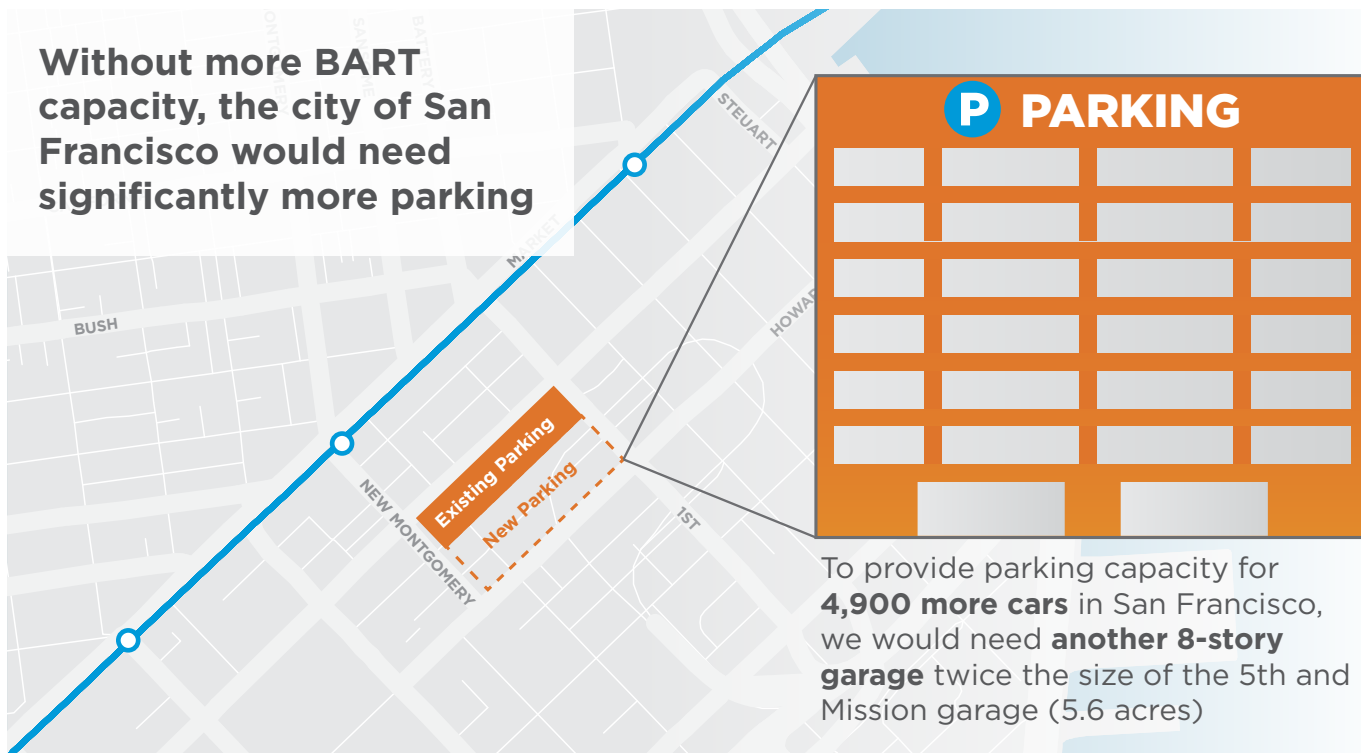
### **Transportation system capacity constraints**

Without new system capacity, BART will be unable to accommodate its share of growth in the region's travel demand, pushing more commuters onto the roads, reducing access to jobs, and hindering regional economic growth.

This situation is most acute in the Transbay corridor, where the system is already at capacity for cars. To help meet growing regional demand, BART's planned capacity enhancements would add space for an additional 8,500 riders into San Francisco during the morning peak commute hour, an increase of 36 percent. Without BART investment, the system has no capacity to absorb these same riders in cars: to do so would require an additional 4,900 parking spaces in San Francisco and 3 new traffic lanes on the Bay Bridge (in each direction).

Alternatively, the Bay Area's economic competitiveness would suffer. Many new jobs would go to regions that enjoy shorter travel times and less crowding.

