Why can't BART provide all-night service?

This question is regularly posed by the public, by other agencies, and by our own governing board. The answer reflects fundamentals of the system's design. **First**, BART is a radial network: all BART routes radiate from the Oakland Wye, and all lines of service traverse it. **Next**, BART's routes are almost entirely dual-tracked – two tracks via which trains operate at close intervals in opposite directions (Figure 1). **Finally**, a 'third rail' electrical conductor runs alongside every track in the system to deliver the 1,000 volts of direct current that power our trains.

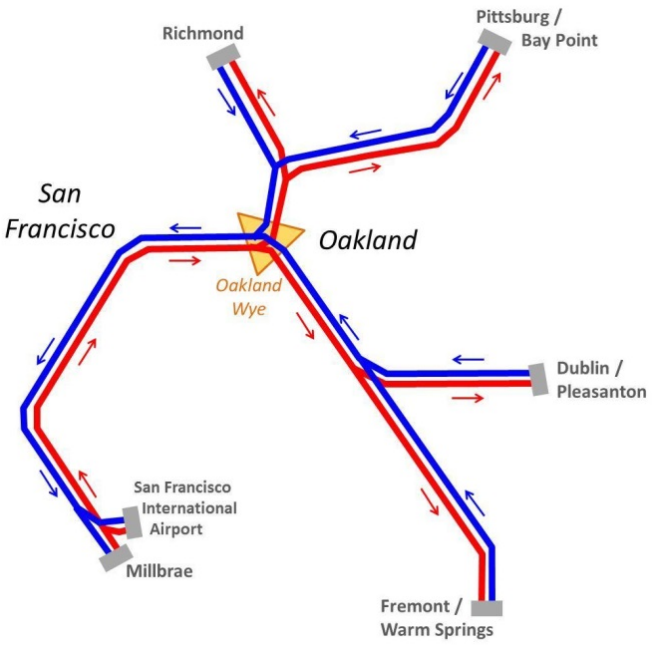


Figure 1 – General BART Network Schematic

These physical characteristics limit the network's capacity – both for service and for any work that requires access to the right of way. The entire schedule of services can only be delivered if the entire network's capacity is available. No alternate routes, sidings or reserve capacity enable continuous scheduled service if local work diminishes the capacity of even one segment. Heavy maintenance, repair and improvement require complete suspension of service over the affected segments.

BART's responsibility for personnel and public safety significantly constrains the performance of work in the right-of-way during hours of service. Passing trains and the energized third rail are imminent hazards. Inspection, maintenance, repair and improvement can only be performed in the right-of-way when no trains are operating and when traction power is off. It is thus vital for BART to efficiently complete maintenance and repair work during these limited times when trains are not operating.

Can the existing system be improved to enable limited service during maintenance windows?

Periods when trains are not in operation and the traction power system is off are known collectively as the "blanket" – mainly between the end of revenue service (EOR) late at night, and the start of revenue service (SOR) early in the morning. The specific duration varies between weekday and weekend service, and from line to line. Because most BART service begins and ends at the remote termini of the system, the blanket can be envisioned spreading outward from the Oakland Wye as the last trains of the night approach their termini. This availability collapses toward the Oakland Wye as the first trains of the morning begin operation from their termini. Figure 2 approximates the weekly durations between EOR

and SOR at all route termini; local refinements and adjustments further enable BART to precisely integrate maintenance and service anywhere on the network. These nightly service recesses enable work in the BART right-of-way for about 25 early-morning hours per week.

Figure 2 – System Availability between Last and First Trains at Termini

	Sunday - Friday			Friday - Saturday			Saturday - Sunday		
	EOR	SOR	Duration	EOR	SOR	Duration	EOR	SOR	Duration
Richmond	1:04 AM	4:09 AM	3:05	1:04 AM	5:55 AM	4:51	1:04 AM	7:55 AM	6:51
Pittsburg – Bay Point	1:20 AM	4:02 AM	2:42	1:20 AM	5:57 AM	4:37	1:20 AM	7:57 AM	6:37
Dublin – Pleasanton	1:28 AM	4:13 AM	2:45	1:28 AM	5:57 AM	4:29	1:28 AM	8:01 AM	6:33
Fremont	1:29 AM	4:00 AM	2:31	1:29 AM	5:54 AM	4:25	1:29 AM	7:54 AM	6:25
Millbrae	1:09 AM	4:03 AM	2:54	1:09 AM	5:57 AM	4:48	1:09 AM	7:57 AM	6:48
SF International Airport	1:35 AM	4:09 AM	2:34	1:35 AM	5:57 AM	4:22	1:35 AM	7:57 AM	6:22
Average Work Availability per Night			**2:45**			**4:35**			**6:36**

The provision of safe, reliable and efficient service depends upon the state of repair to which BART's infrastructure – some of it more than 40 years old – is maintained. BART's rigorous preventive maintenance, repairs and improvements are planned in advance and precisely scheduled to ensure no time or effort is wasted and service is not disrupted. Nonetheless, as service increases in response to demand, the aging infrastructure is subject to accelerating fatigue, wear, and obsolescence. Modernizing critical infrastructure and maintaining legacy systems require resourceful use of all available time and access. Reducing that availability will impede BART's ability to maintain the system to the highest and safest standard.

Can maintenance innovations or near-term capital investments enable longer hours of BART service?

The active BART right-of-way is a hazardous workplace. Trains are in continuous operation, the third-rail traction power system is energized, the work area is necessarily constrained, and a great deal of infrastructure is compressed into the right-of-way. In addition, 36% of the right-of-way is in tunnels or tubes, and 22% is on elevated structures; both inherent hazards.

To assure the safety of its employees, contractors and the public, BART maintains stringent exclusions from its right-of-way. Work that is performed during daylight hours on conventional railroads can be performed on BART only when train operations, traction power, and other systems have been secured: during the late night and early morning. Access to the right-of-way at any time is subject to rigorous permissions and notifications.

There are few if any maintenance innovations or near-term investments that enable heavy work to be performed without access to the right-of-way. Any direct intervention in the right-of-way interferes with train operations, and many maintenance functions simply cannot be automated. Train operations must therefore be temporally separated from work in the right-of-way to maintain the service schedule and to ensure the safety of personnel, the public, and BART assets.

Can single-tracking and skip-stop operations facilitate maintenance during service hours?

Dual-track railroads like BART may employ "single-tracking" – operating trains in both directions via one of their two tracks – to isolate a section of track for work prohibited by the frequency of regular train traffic. Single-tracking is typically used to facilitate maintenance during periods of lightest service, to minimize schedule disruption and delay. There are segments of BART that carry trains at headways as long as 20 minutes, whether off-peak or on weekends, enabling single-track operation while work is performed. Elsewhere, and at other times, train frequencies make single-tracking less viable.

