



▶ Hayward Maintenance Complex
Sustainability and Capacity
Improvements Project

Local Partnership Program
June 2020





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2020

June 30, 2020

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Mitch Weiss
California Transportation Commission
1120 N Street, MS 52
Sacramento, CA 94814

Re: BART's Core Capacity Program: Hayward Maintenance Complex
Sustainability and Capacity Improvement Project

Dear Mr. Weiss:

On behalf of the San Francisco Bay Area Rapid Transit District, I am pleased to submit BART's request for \$25 million in funding from the 2020 Local Partnership Program (LPP) Competitive Grant Program.

The Hayward Maintenance Complex (HMC) - Sustainability and Capacity Improvement Project is a critical element of the HMC Project, one of four project components of BART's Core Capacity Program.

BART's Core Capacity Program is a comprehensive program of projects that will relieve crowding, increase ridership, and decrease greenhouse gas emissions and vehicle miles traveled by increasing the frequency and capacity of trains operating on the BART heavy rail system. The Program has four major project components: 1) the Train Control Modernization Project; 2) an additional 306 new rail cars; 3) construction of a new railcar storage yard at the HMC; and 4) six new traction power substations.

The 2020 LPP grant request is critical to funding the HMC Sustainability and Capacity Improvements Project and to achieve the sustainability and capacity benefits of the Program.

We appreciate your consideration of this application. As BART's General Manager, I have reviewed the materials submitted and approve the cost estimates provided in this application, including the amounts and fund sources cited. Please feel free to contact us with any questions or requests for additional materials if needed.

Mitch Weiss
California Transportation Commission
June 30, 2020
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Please do not hesitate to contract me or Emilia Sanchez, Group Manager of Hayward Maintenance Complex, at (510) 874-7376.

Sincerely,

A handwritten signature in blue ink that reads "Robert M. Powers". The signature is written in a cursive style with a large initial "R" and a long, sweeping underline.

Robert M. Powers
General Manager



Hayward Maintenance Complex

Sustainability and Capacity Improvements | 2020 LPP

Hayward Maintenance Complex Sustainability and Capacity Improvements

BART's Hayward Maintenance Complex (HMC) - Sustainability and Capacity Improvement Project is a critical element of the HMC Project, one of four project components of BART's Core Capacity Program.

BART's Core Capacity Program is a comprehensive program of projects that will relieve crowding, increase ridership, and decrease greenhouse gas emissions and vehicle miles traveled by increasing the frequency and capacity of trains operating on the BART heavy rail system. The Program has four major project components: 1) the train control modernization project; 2) an additional 306 new rail cars; 3) construction of a new railcar storage yard at the Hayward Maintenance Complex; and 4) six new traction power substations.

The HMC Sustainability and Capacity Improvements Project is made up of five project elements that will meet drainage requirements and add electric service redundancy to the complex.

- Rainwater Catchment
- Drainage Remediation
- Solar Thermal
- Substation F
- Civil Grading

Benefits

The HMC Sustainability and Capacity Improvements Project are necessary to achieve the sustainability and capacity benefits of the Program.

Delivery Schedule

Project	2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Rainwater Catchment	Contract Prep		Design/Build					
Drainage Remediation	Design		Contract Prep		Construction			
Solar Thermal	Contract Prep		Design/Build					
Substation F	Design	Contract Prep	Construction					
Civil Grading	Contract Prep		Construction					

Cost Estimate

BART is requesting \$25 million to fully fund the Hayward Maintenance Complex Sustainability and Capacity Improvements project. The estimated cost for the HMC Sustainability and Capacity Improvement Project is approximately \$93.3 million.

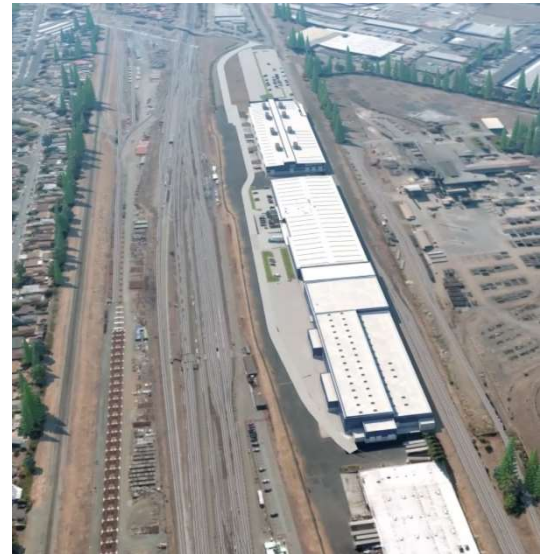


I. Project Overview

BART is submitting this application for the 2020 Local Partnership Competitive Program (LPP) for the Hayward Maintenance Complex (HMC) Sustainability and Capacity Improvements Project. This grant proposal is for \$25 million in 2020 LPP funds to fully fund the HMC Sustainability and Capacity Improvement Project. The estimated cost for the HMC Sustainability and Capacity Improvement Project is approximately \$93.3 million.