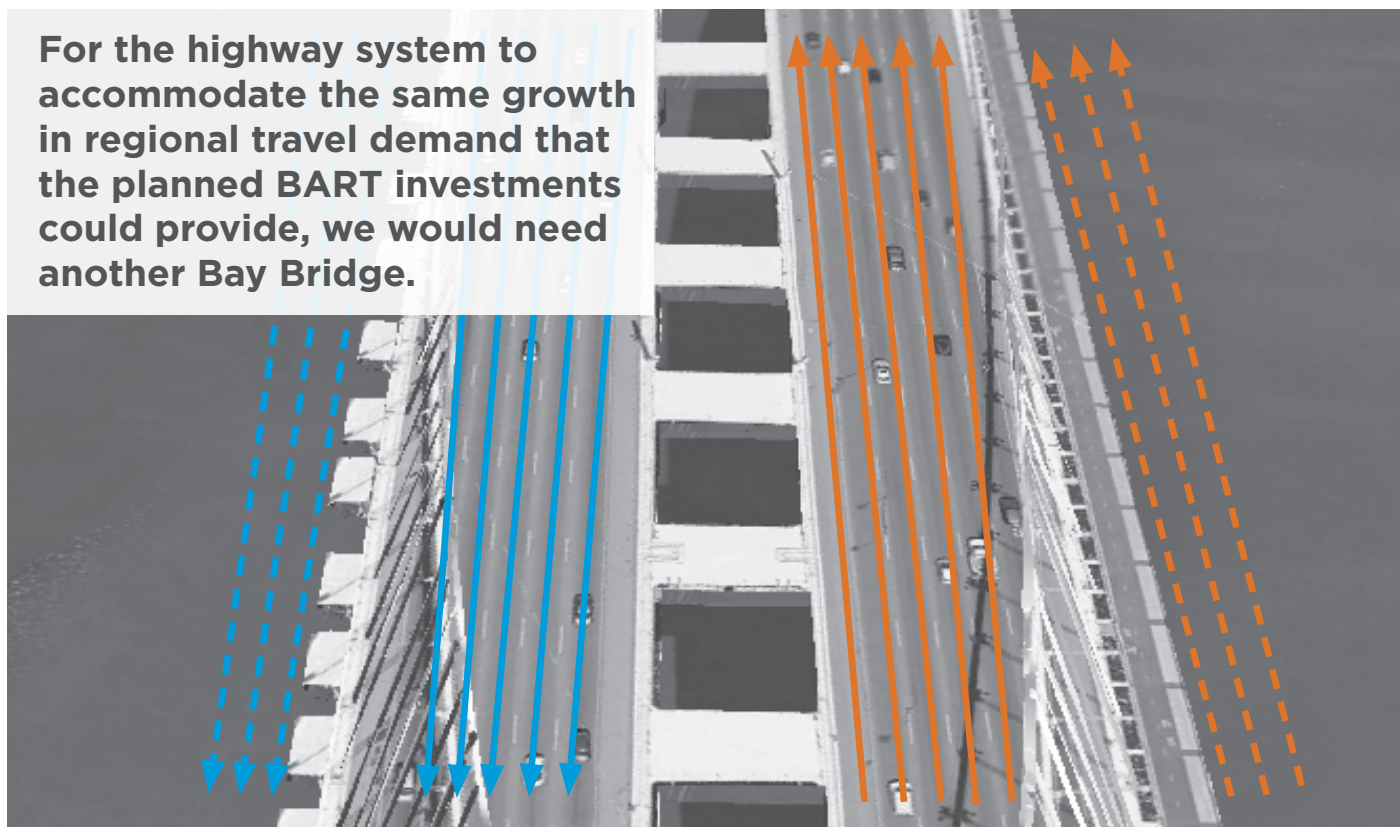
Without more BART capacity, the city of San Francisco would need significantly more parking



BART's planned investments will add capacity for an additional 8,500 riders into San Francisco during the AM peak, a 35 percent increase. To serve the same number of people, we would need an additional 4,900 parking spaces.

BART is planning to add capacity for an additional 8,500 riders into San Francisco during the peak commute hour. To serve the same number of people, the region would need an additional 3 lanes on the Bay Bridge (in each direction).

For the highway system to accommodate the same growth in regional travel demand that the planned BART investments could provide, we would need another Bay Bridge.



## BUSINESS IMPACTS CASE STUDY

The Bay Area's economy depends on the transportation system to move workers, customers, and goods. Increased BART crowding and delays, along with increased traffic congestion, **harm business and the economy.**

### PUCCI FOODS, HAYWARD DISTRIBUTION CENTER

Pucci Foods, established in 1918, is one of California's leading distributors of fresh seafood, meat, and specialty foods. It operates a 53,000 square foot manufacturing and distribution center in Hayward, which is the hub of a network of partnerships that supply fish and seafood from around the world to the Bay Area. Pucci Foods operates its delivery trucks for early morning delivery in order to avoid traffic—typically leaving between 4:00 a.m. and 6:00 a.m. Because its deliveries are not completed until 1:00 p.m., Pucci Foods's operations are impacted by traffic congestion on roads caused by commuters. When BART outages have forced more workers into their cars, Pucci Foods's trucks spent more time sitting in traffic, which equates to higher fuel costs, more wear and tear on the company's trucks, and late deliveries to customers.



Image: Pucci Foods





Image: Abe Bingham

## **BART AND THE BANKING INDUSTRY**

Many national and regional banks are headquartered in San Francisco, but have administrative back offices and branch locations in other parts of the Bay Area, meaning these companies have employees moving through the BART system in multiple directions.

It is critical to bank operations to have its employees in the office. During BART outages, one regional bank puts its business continuance program into effect. This program is used to make sure that the core function of the bank will keep going during natural disasters and extreme weather. While banks can cancel some non-critical tasks and allow telecommuting where possible, employees who need to be in the office arrive late and leave early on days when BART service is unavailable, which creates staffing difficulties.





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## CHAPTER 4

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# MEETING THE CHALLENGE

BART has served the Bay Area for 44 years, delivering high-quality, efficient transportation that moves the region's diverse population, supports the economy, and protects the environment. BART's best-in-the-business maintenance practices have sustained the system's original infrastructure far longer than expected, but even well-maintained equipment eventually reaches the end of its useful life and must be renewed. For the BART system, the time has finally come for a major overhaul.

In consultation with stakeholders from across the region in more than 200 meetings, BART has developed a program of investments that will take a major step toward meeting this need. The program includes: Repair and replace critical infrastructure, Reduce overcrowding and relieve Bay Area traffic congestion, and Improve safety and access to the BART system. The major benefits of this program will be improvements in safety and reliability, as well as reduced crowding and reduced regional traffic congestion.

This chapter covers the following topics:

- Proposed Program of Investments
- Key Benefits for the Region





# Program of Investments

The 2016 BART System Renewal Program (referred to throughout this document as the Program) responds to the San Francisco Bay Area's transportation needs by investing in the renewal of the BART system. In consultation with stakeholders from across the region in more than 200 meetings, BART has developed a program of investments that will:

- **Repair and replace critical infrastructure:** BART will renew the basic infrastructure that comprises the core of the BART system, including tracks, power systems, tunnels and structures, and mechanical systems. After 44 years of service, these systems require a major overhaul to allow BART to continue to perform as passengers expect.
- **Reduce overcrowding and relieve Bay Area traffic congestion:** BART will implement a package of projects that will allow it to meet soaring demand, continue to support the region's growing economy, and get more cars off the road. Projects include upgrading the aging train control system, expanding maintenance facilities to store and service a larger fleet of rail cars, and upgrading power systems to permit more service.
- **Improve safety and access to the BART system:** BART will invest in improving and modernizing stations by improving station safety and security, reducing fare evasion, reconfiguring elevators, and overhauling escalators to ensure fast and convenient access to platforms. BART will also make investments to improve accessibility of stations for people with disabilities and add new access opportunities, such as parking, bicycle facilities, and upgraded bus facilities.