To enable extended access for maintenance, BART sometimes closes a segment of the system in both directions, and provides alternate services (i.e. bus bridge or ferry) during the closure. While this is a costly alternative, and inconvenient to our riders, BART's ambitious program of track and interlocking replacement necessitates such occasional segment closures. These projects are planned such that work the requiring closure occurs on weekends and holidays, facilitated by public information and passenger assistance.

A station may be skipped by limited or express trains, or if work requires a station's temporary closure during normal service hours. Train operations, however, require keeping traction power energized and excluding personnel from the right of way. Skip-stop operation does not therefore help expedite track or system work on main-line tracks.

What is the impact of extended service hours on system maintenance and performance?

Extending the duration of revenue service anywhere in the system reduces the duration of the right-of-way's availability for work. Adding trains to existing lines of service and expanding the physical network both extend the duration of service and the amount of wear and fatigue on the infrastructure. Further reducing availability to provide late-night service will exacerbate this situation.

What factors determine BART's periodic decisions to extend service hours for special events?

BART sometimes extends operations beyond the scheduled hours of service, given advance notice of a special event and the demand it is expected to generate. Planning for these cases is based on communication with event sponsors and other agencies, and on BART's own experience. Knowing where an event is scheduled, when the event begins and ends, and forecasts of passenger loads, BART will direct sufficient capacity via the lines that serve event venues, sometimes staging trains 'upstream' from a venue to maximize capacity in the direction of greatest demand.

BART's decision to extend, augment or otherwise modify service for a special event is based on the travel demand predicted in association with that event. For BART to extend hours of operation beyond the normal period of service, demand must be sufficiently high to generate enough fare revenue to offset the considerable costs of opening service early or closing late. BART's Operations Planning Department maintains and monitors a calendar of events throughout its service area that may require service above and beyond regularly scheduled operations. Some of these may require proactive public information and augmented staff presence in the field. Examples of such annually occurring events are

New Years' Eve, the Bay to Breakers run, the Gay Pride Parade, the Outside Lands music festival, Fleet Week, and the Chinese New Year parade. BART's advance planning for these events involves transportation, maintenance, train control, security and other staff functions. Special event services may also require coordination with other transit agencies to ensure connectivity and safety beyond the normal hours of service.

BART responds to unscheduled or singular events via a similar planning process, albeit with much less advance notice. BART has executed extemporaneous planning in response to such events as team championship parades and America's Cup yacht races, often with only days of advance notice.

What are the approximate scope and cost of additional studies or other resources needed to better answer these questions?

BART is always considering ways to increase capacity. Discussions currently range from optimizing the availability and capacity of 40-year-old legacy cars to understanding how an additional tube could serve burgeoning transbay travel demand. Addressing these questions may also identify solutions that enable BART to serve late-night markets. However, facing the combined challenges of an aging system, increasing demand, and evolving technology, BART's planning and development efforts are focused intently on increasing the capacity of existing services while maintaining overall system reliability.

* * * * *

Conclusion

BART is among rail properties around the world that are designed such that work requiring access to the right-of-way must primarily be performed when trains are not operating. Periods of such availability are limited in number and duration, and are subject to erosion by extending the duration and length of existing services. Worker safety regulations further limit when and how work may be performed in the right-of-way.

After assuring passenger and worker safety, BART's priorities are meeting existing service commitments and accommodating burgeoning demand during regular service hours, including travel generated by new extensions. Increasing both the extent and frequency of service further stress our system and require more intense maintenance during diminishing periods of availability. Enabling service during the intervals currently reserved for maintenance would require system redundancies and operational changes of greater extent, cost and impact than the capacity enhancements we are currently striving to fund and accomplish. In this context, it is irresponsible for BART to speculate on potential improvements solely to enable the provision of late-night service.

Table of Contents

1. Overview of transit network service & network capacity

1.1 Service area

The San Francisco Bay Area Rapid Transit District (BART) is an automated passenger rail network serving the greater San Francisco Bay Area. The system was conceived in the 1950s as a regional alternative to automobile travel. Construction began in 1964 and the first part of the network opened in 1972. A hybrid of urban metro and suburban railway, BART was designed and constructed to operate entirely independently of other rail services. Unlike conventional rail systems, BART trains operate on track with rails gauged at 5 feet, 6 inches, and are powered by electricity delivered via third rail at 1,000 volts of direct current. BART stations serve dense urban centers via pedestrian, bicycle and transit access, as well as generally low-density suburban communities, where 47,000 car-parking spaces enable automobile access to stations.

BART is a government-owned company supervised by a board of directors that is directly elected by the public, an unusual governance structure among transit agencies in the United States. The directors represent nine districts apportioned among the three counties originally served by BART – Alameda, Contra Costa and San Francisco. An extension introduced BART service to San Mateo County in 2004, and a subsequent extension will open to Santa Clara County in 2018.

The BART network (Figure 1) comprises three (3) trunk routes radiating from the Oakland Wye, the central interchange of the entire network. Each trunk splits into two (2) diverging limbs. Of the six (6) total limbs, four (4) terminate in the East Bay, and two (2) in the West Bay. The three (3) trunk routes comprise a core network of 10 system-miles, each trunk currently carrying three or more (3+) lines of service. One of these trunks immediately connects the city centers of San Francisco and Oakland via the 3.6-mile Transbay Tube, a structure submerged and covered under the Bay floor. On the west side of the Bay, BART serves four (4) busy San Francisco city center stations under Market Street, in a subway shared with the San Francisco Municipal Railway. BART service between Oakland and San Francisco offers an alternative to the tolled and congested San Francisco-Oakland Bay Bridge, as well as to the cost and inconvenience of driving and parking in San Francisco. On the Peninsula south of San Francisco, BART serves San Francisco International Airport and Millbrae (an interchange with the Caltrain suburban rail service) via an extension opened in 2003. An additional extension is under construction to connect BART service south of Fremont and directly to downtown San Jose.

As of January 1, 2016, the BART network comprises 8 physical lines, and 104 total system-miles:

LINE	TERMINI		MILES
A	Oakland Wye	Fremont	23.5
K	Oakland Wye	MacArthur	2.5
C	MacArthur Junction	Pittsburg – Bay Point	29.0
R	MacArthur Junction	Richmond	10.5
M	Oakland Wye	Daly City Yard	16.5
L	Bay Fair Junction	Dublin - Pleasanton	13.0
W	Daly City Yard	Millbrae	8.5
Y	SF Airport Junction	SF Airport	1.0

There are approximately 37 miles of track through subways and tunnels, 23 miles of aerial track and 44 miles of surface track.

BART serves 45 stations, of which 17 are at the surface level, 13 are elevated and 15 are under ground. Four of these are a combination of BART and Muni Metro stations in downtown San Francisco, one station serves BART and Caltrain in Millbrae, and the Richmond station serves BART and the Capitol Corridor regional trains.

Figure 1 – Existing BART Network and Extensions in Progress

1.2 Statistics on rail service (number of trains, trips, other data)

BART's current fleet of 669 cars is comprised of 59 A2 cars, 380 B2 cars, 150 C1 cars and 80 C2 cars. The average age of the fleet is greater than 36 years, with a maximum of 42 years. The seated capacity of

these legacy cars is 56 passengers, and total capacity exceeds 110. 775 new cars are on order to replace BART's legacy fleet and expand services.