Project Description

The HMC Sustainability and Capacity Improvement Project is a critical element of the HMC Project, one of four project components of BART's Core Capacity Program.



BART's Core Capacity Program (Program) is a comprehensive program of projects that will relieve crowding, increase ridership, and decrease greenhouse gas (GHG) emissions and vehicle miles traveled (VMT) by increasing the frequency and capacity of trains operating on the BART heavy rail system. The Program has four major project components: 1) the train control modernization project (TCMP); 2) an additional 306 new rail cars; 3) construction of a new railcar storage yard at the HMC (HMC Project); and 4) six new traction power substations.

The 2020 LPP grant request is critical to funding the HMC Sustainability and Capacity Improvements Project and to achieve the sustainability and capacity benefits of the Program.

HMC is one of four rail vehicle maintenance yards serving the BART system with train storage, train washing, and general maintenance facilities for the BART fleet. BART's legacy fleet of 669 cars can all be stored at the four existing yards and serviced at the existing vehicle maintenance shops. As the fleet expands to meet future needs for the Program, additional maintenance and storage will be necessary to accommodate the expected number of cars; and minimize non-revenue train movements to begin and end daily service. BART's HMC Project will increase the maintenance and storage capacity of the Hayward Yard by 250 rail cars. The HMC Sustainability and Capacity Improvement Project is critical to meet the demands required by the additional 250 rail cars that will need to be serviced and stored at the Hayward Yard. The existing facility cannot accommodate the expansion without the required sustainability and capacity improvement projects.

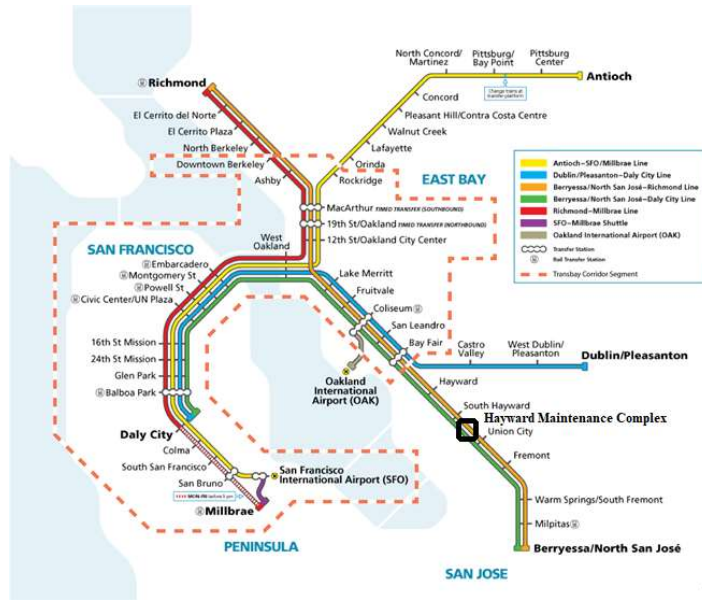
BART is committed to advancing regional sustainability by providing safe, affordable, equitable, and environmentally-friendly transit to move people to jobs, recreation and services. BART incorporates cost-effective sustainability through fulfillment of the goals found in the BART's Sustainability Policy that was adopted in 2017. The HMC Sustainability and Capacity Improvement Project takes BART's sustainability policy goals into account by using water, energy and other resources efficiently. The HMC Sustainability and Capacity Improvements Project currently is focused on meeting drainage requirements and adding electric service redundancy to the complex.





BART is maximizing the opportunity to implement sustainable technologies and meet the state’s goals of reducing Green House Gas (GHG) production and increasing the water supply. With this application, BART is requesting \$25 million to fully fund the Hayward Maintenance Complex Sustainability and Capacity Improvements project.

The estimated cost for the HMC Sustainability and Capacity Improvement Project is approximately \$93.3 million. Matching funds include BART Measure RR (a \$3.5 billion general obligation measure passed by the voters in November 2016), BART Capital Allocations, and FTA Capital Investment Grant.