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**BART crews will replace 90 miles of original rails that have been worn down from 44 years of use.”**



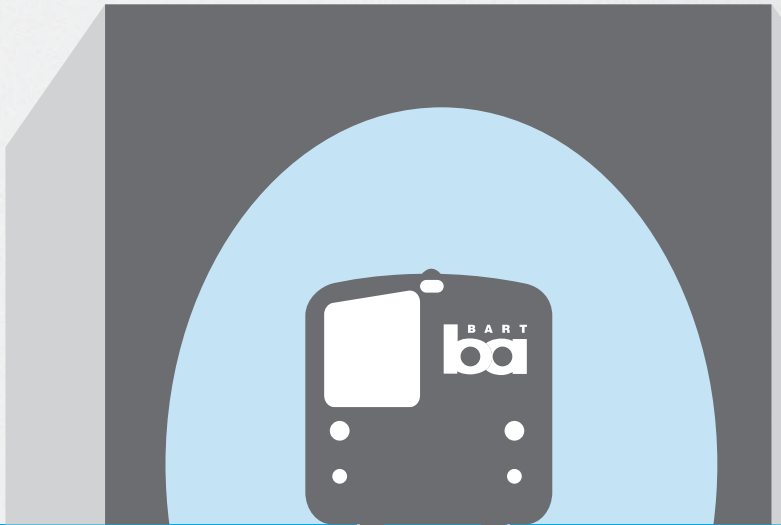


## Repair and Replace Critical Infrastructure

The core of the proposed program is a major investment in repairing and replacing BART's critical infrastructure. These systems are invisible to passengers, but they are the heart of the BART system, and the experience of every passenger depends on them. Many have been in place since the system began operating in the early 1970's, and require a major overhaul to continue to perform their essential roles. BART plans to improve these systems by:

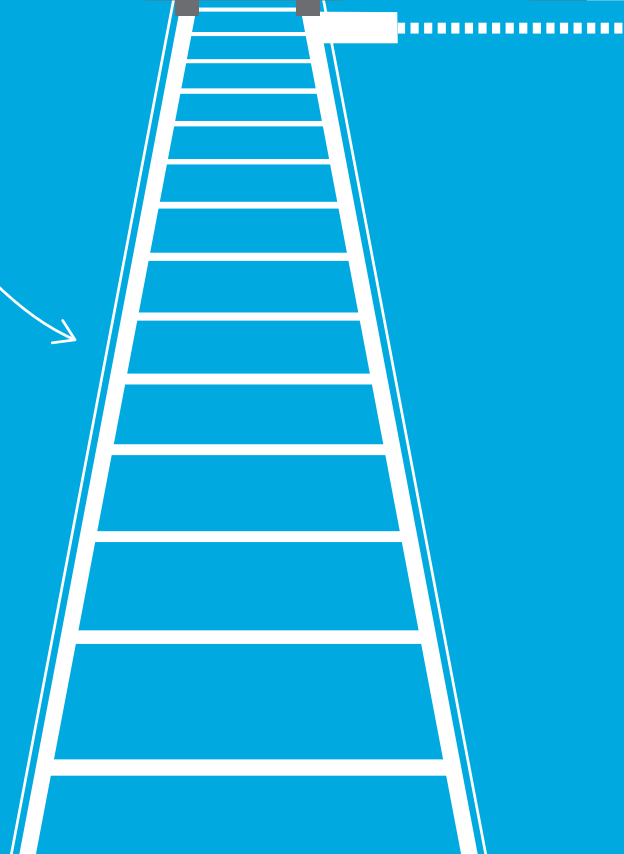
### REPAIRING TUNNELS + STRUCTURES

BART tracks are supported by a range of structures and use several tunnels to provide service throughout the region. Like much of the system's infrastructure, these tunnels and support structures have been in use for decades and some are in need of major rehabilitation. Repairing damage to key structures will ensure continued passenger safety and reliable BART operations. For example, BART will repair damage from water intrusion in the Market Street and Berkeley Hills Tunnels and water damage to trackways and platforms at numerous outdoor stations.