During the fiscal year ending June 30, 2015, BART recorded an average weekday ridership of 423,120, the highest in its history, making BART the fifth-busiest heavy rail rapid transit system in the United States. During fiscal year 2015, the busiest station was Embarcadero with 45,460 average weekday exits, followed by Montgomery Street with 44,333. The busiest station outside of San Francisco was 12th Street Oakland City Center with 13,921 riders, followed by Downtown Berkeley with 13,744.

Annual Passenger Journeys	126 million
Fleet Size (no. of revenue vehicles)	669
Stations (served)	45
Route Miles	104 miles
Track Miles (revenue)	208 miles
Headcount (full-time equivalent)	2,989
Maximum Service Frequency (trains per hour)	24 tph (Trans-Bay / city-center core route)
Hours of Operation	04:00 to 00:30 (weekdays) 06:00 to 00:30 (Saturdays) 08:00 to 00:30 (Sundays)
Population	864,816 (San Francisco) 422,856 (Oakland) 4,394,911 (4 counties served by BART – Alameda, San Francisco, Contra Costa and San Mateo) 7,654,870 (9 Bay Area counties)
Population Density (residents/mile^2)	18,451 (San Francisco) 5,421 (Oakland) 2,254 (4 counties served by BART) 1,108 (9 Bay Area counties)

Source: *United States Census Bureau / American FactFinder. "Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2015". 2015 Population Estimates Program. Web. March 2016. http://factfinder2.census.gov.*

1.3 Number of people served and available demographic data (include subsections for data on ridership at beginning of morning service and end of evening service if available)

- During FY 2015, average weekday ridership was 423,120 trips.
- Average Saturday ridership was 207,539, and average Sunday ridership was 151,562.
- Total annual trips were 126 million.

Passenger demographics (weekday, weekend, total)

The following data are from BART's 2014 Customer Satisfaction Study.*

		Weekday	Weekend	Total
Gender	Male	50%	51%	50%
	Female	50%	49%	50%
	Total	*100%*	*100%*	*100%*

		Weekday	Weekend	Total
Age	13-17	2%	3%	2%
	18-24	15%	22%	16%
	25-34	31%	33%	31%
	35-44	20%	14%	19%
	45-54	16%	12%	16%
	55-64	11%	9%	11%
	65+	5%	7%	5%
	Total	*100%*	*100%*	*100%*
Race	White alone, non-Hispanic	37%	42%	38%
	African American alone, non-Hispanic	10%	11%	10%
	Asian/Pacific Islander alone, non-Hispanic	28%	23%	27%
	Amer Indian alone, non-Hispanic	1%	1%	1%
	Other or multi-race, non-Hispanic	5%	4%	5%
	Hispanic	19%	20%	19%
	Total	*100%*	*100%*	*100%*
Annual Household income	Under $25,000	17%	27%	18%
	$25,000 - $49,999	19%	24%	19%
	$50,000 - $74,999	17%	16%	17%
	$75,000 - $99,999	13%	9%	13%
	$100,000+	34%	24%	32%
	Total	*100%*	*100%*	*100%*
Frequency of BART Use	6-7 days/week	17%	18%	17%
	5 days/week	44%	15%	40%
	3-4 days/week	16%	11%	16%
	1-2 days/week	9%	15%	10%
	1-3 days/month	7%	21%	9%
	Less than once/month	7%	20%	9%
	Total	*100%*	*100%*	*100%*

**Missing responses have been excluded from these percentages, as well as from other tables in this section.*

Early-Morning Passenger Demographics

- During FY 2015, average weekday exits from 4-4:59 a.m. were 732.
- Average Saturday exits from 6-6:59 a.m. were 2,233.
- Average Sunday exits from 8-8:59 a.m. were 4,712.

While the Customer Satisfaction Study does not have sufficient sample sizes of early morning riders to provide reliable demographic information about this group, two other surveys can provide some insight.

BART's 2015 Station Profile survey collected data from 156 to 189 early morning weekday riders (sample sizes varied, depending on response rates to the specific questions). Note that due to these relatively small sample sizes, the margins of error for these percentages are relatively high.

		Early AM Weekday Riders	All Other Weekday Riders
Gender	Male	61%	52%
	Female	39%	48%
	Total	*100%*	*100%*
Age	5-17	<1%	1%
	18-24	14%	14%
	25-44	69%	59%
	45-54	12%	15%
	55-64	3%	8%
	65-74	1%	3%
	75+	<1%	1%
	Total	*100%*	*100%*
Race	White alone, non-Hispanic	34%	44%
	African-American alone, non-Hispanic	21%	12%
	Asian/Hawaiian Native/Pacific Islander alone, non-Hispanic	19%	23%
	American Indian alone, non-Hispanic	<1%	<1%
	Other, non-Hispanic	0%	<1%
	Mixed race, non-Hispanic	2%	3%
	Hispanic, any race	25%	18%
	Total	*100%*	*100%*
Household income	Under $25,000	6%	8%
	$25,000 - $49,999	31%	18%
	$50,000 - $74,999	38%	27%
	$75,000 - $99,999	17%	15%
	$100,000+	8%	31%
	Total	*100%*	*100%*

Passenger demographics (early Saturday morning)

A separate survey of early Saturday morning riders in 2011 collected demographics on these riders:

		Early AM Saturday Riders
Gender	Male	57%
	Female	43%
	Total	*100%*

		Early AM Saturday Riders
Age	13-17	1%
	18-24	12%
	25-34	25%
	35-44	20%
	45-54	22%
	55-64	15%
	65+	6%
	Total	*100%*

Race	White alone, non-Hispanic	32%
	African-American alone, non-Hispanic	15%
	Asian/Hawaiian Native/Pacific Islander alone, non-Hispanic	22%
	American Indian alone, non-Hispanic	1%
	Other or Mixed race, non-Hispanic	4%
	Hispanic, any race	26%
	Total	*100%*

Household income	Under $25,000	32%
	$25,000 - $49,999	27%
	$50,000 - $74,999	20%
	$75,000 - $99,999	9%
	$100,000+	12%
	Total	*100%*

Late evening service

- During FY15, average weekday exits after 11:30 pm were 7,339.
- Average Saturday exits after 11:30 pm were 9,267.
- Average Sunday exits after 11:30 pm were 4,122.

Passenger demographics (Friday late evening)

While the Customer Satisfaction Study does not have sufficient sample sizes of late evening riders to provide reliable demographic information about this group, the following data from a survey of late Friday night riders in 2011 can provide some insight. This study was conducted onboard trains on two Friday nights on all three BART lines that provide late night service approximately during the last two hours of service.