Project Scope

The HMC Sustainability and Capacity Improvements Project is made up of five project elements that will meet drainage requirements and add electric service redundancy to the complex.

- Rainwater Catchment
- Drainage Remediation
- Solar Thermal
- Substation F
- Civil Grading

Rainwater Catchment

This rainwater catchment element of the HMC Sustainability and Capacity Improvements Project presents a unique convergence of a large supply of non-potable water with a large demand for non-potable water.

In a normal year, the runoff of the project’s three Costco-sized buildings will receive 2.8 million gallons in rainfall. The existing Train Car Wash (Train Car Wash) uses approximately 6,000 gallons per day to wash the 153-car fleet. The Component Repair Shop is projected to use 2,000 gallons per day to supply spray stations and parts washers. By collecting the roof runoff of the three buildings, this water demand can be met on site.



Rainy season runoff would be stored in a modular tank near Whipple Road to supply the Train Car Wash. Water can thus flow from the roofs to the modular tank and from the modular tank to the Train Car Wash purely by gravity. The relation of the onsite supply and demand is illustrated in Figure 1 below.

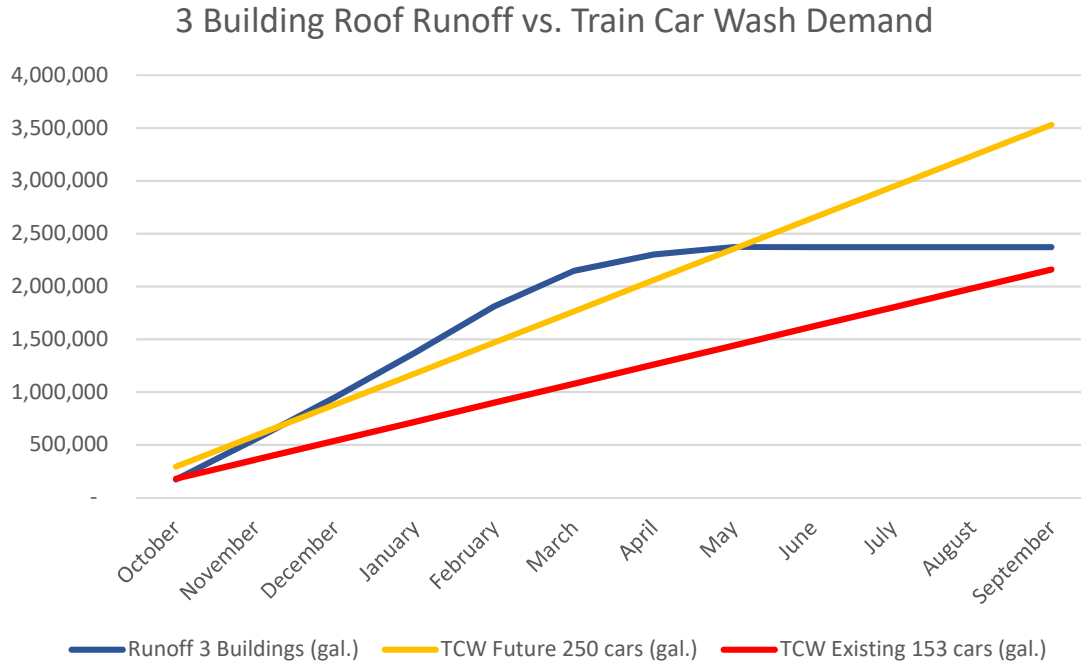


Figure 1: Three-Building Runoff vs. Train Car Wash Demand

One section of the roof of the Component Repair Shop (CRS) is not high enough to send water to the modular tank. This water will be stored in a series of vertical tanks on the west side of the building and supply the CRS spray stations and parts washers. Wash water demand at the CRS is expected to grow to 2,000 gallons per work day. The wash water demand will outstrip supply at the CRS as illustrated in Figure 2 below. The figure understates the water available at the CRS for reasons that will be explained in the Solar Thermal component of this Project Scope . This will reduce the metered usage of water used by BART.