### RENEWING TRACK

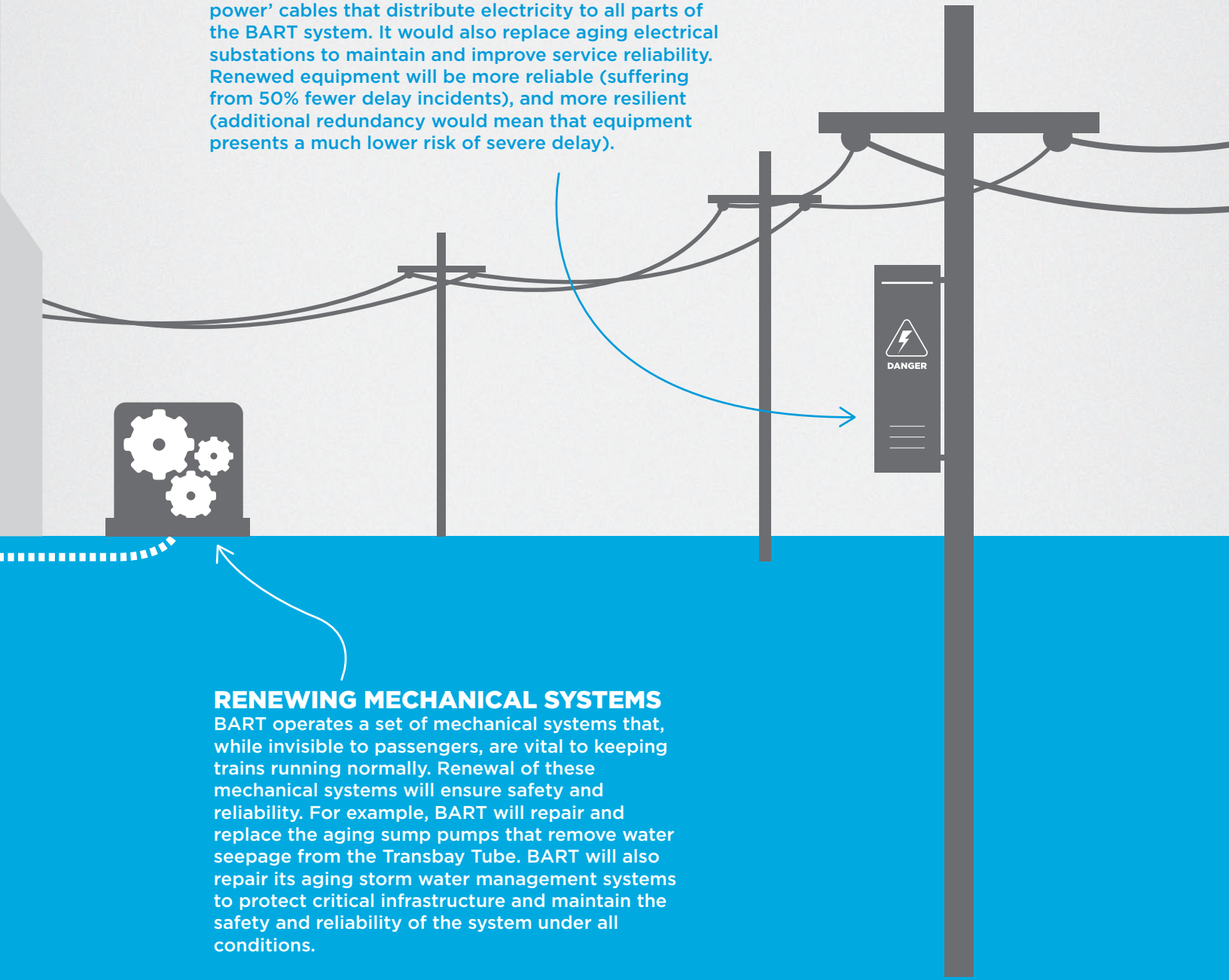
BART crews will replace 90 miles of original rails that have been worn down from 44 years of use, and they will replace many hundreds of original rail ties supporting those rails. They will rebuild major interlockings, the rail merges that allow BART lines to join and divide safely. By 2035, renewed tracks will have 15% fewer delay incidents, and a far lower risk of major failure that could affect passenger safety.





## RENEWING POWER SYSTEMS

BART would repair and replace the original 'traction power' cables that distribute electricity to all parts of the BART system. It would also replace aging electrical substations to maintain and improve service reliability. Renewed equipment will be more reliable (suffering from 50% fewer delay incidents), and more resilient (additional redundancy would mean that equipment presents a much lower risk of severe delay).



## RENEWING MECHANICAL SYSTEMS

BART operates a set of mechanical systems that, while invisible to passengers, are vital to keeping trains running normally. Renewal of these mechanical systems will ensure safety and reliability. For example, BART will repair and replace the aging sump pumps that remove water seepage from the Transbay Tube. BART will also repair its aging storm water management systems to protect critical infrastructure and maintain the safety and reliability of the system under all conditions.

## Invest in Core Capacity for Crowding and Traffic Reduction

Strategic crowding relief will allow the BART system to accommodate a growing regional economy, moving people that would otherwise be clogging the region's already crowded roads. Examples of projects in this area include:



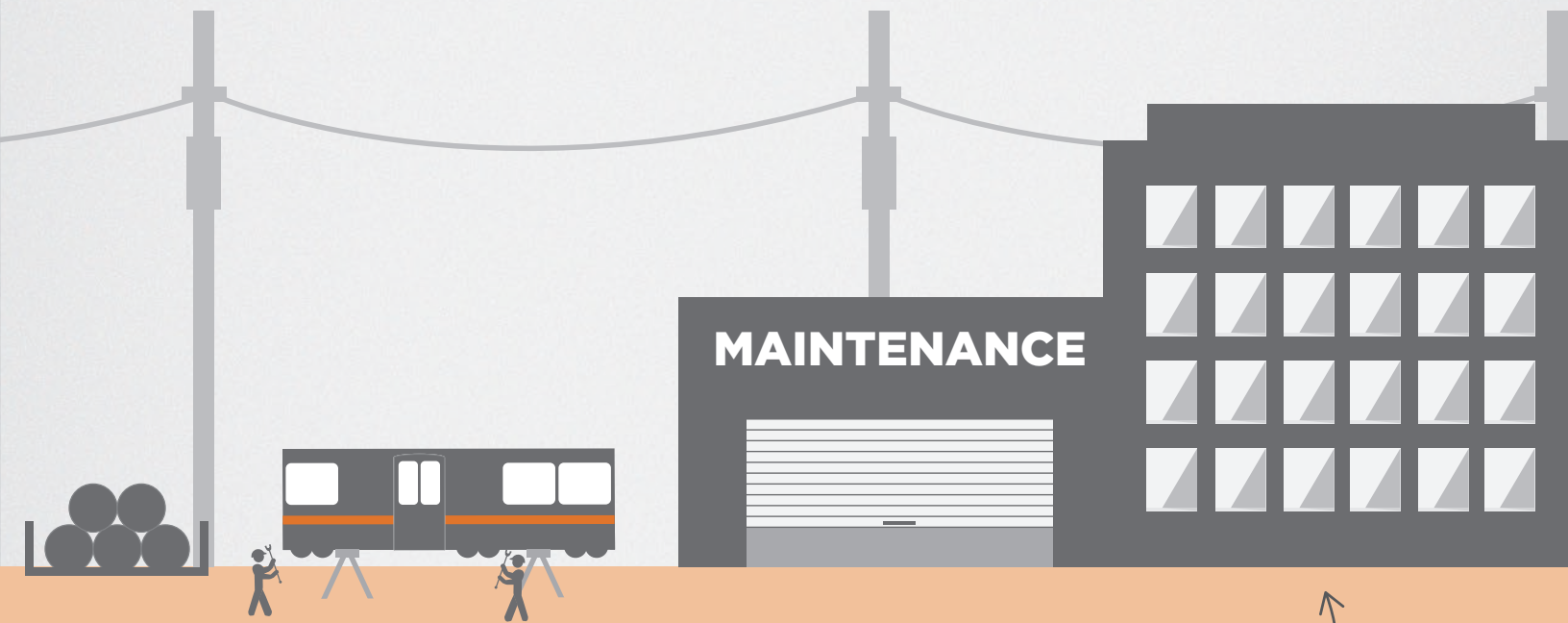
### UPGRADING TRACTION POWER CAPACITY

Before BART can begin to run more service between Oakland and San Francisco, it must be able to supply more electrical power through the Transbay Tube than the system was originally design to handle. This project will supply that electricity, while supplying the redundancy that the system needs to be more resilient in the case of a failed traction power cable or substation in the future.



### UPGRADE THE TRAIN CONTROL SYSTEM

A train control system consists of both hardware and software that are used to ensure safe operation of the system. It monitors train location, ensures sufficient distance between trains, and manages train movements. The Train Control Modernization Project (TCMP) entails removing aging train control equipment from the BART system and upgrading to a new system. This project will improve the reliability of the system, while allowing trains to operate at more closely spaced intervals, thereby increasing the BART system's capacity to carry passengers.



## **EXPANDING VEHICLE STORAGE AND MAINTENANCE CAPACITY**

BART will expand and reconfigure its existing maintenance facility in Hayward, giving BART the ability to service the existing fleet more efficiently, and to store and to maintain a larger fleet of rail cars, which is essential for providing more service than is offered today.



## Relieve Crowding and Reduce Bay Area Traffic Congestion

BART's 44 stations are the gateways to the system. However, like much of the rest of the system, many are more than 40 years old and are in need of renewal. Key stations, such as Montgomery and Embarcadero, have substantial crowding issues on platforms and escalators during peak times. As demand for BART has grown, crowding has also increased for those trying to access BART. Parking for both vehicles and bicycles reaches capacity early in the morning at many BART stations. At the same time, aging and out-of-date facilities at original stations limit many BART riders who might like to reach stations on foot, on buses, or using emerging ride-sharing services. BART will invest in stations and access by:

The illustration features a horizontal line representing a platform or track. Above the line, several dark grey silhouettes of people are shown standing. Below the line, more silhouettes of people are shown walking. The background is a light blue gradient.