		Late Friday Night Riders
Gender	Male	61%
	Female	39%
	Total	*100%*

		Late Friday Night Riders
Age	13-17	1%
	18-24	25%
	25-34	42%
	35-44	17%
	45-54	9%
	55-64	4%
	65+	1%
	Total	*100%*

Race	White alone, non-Hispanic	45%
	African-American alone, non-Hispanic	10%
	Asian/Hawaiian Native/Pacific Islander alone, non-Hispanic	15%
	American Indian alone, non-Hispanic	1%
	Other or Mixed race, non-Hispanic	5%
	Hispanic, any race	24%
	Total	*100%*

Household income	Under $25,000	32%
	$25,000 - $49,999	21%
	$50,000 - $74,999	18%
	$75,000 - $99,999	12%
	$100,000+	17%
	Total	*100%*

1.4 Economic impact of system

The following highlighted text is excerpted from the 2014 report "Building a Better BART - Investing in the Future of the Bay Area's Rapid Transit System, included as Appendix 4.

INTRODUCTION

In 1962, the residents of the Bay Area made a visionary investment in the region's future by voting to fund the initial construction of the Bay Area Rapid Transit system (BART). Thanks to their foresight, today's Bay Area residents enjoy one of the strongest economies and highest qualities of life in the world, supported by the efficient mobility provided by BART.

After decades of service to the region, the BART system now finds itself facing two critical challenges. First, hundreds of millions of dollars in reinvestment are needed to maintain and upgrade 40-year old systems and infrastructure. While BART has always been an exceptional steward of public resources, much of its core infrastructure is now approaching the end of its useful life and major capital investment is required for the system to continue its record of safe, high-quality, and reliable service.

Secondly, new system capacity is needed to support a growing region. Ridership is already outgrowing BART's capacity as demographic changes have made transit increasingly popular. The region is planning

for much of its future growth to be located around BART stations, which will add even more passengers. Finally, system extensions are under construction to southern Fremont, Silicon Valley/San Jose, Oakland International Airport (*completed and opened 2014– ed*), and eastern Contra Costa County that may add still more riders to BART's already heavily-used core system. Ironically, BART's extraordinary success is driving some of its most urgent challenges.

BART'S ROLE IN THE REGION

The Birth of BART: A Defining Moment in Bay Area History

The idea of a Bay Area rapid transit system surfaced at a turning point in the Bay Area's history. In the late 1940s, the region was experiencing unprecedented growth and increasing congestion on the region's highways threatened to undermine the Bay Area's economic vitality.[1] Just a decade after opening in 1936, the Bay Bridge was already reaching its capacity and the need for another transbay link was becoming apparent.

Policymakers realized that to manage this dramatic growth and allow Bay Area cities to thrive, they needed a strong and coherent vision for the region. The early planners saw the creation of BART as a mechanism that could lend structure to the region's growth. BART would encourage cohesive development by linking the major commercial centers throughout the nine counties that touch the San Francisco Bay.

BART began operating in 1972 with 28 route miles of track serving 12 stations. It carried 100,000 people during its first week of revenue service. Today, BART comprises 104 route miles of track serving 44 (*45 with the opening of the Oakland Airport Connector in 2014 – ed*) stations in 21 cities and 4 counties. A full overview of the system is provided on pages 8-9.

As the fifth-busiest heavy rail rapid transit system in the United States, BART enables over 400,000 daily riders to access many of the region's prime destinations for work, school and recreation. BART meets the diverse needs of people from different parts of the region, enabling them to interact and share space. In so doing, BART plays a critical role in reinforcing the Bay Area's identity as one region. From the opening of service to the present day, BART has enhanced quality of life in the Bay Area by providing a rapid and reliable alternative to the car and fostering a lifestyle that enables all people to conveniently live, work, and play in different cities.

Supporting the Region's Economic Vitality

Since its creation in the 1970s, BART has served as a guiding force in the Bay Area's growth and development. Research indicates that BART helped preserve the preeminence of downtown San Francisco as a regional economic center during the 1980s when downtowns of

Events Dramatically Illustrate BART's Role

Recent events have demonstrated the magnitude of BART's impact on the Bay Area. BART provided critical support during the Bay Bridge closures over Labor Day weekend in 2013. During Thursday and Friday of that weekend, BART experienced its third- and fourth-highest ridership days ever, at 475,000 and 457,000 riders respectively.

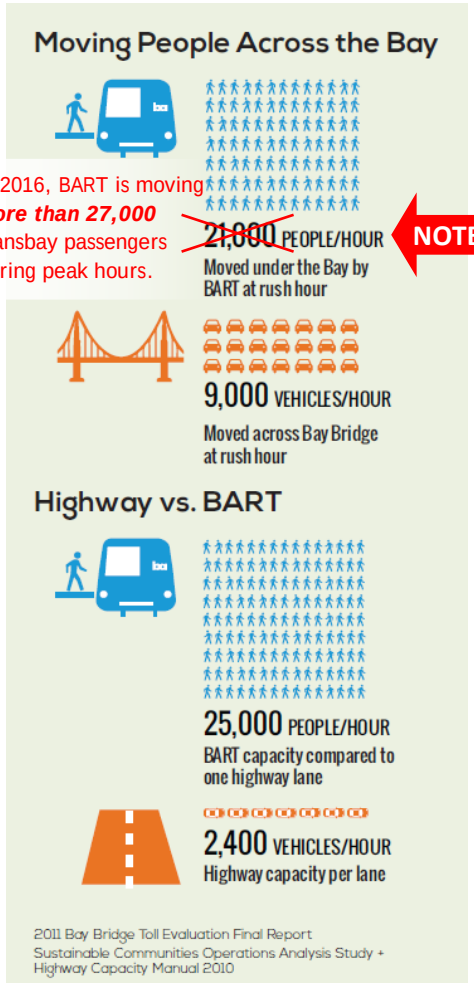
But, BART is a critical back-up when the bridge is not an option; it supports hundreds of thousands of commuters daily. The 2012 fire near the West Oakland station, which resulted in a shut-down of BART's transbay service for morning commuters, dramatically illustrated the challenges of a Bay Area without BART. The emergency shutdown resulted in hours of delay across the Bay Bridge. Despite the deployment of alternatives such as telecommuting, carpooling, and increased ferry and bus service, it was readily apparent that BART is a foundation of the Bay Area's transportation system and plays an essential role in supporting the region's economy.

Both these incidents underscore the fact that the Bay Area's quality of life and economic strength has come to be inextricably linked to the fast, reliable, and resilient regional rail service provided by BART.

major cities in similar metropolises experienced significant losses in employment.[2]

Beyond San Francisco, the BART system has supported the rise of major employment centers in cities throughout the region—including Oakland, Berkeley, Walnut Creek, Fremont, Dublin, Pleasanton, and Pleasant Hill—by providing a reliable connection to thousands of commuters who work in these cities each day. The system has also encouraged mixed-use developments and multi-family housing around its stations, allowing more Bay Area families access to jobs and schools without the expense of a car.