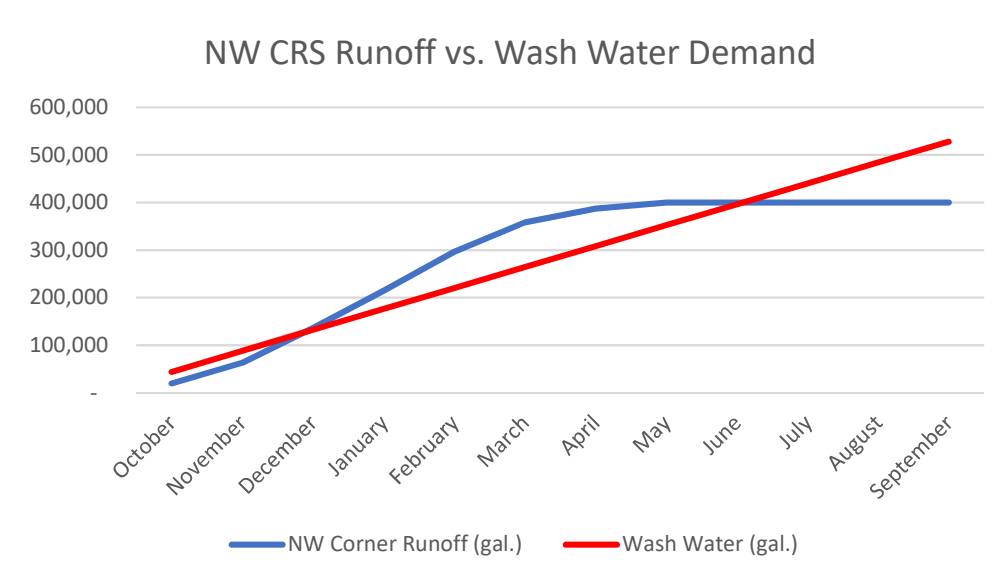


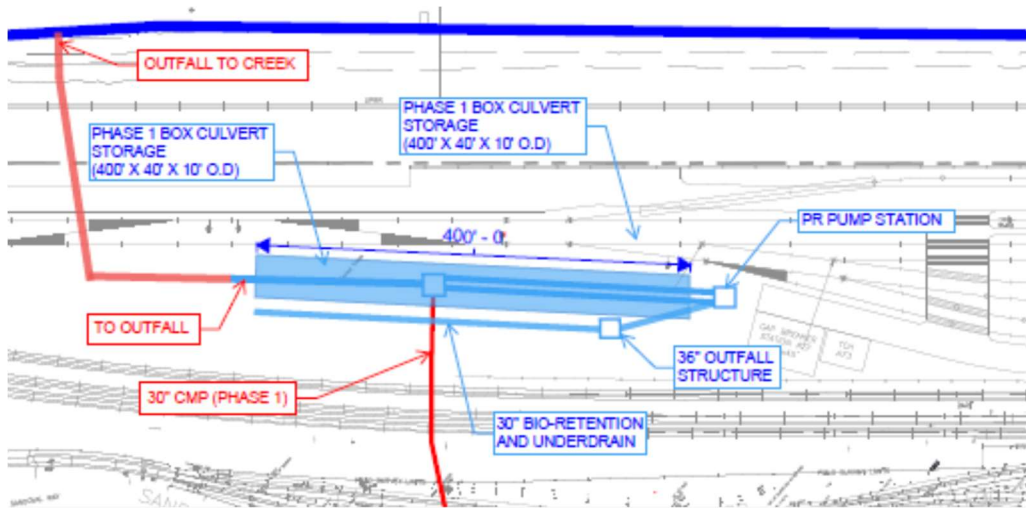
Figure 2: CRS Runoff Supply vs. Washwater Demand

The rainwater catchment system would also reduce BART’s operating costs. In a normal year’s amount of rainfall, the system would save \$20,000 in water costs. Maintenance costs for the system were quoted by rainwater design/build/maintain contractors at \$1,500 for the expected single annual visit.

Drainage Remediation

In 2015, BART acquired a 28-acre parcel of land that included four previously constructed buildings that will become the new Hayward Maintenance Complex. Since the facilities were built in the 1970s, they currently do not meet state Water Board requirements. To meet the state Water Board drainage requirements, BART must construct an outfall structure and install a bio-retention facility to retain and treat the surface stormwater runoff. This portion of the HMC Sustainability and Capacity Improvements Project includes a water storage and filtration system to serve the west side of the mainline tracks of the Hayward Maintenance Complex. In this component, water would flow from west to east under the tracks to the bioretention area. The storage facility would consist of four side-by-side box culverts, cross-connected to act as a single storage volume. The culvert dimensions would be approximately 8 feet by 8 feet by 400 feet long and would provide approximately 100,000 cubic feet of storage. Stormwater runoff from the west side would flow to a bypass structure. West side flows would be conveyed to a pump station and stored in the box culverts. Once the storm has passed, and there is available capacity in the bioretention basin, the pump station would discharge the west side flows into the bioretention area for water quality treatment and eventual discharge to the eastern side creek. Flows released from the bioretention basin are classified as treated stormwater by the Water Board and can be released into receiving waters of the State. Pump stations and piping for this component would be provided as part of the project.