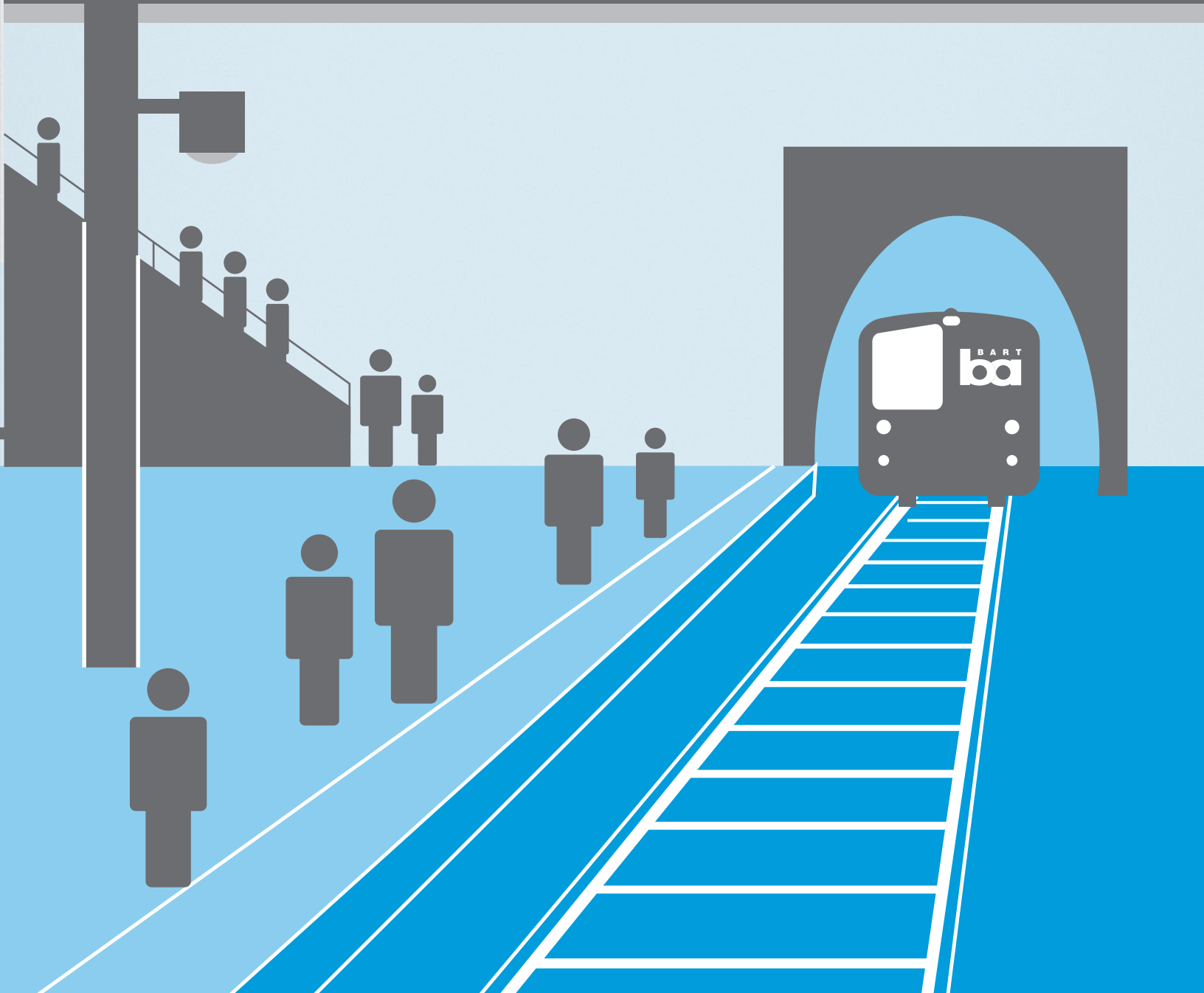
### RENEWING STATIONS

The program will allow BART to renew its aging stations, improving comfort, safety and security, and overall station capacity. By inviting more riders into the BART system, these investments will also help to keep cars off the road. For example, BART will invest in safety, security, and reduced fare evasion. BART will also repair, replace, and upgrade escalators and elevators to increase capacity and improve access for people with disabilities.

## EXPANDING STATION ACCESS OPPORTUNITIES

The goals of BART's access program include a healthier, safer, and greener BART system; more riders, a more efficient and productive system, a better experience, equitable services, and the use of strategies that encourage innovation and partnerships. Using funds from this program in combination with other funding sources, BART will enhance access opportunities throughout the system. Examples of projects in this category include: enhancing access for seniors and people with disabilities; improve parking availability; expanding bicycle facilities; and renewing bus intermodal facilities.

BART  
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## WHAT ABOUT RAIL CARS?

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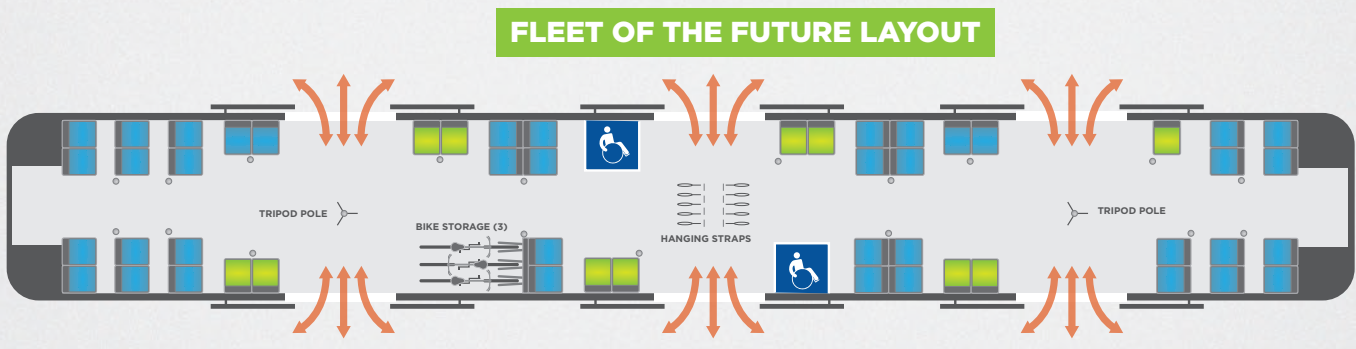
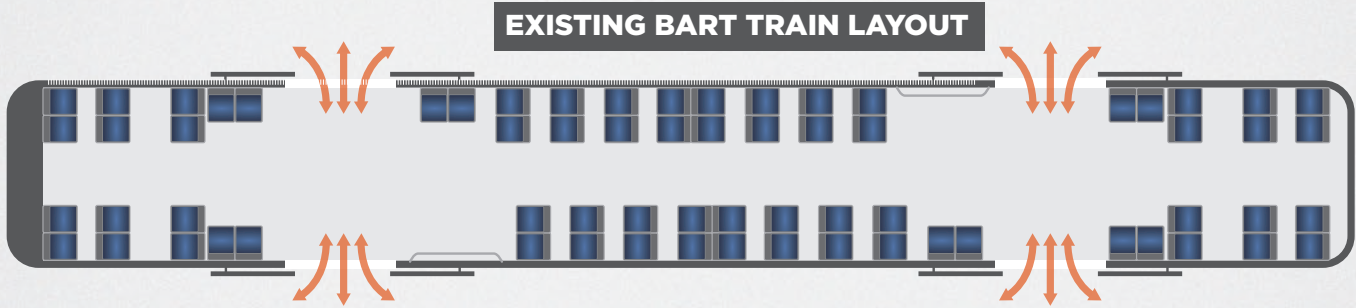
Like the other infrastructure described in these pages, BART's fleet of rail cars are aging, and can't provide enough capacity to meet the needs of the future. To respond to this challenge, BART has developed the Fleet of the Future project. This project is separate from, but closely related to, the other infrastructure investments described in this report.

Once complete, the program will replace the existing 669 rail cars with new, higher-capacity and faster-boarding cars, and expand the fleet to a total of 1,081 cars. The new fleet will be more reliable, less expensive to maintain, and will help to meet growing demand.