In 2012, UC Berkeley and the Bay Area Council conducted a "BART State of Good Repair Study," which provides insight into how BART service impacts the Bay Area's economy. The study estimated a net loss in value for the region if BART is unable to maintain its reliable service between $22 and $33 billion dollars over the next 30 years.[3] The study found the following benefits of BART: travel and vehicle ownership cost savings for riders; reduced traffic congestion; business operating cost savings corresponding with reduced costs for workers and increased reliability stemming from reduced congestion; and increased business productivity due to expansion in access to labor markets.



Sustainability

BART plays a central role in meeting the region's sustainability goals. In California, about 40% of greenhouse gas emissions come from transportation, and of those, about 70% are from personal driving.[4] A 2010 study seeking to quantify the greenhouse gas emissions related to the BART system found that BART reduced over 1 million metric tons of carbon dioxide per year, an d the system eliminated 12.7 times the emissions it produced through its own service.[5] These emissions reduction benefits result from a mode shift from personal vehicles; a reduction in roadway congestion; and transit's ability to promote dense, mixed land-use patterns that reduce vehicle trips and trip distances. Data gathered by the Bay Area Council in 2013 indicated that when BART is not running, congestion produces 16 million pounds of additional carbon each day.[6] These contributions make BART indispensable to the important task of creating a more sustainable Bay Area.

Accommodating Growth

Similar to the era of BART's founding, the Bay Area is once again at a turning point. The State of California has acknowledged climate change as a major public policy issue, and has mandated that regions develop sustainable visions for future growth that reduce the 40% of the state's

greenhouse gas emissions that are associated with transportation.[7] In response, the region has developed its first integrated transportation and land use plan, Plan Bay Area.

Plan Bay Area combines the Metropolitan Transportation Commission's (MTC) 2040 Regional Transportation Plan with the Association of Bay Area Governments' (ABAG) Sustainable Communities Strategy. This plan sets a vision for regional growth in which public transportation forms the backbone of the next chapter in the Bay Area's development.[8] By 2040, Plan Bay Area anticipates 2 million additional Bay Area residents. It seeks to accommodate this growth by concentrating future population and employment within priority development areas around major transit hubs – many of which are centered on BART stations. Plan Bay Area also projects 250,000 new jobs (a 40% increase) located in areas adjacent to BART stations. With the system already supporting nearly half of the Bay Area's transit passenger miles, BART's role to the region is projected to become more important than ever before.

The Challenge of Supporting the Bay Area's Future

Based upon Plan Bay Area growth projections, BART estimates daily ridership of nearly 500,000 by 2025 and 600,000 daily riders by 2040.[9] These forecasts assume the BART system continues to operate reliably day-to-day and is able to expand its capacity to serve this increase in ridership.[10] However, to accommodate this growth and guarantee the system's ongoing reliability will require significant reinvestment in aging infrastructure and expansion of the system. BART faces nearly $20 billion in operating and capital needs over the next 10 years. Although staff has identified substantial funding to meet this need, both the operating and capital programs face significant funding challenges in coming years. If BART is unable to reinvest sufficiently to keep its infrastructure in good working order, system failures will become more frequent, reliability and service quality for current passengers will decrease, and the system will be unable to serve additional riders; as well as become a less appealing alternative for potential new passengers.

Diminished levels of BART service would have severe implications for the Bay Area's transportation network. Passengers who shift from BART to private automobiles due to poor service would exacerbate congestion on highways that are already at capacity, thus degrading service for existing highway users.

BART's Transit-Oriented Development Program

Transit-Oriented Development (TOD) is higher-density, walkable, mixed-use development located at a transit stop or station. It is designed to allow people to drive less and walk, bike, and take transit more by providing well-connected and human-scale street networks focused around frequent transit service. Successful TOD also improves the efficiency and cost effectiveness of transit service.

BART's adopted TOD Policy (2005) acknowledges that

> *"by promoting high quality, more intensive development on and near BART-owned properties, the District can increase ridership, support long-term system capacity and generate new revenues for transit… [create] attractive investment opportunities for the private sector and [facilitate] local economic development goals."*

BART's TOD program supports the growth projected in Plan Bay Area by promoting mixed use development at BART stations. BART staff works actively in partnership with cities, community stakeholders, and the private sector to advance and facilitate projects. Completed TOD projects include Castro Valley, Richmond, Fruitvale, Powell Street, Pleasant Hill/Contra Costa Centre, Ashby, and Hercules. New projects are being considered or developed at Pleasant Hill/Contra Costa Center, Richmond, Walnut Creek, West Dublin/Pleasanton, MacArthur, San Leandro, South Hayward, Glen Park, Coliseum, and Millbrae.

Source: BART Transit-Oriented Development Policy, http://www.bart.gov/sites/default/files/docs/BART_TOD_Policy.pdf.

A reduction in BART riders and increase in automobile users would further increase vehicle miles traveled, leading to greater greenhouse gas emissions, air pollution, and respective losses in the Bay Area's economic and environmental health. Diminished levels of BART service would also result in a decrease in the number of people the transportation system can move during peak periods at a time when travel demand in the region is growing.

The commitment of funding agencies and public and private partners will be critical to BART's next 10 years and beyond.

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4. "California Greenhouse Gas Inventory for 2000-2012." California Air Resources Board, http://www.arb.ca.gov/cc/inventory/data/data.htm.
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6. Bay Area Council. BART Strike Having Costly Environmental Impact on Bay Area. 2013.
7. California Assembly Bill 32 (AB 32) passed in 2006 required the California Air Resources Board to devise a plan that would reduce California's greenhouse gas emissions to a certain level by 2020. Senate Bill 375 (SB 375) passed in 2008 mandated reductions in greenhouse gas emissions and vehicle miles traveled through strengthening linkages between transportation investment decisions and land use patterns.
8. BART Transit-Oriented Development Policy, http://www.bart.gov/sites/ default/files/docs/BART_TOD_Policy.pdf.
9. Bay Area Rapid Transit. SRTP ridership forecasts: does not include the two station SVBX project, State-of-Good-Repair
10. Deakin, Elizabeth, et al. "A State-of-good-repair for BART: Regional Impacts Study." (2012)

Source: Bay Area Rapid Transit District: "BUILDING A BETTER BART - Investing in the Future of the Bay Area's Rapid Transit System." July 2014 DRAFT https://www.bart.gov/sites/default/files/docs/BART%20Building%20a%20Better%20BART%20Executive%20Summary_0.pdf

1.5 Economic costs of the lack of overnight service (if data are available)

BART's response to question 1.5 is encompassed by the findings of the study performed for BART in 2012, entitled "A State of Good Repair for BART: Regional Impacts Study - What Could Happen if BART Fails To Maintain A State of Good Repair." Prepared under the leadership of Dr. Elizabeth Deakin of the University of California, Berkeley, the study addresses both the economic importance of BART to the Bay Area and the economic costs of not maintaining BART infrastructure to a safe and competent material condition. BART was conceived, designed and constructed to be maintained continuously during periods each 24-hour cycle when trains are not in operation. BART has experimented, however, with limited late-night or 24 hour services, which have consistently demonstrated that:

(a) Insufficient ridership is generated to support the operating and maintenance expenses of the increased service, and

(b) Infrastructure and fleet maintenance are compromised by eliminating the daily periods when parts or all of the network can be secured for maintenance, repair and improvement.

The 2012 study concluded that:

"…Using MTC needs estimates, which in turn are based on methods developed by the FTA, BART needs to spend over $500M a year on the core system if it is to attain and maintain SGR over the coming years. Currently MTC's 2035 regional funding plan identifies about $250M a year for BART rehabilitation and replacement activities, about half of the estimated SGR needs. The shortfall in capital funds together with competing needs means that BART may be able to cover only 30% to 50% of SGR costs if the 50% regional funding commitment is the only amount available."

"If BART's expenditures on SGR fall this short, the consequences will be drastically negative. BART's aging infrastructure will fail more frequently, causing substantial declines in reliability and more crowding. In turn, BART ridership, which is expected to increase to half a million riders a day if current levels of service can be maintained, will stagnate or even decline if service quality becomes as poor as predicted. Both peak and off peak services will be negatively affected. The results will be more congestion, more pollution, and less equity for transit dependents."

"Attaining and maintaining SGR for BART would require an investment of some 15 billion dollars over the next 30 years. This is a large investment, but the payback would also be large: transit investments have been found, conservatively, to return 1.7 dollars in business activity for every dollar spent, and benefits from travel time savings are in addition to this. Investing only 30% of the amounts needed for a state of good repair would cost the region at least $33 billion; investing only 50% of needed amounts would cost the region at least $22 billion."

Source: "A State of Good Repair for BART: Regional Impacts Study What Could Happen if BART Fails To Maintain A State of Good Repair" Elizabeth Deakin, University of California, Berkeley, Arlee Reno, Cambridge Systematics, Inc., James Rubin, University of California, Berkeley, Sean Randolph, Bay Area Council Economic Institute, Michael Cunningham, Bay Area Council, May 2012.

2. Existing constraints on extending hours of rail service

First, BART is a radial network: all BART routes radiate from the Oakland Wye, and all lines of service traverse it. Next, BART's routes are almost entirely dual-tracked - two tracks via which trains operate at close intervals in opposite directions (Figure 1). Finally, a 'third rail' electrical conductor runs alongside every track in the system to deliver the 1,000 volts of direct current that power our trains.

These physical characteristics limit the network's capacity – both for service and for any other work that requires access to the right of way. The entire

Figure 2 – BART Network Schematic

schedule of services can only be delivered if the entire network's capacity is available. No alternate routes, sidings or reserve capacity enable continuous scheduled service if local work diminishes the capacity of even one segment. Heavy maintenance, repair and improvement require complete suspension of service over the affected segments.

BART's responsibility for personnel and public safety significantly constrains the performance of work in the right-of-way during hours of service. Passing trains and the energized third rail are imminent hazards. Inspection, maintenance, repair and improvement can only be performed in the right-of-way when no trains are operating and when traction power is off. It is thus vital for BART to efficiently complete maintenance and repair work during these limited times when trains are not operating.

2.1 Daily maintenance, safety, and performance needs and processes (and the impact of extended service hours on them)

Periods when trains are not in operation and the traction power system is off are known collectively as the "blanket" – mainly between the end of revenue service (EOR) late at night, and the start of revenue service (SOR) early in the morning. The specific duration varies between weekday and weekend service, and from line to line. Because most BART service begins and ends at the remote termini of the system, the blanket can be envisioned spreading outward from the Oakland Wye as the last trains of the night approach their termini. This availability collapses toward the Oakland Wye as the first trains of the morning begin operation from their termini. Figure 2 approximates the weekly durations between EOR and SOR at all route termini; local refinements and adjustments further enable BART to precisely integrate maintenance and service anywhere on the network. These nightly service recesses enable work in the BART right-of-way for about 25 early-morning hours per week.

Figure 2 – System Availability between Last and First Trains at Termini

	Sunday - Friday			Friday - Saturday			Saturday - Sunday		
	EOR	SOR	Duration	EOR	SOR	Duration	EOR	SOR	Duration
Richmond	1:04 AM	4:09 AM	3:05	1:04 AM	5:55 AM	4:51	1:04 AM	7:55 AM	6:51
Pittsburg – Bay Point	1:20 AM	4:02 AM	2:42	1:20 AM	5:57 AM	4:37	1:20 AM	7:57 AM	6:37
Dublin – Pleasanton	1:28 AM	4:13 AM	2:45	1:28 AM	5:57 AM	4:29	1:28 AM	8:01 AM	6:33
Fremont	1:29 AM	4:00 AM	2:31	1:29 AM	5:54 AM	4:25	1:29 AM	7:54 AM	6:25
Millbrae	1:09 AM	4:03 AM	2:54	1:09 AM	5:57 AM	4:48	1:09 AM	7:57 AM	6:48
SF International Airport	1:35 AM	4:09 AM	2:34	1:35 AM	5:57 AM	4:22	1:35 AM	7:57 AM	6:22
Average Work Availability per Night			2:45			4:35			6:36

The provision of safe, reliable and efficient service depends upon the state of repair to which BART's infrastructure – some of it more than 40 years old – is maintained. BART's rigorous preventive maintenance, repairs and improvements are planned in advance and precisely scheduled to ensure no time or effort is wasted and service is not disrupted. Nonetheless, as service increases in response to demand, the aging infrastructure is subject to accelerating fatigue, wear, and obsolescence. Modernizing critical infrastructure and maintaining legacy systems require resourceful use of all available time and access. Reducing that availability will impede BART's ability to maintain the system to the highest and safest standard.

2.2 Constraints from planned construction projects

BART is engaged in a comprehensive program of replacing and improving aging infrastructure, at the same time that capacity must increase in response to burgeoning demand. The following program of improvements represent BART's efforts to modernize the system while maintaining and improving safety, capacity, comfort, convenience and efficiency. The fact that this program is concurrent with regular BART service, and with its extension and intensification, means that a great deal of work can only be performed when trains are not in operation – consistent with BART's original concept and design.

System-Wide Rail replacement

BART gets extra life from conventional steel rail, because BART operates some of the lightest train cars in the country. Over time, however, even the strongest steel wears down. BART is replacing 90 miles of worn, original rail with tougher, harder steel that will last even longer than the rail first installed during the '60s and '70s. New rail will enable smoother, safer, and quieter travel. Much of the work required to replace original rail occurs during the periods between the cessation of services late at night and the beginning of service in the early morning.

Interlocking Replacements

Throughout the BART network, special trackwork such as crossovers, sidings and pocket tracks enable the operational flexibility necessary to respond to varying demand and conditions. Known as "interlockings," these complexes of track switches, crossings, signaling and communications equipment wear and fatigue faster than does straight track. As interlockings age, their conditions cause noise and vibration, and require trains to traverse them at reduced speeds for safety. If maintenance is too long deferred, interlockings become causes of poor ride quality, excessive noise, delay, and reduced capacity.