The new fleet is essential if BART is to continue serving its important role in the region. But just as essential is the infrastructure required to support the new, larger fleet and keep it operating smoothly and safely: a modern train control system, and expanded maintenance facility, and the power systems to keep the trains running.



# BART's Fleet of the Future will be phased in beginning in Fall 2016

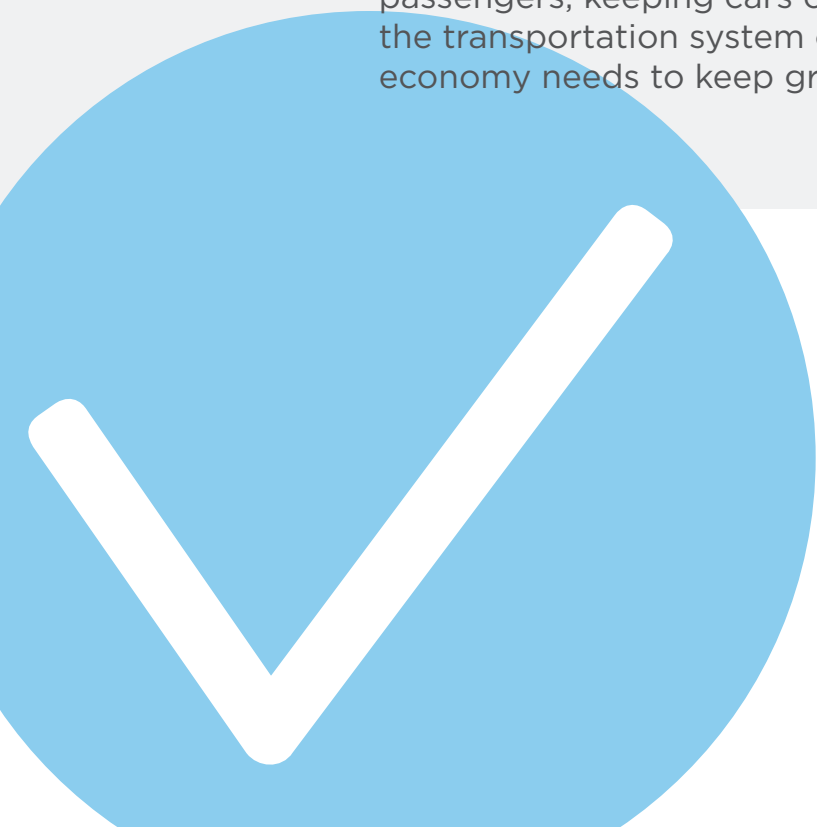




# Key Benefits for the Region

The proposed investment program is important not just for BART riders, but for the whole region. The major benefits of the program include:

- **Safety:** Proposed projects will help keep riders and workers safe and secure, maintaining confidence in the BART system.
- **Reliability:** Projects will keep BART trains running on time.
- **Capacity:** Projects will make room for more passengers, keeping cars off the road and providing the transportation system capacity that the regional economy needs to keep growing.





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**Renewing the system’s basic infrastructure is essential to maintaining the high level of reliability that Bay Area travelers have come to depend on from BART.”**

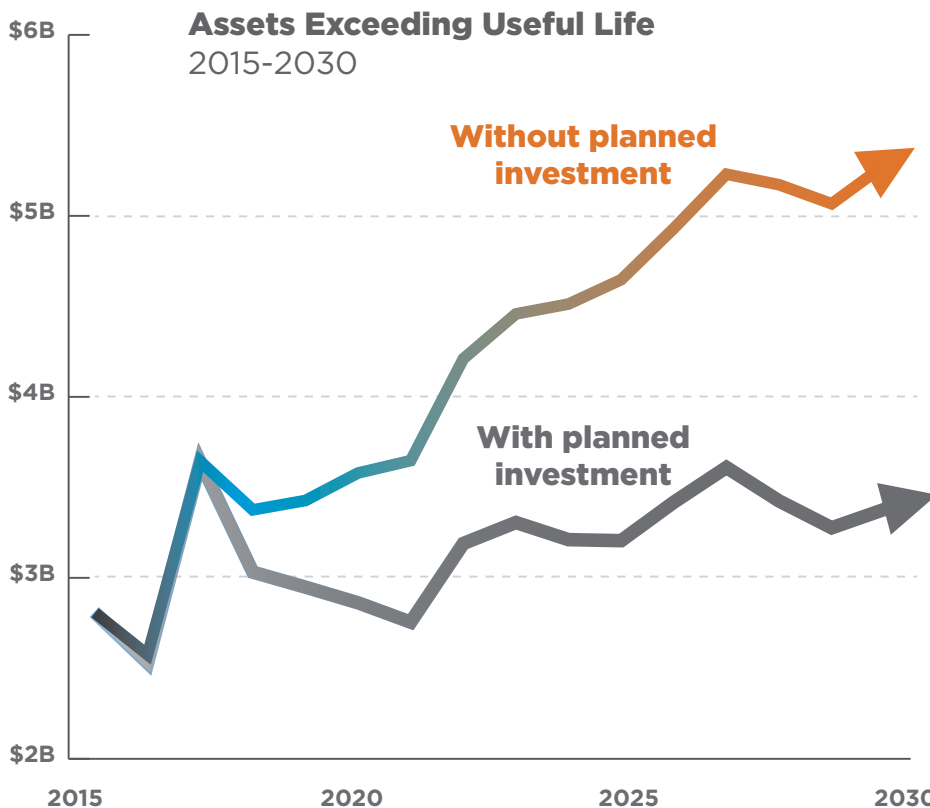




## Maintains BART State of Good Repair

BART modeling shows that without reinvestment, the continued deterioration of BART’s essential infrastructure will worsen service. The value of BART assets older than their expected useful life will increase by 90 percent over the next 15 years, delaying passengers and regional traffic, adding risk to the BART system, and increasing operating and maintenance costs.