BART is engaged in a long-term process of sequentially replacing and modernizing interlockings that date back to the 1960s. This process is most apparent to the public when service is suspended on weekends and holidays, as BART works around the clock to finish this critical work. Every such project includes work that must be performed during the periods between the cessation of services late at night and the beginning of service in the early morning.

Train Control Modernization

Modernizing BART's train control system will allow trains to operate at closer intervals and at faster speeds, vitally increasing the system's capacity. The modernized train control system will enable BART to meet projected transbay demand approaching 40,000 passengers per hour in the peak hour, compared to today's demand of approximately 27,000 riders.

BART is targeting mid-2018 to award the contract, after which it will take about eight years to fully design and install the system. Throughout the duration of installation, work will occur on the right of way and in control facilities, requiring access when service is not in operation and on weekends, as well as during normal service. The project will start on a test segment of the active railway to prove the new

technology. It will then be phased into BART service to enable more frequent train service through the Transbay Tube as early as late 2023.

Traction Power Capacity Upgrade

Even though BART uses the 'cleanest' form of energy to power its train, an enormous amount of electricity is required. Increasing frequency, operating speeds, performance and capacity require greater electrical capacity and efficiency than the original system provides. Most of the elements that transmit power — miles of cabling, substations, converters, and backup supplies — are original 1972 components, and are in a state of age-related fatigue and disrepair. As BART's Fleet of the Future arrives and enables more trains to operate at one time, the need for more energy and greater efficiency will increase. Energy infrastructure replacement is both time-consuming and expensive, and its replacement is the largest and most critical portion of BART's future needs. Bringing additional power to the system will require construction and installation that can only be performed during the periods between the cessation of services late at night and the beginning of service in the early morning.

Hayward Maintenance Complex

BART's existing maintenance and storage facilities in Hayward are being expanded to accommodate the growing fleet and the system expansions currently underway, including the Santa Clara Valley Transportation Authority's (VTA) BART Silicon Valley project. The Hayward Maintenance Complex (HMC) program has two components:

- Reconfiguring the existing Hayward Yard for greater storage capacity and more efficient operation, and
- Constructing a larger primary repair shop, a new component repair shop, a vehicle overhaul shop, a new central parts warehouse, and a new maintenance and engineering repair shop.

The HMC will ensure that BART's maintenance and repair capacity is sufficient to support the new railcar fleet for both the current system and system expansions. While most of the construction activity will occur off the active tracks, there will be periods when deliveries, track modifications and system testing require uninterrupted access to the BART mainline – between the cessation of services late at night and the beginning of service in the early morning, as well as during longer periods enabled by weekend suspensions of service.

Extensions

BART is currently engaged in the completion of three extension projects, all of which will add to the volume of traffic on the system, will require expanded inspection and maintenance efforts, and will effectively reduce the duration of the periods when trains are not in operation. The activation of these extensions will additionally require testing and verification to ensure their facilities, systems and operation are seamlessly appended to the existing BART network with no detriment to existing capacity, efficiency and reliability.

- The **Warm Springs Extension** (WSX) Project adds 5.4 miles of track, extending from the Fremont Station to the new Warm Springs Station in South Fremont. Service is expected to begin via the WSX in late 2016.
- The Santa Clara Valley Transportation Authority (VTA) **Silicon Valley Rapid Transit** (SVRT) Project is a 16.3-mile extension from the new Warm Springs Station to Milpitas alongside Union Pacific Railroad tracks, continuing to 28th Street and Santa Clara Street in San Jose, then proceeding underground through downtown San Jose to the Diridon Caltrain Station and finally terminating at a new Santa Clara Station. The first phase of this project, the **Silicon Valley Berryessa Extension** (SVBX) will extend BART to serve new stations at Milpitas and Berryessa, in San Jose. Service is expected to begin via the SVBX in late 2017
- The **East Contra Costa BART Extension** (eBART) Project will provide passenger service along 10 miles of the California State Route 4 corridor connecting east of the Pittsburg/Bay Point Station. The extension will use Diesel Multiple Unit vehicles running on standard gauge tracks instead of BART's typical heavy rail trains on wide-gauge tracks, and includes two new stations and a transfer platform to provide timed transfers between eBART and traditional BART trains. While not an extension of the existing BART network as such, eBART is intended to provide convenient transfer between modes and will be operated as an integral part of overall BART service. Service is expected to begin via eBART in late 2017

Earthquake Safety

Because of the likelihood of a major earthquake, and to safeguard the public's investment in the system, BART has initiated the Earthquake Safety Program. The program is comprehensively upgrading vulnerable portions of the original BART system to ensure safety for the public and BART employees. Portions of the original system with the highest traffic are being upgraded not only for life safety but also to ensure that they can return to operation shortly after a major earthquake. The upgrades incorporate the latest seismic standards, materials and technologies to improve the structural integrity and resilience of BART facilities. Two of the key assets whose seismic upgrade will temporarily preclude service are BART's major sub-surface facilities. Work on the Trans-Bay Tube and the Berkeley Hills Tunnel must proceed uninterrupted when trains are not operating; both during late nights and early mornings, or when services via the tunnel and tube are suspended.

- **Trans-Bay Tube**: BART's Seismic Vulnerability Study indicated that if the BART system is not strengthened, it will take years to restore service after a major earthquake. The study recommended that priority be given to the Transbay Tube, where soil backfill is prone to liquefaction. Though the consequences of liquefaction on the Tube are uncertain, a worst-case scenario could cause excessive movement of the seismic joints and structural stress that could result in significant damage. Upgrade concepts include the following:
  - Vibro-replacement to compact soil backfill,
  - Increasing seismic joint capacity and sealing around joints, and
  - New concrete shear walls in the Oakland Ventilation Structure.

- **Berkeley Hills Tunnel:** The tunnel bores through the hills east of Berkeley and Oakland a distance of 3.2 miles through a variety of rock strata, most of which are soft and porous. The earthquake-active Hayward Fault intersects the tunnel about 984 feet inside the west portal (Oakland side).

2.3 Constraints from future construction projects

Future extensions and improvements may include, but not be limited to Phase II of the Santa Clara Valley Transportation Authority (VTA) **Silicon Valley Rapid Transit** (SVRT) Project, an extension of BART service to **Livermore**, and construction of a **second trans-bay crossing**. In every case, construction and maintenance of additional BART facilities should be assumed to require work during periods between the cessation of services late at night and the beginning of service in the early morning, as well as during longer periods enabled by weekend suspensions of service. This will remain the governing principle of BART's maintenance until such time, if ever, that sufficient redundancy exists to enable segments to be closed to service while other segments respond to the displaced demand.

2.4 Budget and other factors

BART has not estimated costs specifically for the provision of late night/early morning services. The incremental per-train costs to operate late-night service far exceed the marginal costs per regular-service train, as threshold levels of operations, maintenance, support, station, security and administrative staff are needed to provide the most minimal service. It is likely that the rates at which these shifts would be compensated would be higher than those paid during existing hours of BART service.