This program will overhaul or replace the most important deteriorated infrastructure assets. Risks will be reduced, and the system will be less costly to maintain than it would be without this investment program. This process will be guided by BART’s Strategic Asset Management Program, which monitors data on the performance of each asset and selects investments based on evaluating risks and benefits to the system.



# Preserve BART's strong safety record, and **maintain confidence in the system.**

## **Safety: Keeping riders and workers safe and secure**

BART has no higher responsibility than keeping its rider safe. Over its 44 years of service to the Bay Area, BART's safety record is as strong as any transit service in North America. That record is maintained by the vigilance of BART system workers and sound system management practices that have prevented collisions, derailments, and other major system failures. By contrast, other transit systems of similar age have already begun to experience major safety incidents related to aging infrastructure.

The program will help to preserve BART's strong safety record and maintain the region's confidence in the system. For example:

- Rail renewal will allow BART to continue to safely operate at normal speeds throughout the system.
- A new, modern train control system will allow BART to operate more frequent service safely and without any risk of collision.
- Repairs to Market Street tunnel and at 16 stations will ensure that these structures are sound for the long term, ensuring safe conditions for riders and workers.
- Investments in improved lighting and other facilities at BART stations will help to enhance passenger experience, facilitate easy access to the system, and improve personal security in and around BART stations.





# Train delay reduced by 250 hours per year. **Reduce the risk of severe or recurrent delays**

## Reliability: Keeping BART dependable

After more than four decades of service, reinvestment to repair and replace the system's critical infrastructure is essential to maintaining the high level of reliability that Bay Area travelers have come to depend on from BART. The program will yield a system with 40 percent fewer delays caused by mechanical issues than occur today, savings of 250 hours of delay each year. For example:

- The new, modern train control system will cause 80 percent fewer delay incidents than the current aging system, which was responsible for more than half of all infrastructure-related delays in 2014.
- Replacing 90 miles of original rails and rebuilding the system's major rail merges will reduce delay incidents caused by track failures by an estimated 15 percent in 2035. Even more importantly, these projects will substantially reduce the risk of major failures that could cause the system to encounter severe, ongoing delays now faced by some peer rail systems.
- Renewing BART's power systems will reduce delays caused by these systems by an estimated 80 percent in 2035. More importantly, by adding redundancy to the power systems, BART will be far less likely to suffer severe and ongoing delays that could have major impacts on regional traffic.
- The elements of the program that enhance system capacity also play a role in making the system more reliable. With less crowding on trains and platforms, BART will be able to recover more quickly from any delays that do occur.





# Room for 8,500 more peak hour riders equals three lanes on the Bay Bridge

## Capacity: More cars off the road, more room to grow

Over BART's 44 year history, system ridership has grown along with the regional economy, relieving pressure on the region's crowded highways. Today, however, BART ridership is at or above its maximum capacity in major segments of the system during peak commute hours. Investments in BART capacity will relieve crowding and allow BART to continue to take more cars off the region's roads. For example:

- A set of investments in core system capacity, including a modern train control system, an expanded train car maintenance facility in Hayward to accommodate a larger fleet of rail cars, and a more power capacity, will provide space for approximately 36 percent more riders in the Transbay market - equivalent capacity to another three lanes each direction on the Bay Bridge.
- Investments in repairing and replacing critical infrastructure will also be important to keeping cars off the road. In peer systems that have seen prolonged declines in system reliability due to poor state-of-good repair, riders eventually began to abandon the transit system. For example, the experience of one peer agency, SEPTA in Philadelphia, showed that maintaining the system's state-of-good repair and reliability are a key to retaining 9 percent of riders (equivalent to 56,000 daily BART passengers by 2035).
- BART's proposed station investments, including the overhaul of station escalators and reconfiguration of platform elevators, will be important to relieving crowding at the busiest stations and allowing BART ridership room to grow.
- By providing an excellent alternative to driving for many trips, BART helps keeps cars off the road, reducing emissions and improving the region's air and water quality. By keeping BART safe and reliable while making space for more riders, the program will preserve these environmental benefits for future generations.

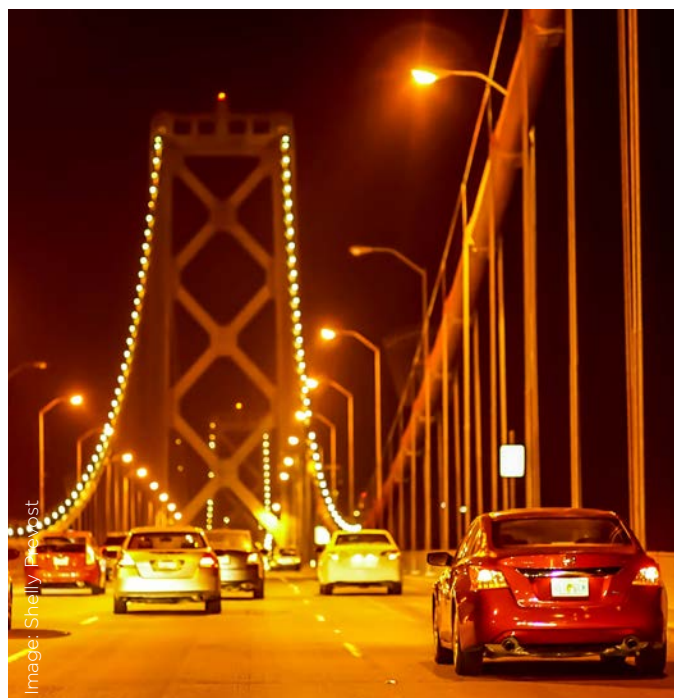


Image: Shelly Beavest