The costs of deferred maintenance, of resultant failures and loss of service would far exceed the costs of providing service during the periods reserved by design for the maintenance of every element of the system. The costs of providing late-night service are therefore irrelevant as compared to the costs of not maintaining the system as intended and required.

2.5 Considerations involved in decisions to extend rail service hours for special events

BART sometimes extends operations beyond the scheduled hours of service, given advance notice of a special event and the demand it is expected to generate. Planning for these cases is based on communication with event sponsors and other agencies, and on BART's own experience. Knowing where an event is scheduled, when the event begins and ends, and forecasts of passenger loads, BART will direct sufficient capacity via the lines that serve event venues, sometimes staging trains 'upstream' from a venue to maximize capacity in the direction of greatest demand.

BART's Operations Planning Department maintains and monitors a calendar of events throughout its service area that may require service above and beyond regularly scheduled operations. Some of these may require proactive public information and augmented staff presence in the field. Examples of such annually occurring events are New Years' Eve, the Bay to Breakers run, the Gay Pride Parade, the Outside Lands music festival, Fleet Week, and the Chinese New Year parade. BART's advance planning for these events involves transportation, maintenance, train control, security and other staff functions. Special event services may also require coordination with other transit agencies to ensure connectivity and safety beyond the normal hours of service.

BART responds to unscheduled or singular events via a similar planning process, albeit with much less advance notice. BART has executed extemporaneous planning in response to such events as team championship parades and America's Cup yacht races, often with only days of advance notice.

3. Potential for short-term or interim network improvements that could extend rail service hours

3.1 Optimizing maintenance efficiencies (including the possibility of using single-tracking or skip-stop operations to facilitate maintenance during service hours)

BART continually finds and employs means to optimize the efficient use of time available for maintenance and improvement. Opportunities to perform maintenance and improvement work in the right-of-way during service hours, however, are extremely limited.

3.1.1 Reasoning and impact

The active BART right-of-way is a hazardous workplace. Trains are in continuous operation, the third-rail traction power system is energized, the work area is necessarily constrained, and a great deal of infrastructure is compressed into the right-of-way. In addition, 36% of the right-of-way is in tunnels or tubes, and 22% is on elevated structures; both inherent hazards.

To assure the safety of its employees, contractors and the public, BART maintains stringent exclusions from its right-of-way. Work that is performed during daylight hours on conventional railroads can be performed on BART only when train operations, traction power, and other systems have been secured: during the late night and early morning. Access to the right-of-way at any time is subject to rigorous permissions and notifications.

Dual-track railroads like BART may employ "single-tracking" – operating trains in both directions via one of their two tracks – to isolate a section of track for work prohibited by the frequency of regular train traffic. Single-tracking is typically used to facilitate maintenance during periods of lightest service, to minimize schedule disruption and delay. There are segments of BART that carry trains at headways as long as 20 minutes, whether off-peak or on weekends, enabling single-track operation while work is performed. Elsewhere, and at other times, train frequencies make single-tracking less viable.

To enable extended access for maintenance, BART sometimes closes a segment of the system in both directions, and provides alternate services (i.e. bus bridge or ferry) during the closure. While this is a costly alternative, and inconvenient to our riders, BART's ambitious program of track and interlocking replacement necessitates such occasional segment closures. These projects are planned such that work the requiring closure occurs on weekends and holidays, facilitated by public information and passenger assistance.

A station may be skipped by limited or express trains, or if work requires a station's temporary closure during normal service hours. Train operations, however, require keeping traction power energized and excluding personnel from the right of way. Skip-stop operation does not therefore help expedite track or system work on main-line tracks.

3.1.2 Associated costs and timeline

BART's optimization of maintenance efficiencies is aimed at making most effective use of the scheduled times when work may be performed in the right-of way, and suspending service in the area of work only when necessary, planned, controlled, and noticed to the public. There are therefore neither costs nor timeline for any system-wide maintenance optimization that will enable maintenance work during service hours.

3.2 Infrastructure and system modernization (including the possibility of improvements that could enable limited service during maintenance windows)

The existing BART network and infrastructure leave little physical or temporal margin for additional hours of service. Displacing vital work with supplemental service during maintenance windows may be possible only in the event of a regional emergency. Such a contingency would have to far outweigh the need to maintain the safety and reliability of BART's regular service.

3.2.1 Reasoning and impact

There are few if any maintenance innovations or near-term investments that enable heavy work to be performed without access to the right-of-way. Any direct intervention in the right-of-way interferes with train operations, and many maintenance functions simply cannot be automated. Train operations must therefore be temporally separated from work in the right-of-way to maintain the service schedule and to ensure the safety of personnel, the public, and BART assets.

3.2.2 Associated costs and timeline

BART's optimization of maintenance efficiencies is aimed at making most effective use of the scheduled times when work may be performed in the right-of way, and suspending service in the area of work only when that is necessary, planned, controlled, and noticed to the public. There are therefore neither costs nor timeline for any system-wide infrastructure or system modernization, including improvements that could enable limited service during maintenance windows.

3.3 Proposed alternatives (e.g., expanded bus service)

BART engages supplemental bus (bus bridge) services only when maintenance and improvement work in the right-of-way requires access beyond the maintenance window, and can be best accomplished over extended periods of segment closure.

3.4 Additional studies or other resources needed to better understand or further explore these issues

N/A

4. Brief overview of any long-term strategy or vision for extending service hours (if available)

4.1 Themes

BART cannot extend the hours of service on its existing network.

4.2 Reasoning and impact

Extending the duration of revenue service anywhere in the system reduces the duration of the right-of-way's availability for work. Adding trains to existing lines of service and expanding the physical network both extend the duration of service and the amount of wear and fatigue on the infrastructure. Further reducing availability to provide late-night service will exacerbate this situation.

4.3 Associated costs and timeline

No such data are available.

4.4 Additional studies or other resources needed to better define this strategy or vision

Supporting data that detail BART's need for ample work time during late night and early morning have been developed by BART's Maintenance and Engineering department.

5. Conclusion

BART is among rail properties around the world that are designed such that work requiring access to the right-of-way must primarily be performed when trains are not operating. Periods of such availability are limited in number and duration, and are subject to erosion by extending the duration and length of existing services. Worker safety regulations further limit when and how work may be performed in the right-of-way.

After assuring passenger and worker safety, BART's priorities are meeting existing service commitments and accommodating burgeoning demand during regular service hours, including travel generated by new extensions. Increasing both the extent and frequency of service further stress our system and require more intense maintenance during diminishing periods of availability. Enabling service during the intervals currently reserved for maintenance would require system redundancies and operational changes of greater extent, cost and impact than the capacity enhancements we are currently striving to fund and accomplish. In this context, it is irresponsible for BART to speculate on potential improvements solely to enable the provision of late-night service.