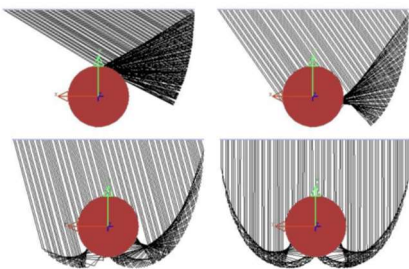
Solar Thermal

BART further hopes to create an environmentally benign way of evaporating its oily wastewater onsite by switching an evaporator’s fuel source from natural gas to solar. The oily wastewater comes from the CRS building’s four spray stations and six parts washing machines. The washing machines clean parts like gears, axles, and wheels. The CRS building currently has two evaporators that are projected to process 2,000 gallons of oily wastewater each workday.



The XCPC

- The XCPC uses non-imaging optics to track the sun, while the XCPC hardware remains stationary



The evaporator would be fueled with a new type of solar collector developed at the Advanced Solar Research Institute at UC Merced. This type of collector (External Compound Parabolic Collector, XCPC) can focus sunlight on a vacuum tube throughout the day without requiring tracking equipment. This reduces both the capital and maintenance costs of the collectors. BART’s installation will hopefully stimulate the use of a technology for which the state has already made a substantial investment.

The proposal also includes a condensation system to recover the water vapor and distribute the hot water to the spray stations and parts washers. This will facilitate the recovery of both the water and thermal energy. This will provide an additional source of water for the CRS building to supplement the rainwater supply illustrated in the figure above.

The solar thermal system would save about \$77,000 in avoided natural gas costs annually. The solar thermal system could also be maintained by one visit per year at a cost of about \$700. The conversion to a solar-fueled evaporator would reduce the maintenance costs. Since the solar heat operates at a lower temperature than the current natural gas flame, less scale will build up on the evaporator tank wall. By comparing the maintenance costs of the evaporator scale removal and adjusting for the greater capacity of the CRS evaporator, it is estimated the solar thermal system would save about \$36,000 per year in avoided maintenance costs.





Substation F

The BART Facilities Standards requires all facilities to have two independent sources of power, one primary and one secondary. The secondary power source ensures continuous facility operation in case the primary power source goes down for an extended period of time. This funding will add a new Substation, Substation F, for HMC to provide the required secondary source through power from the 34.5kV traction power system.

The primary power source to the new HMC facilities will come from the PG&E 12 kV distribution system. New facilities include the following:

1. Vehicle Overhaul and Heavy Repair Shop (VOHRS)
2. Component Repair Shop (CRS)
3. Central Warehouse (CW)
4. Maintenance & Engineering (M&E) Shop

In addition to servicing the new HMC facilities, Substation F will also service existing Hayward Yard facilities, such as the Main Shop, Control Tower, S&I building, motor shop, carwash station and gap breaker AZD. These existing facilities are powered by the existing Substation E only, and currently do not have a secondary power source. Substation F will provide a secondary source by connecting directly to existing Substation E and rerouting cables as necessary for the installation.

The new HMC facilities are expected to operate interdependently with the existing Hayward Yard facilities. By providing a secondary power source to both the new and existing facilities, Substation F will ensure continuous maintenance operations across all facilities in the event of a long-term power outage from the primary power source.

Civil Grading

Civil Grading would be the site preparation work that completes the Vehicle Storage Yard project, as described and evaluated in the Hayward Maintenance Complex (HMC) Project Final Initial Study and Mitigated Negative Declaration (SCH# 2010122013) approved in 2011 which support maintenance and operation of BART's rail transit service in the San Francisco Bay area. Similar to any other Transit and active transportation projects, civil grading is expected to reduce Vehicle Miles Traveled (VMT) and aligns with each of the three statutory goals contained in SB 743 by reducing GHG emissions, increasing multimodal transportation networks, and facilitating mixed use development.

While the HMC design is oriented to sustainability, BART also intends to use sustainable methods to execute construction. BART has found a way to repurpose the 763 truckloads, assuming an average truck capacity of 15 cubic yards per truck, or approximately 11,445 cubic yards of surplus soil onsite. This will eliminate the trucking that would otherwise be needed to remove the soil. As a result, there will be fewer vehicle trips related to heavy construction equipment and construction worker trips during the construction phase; and less disturbance to the local roads and residences adjacent to the project site.





A traffic analysis was done to evaluate potential transportation impact as defined in the recent updates to the California Environmental Quality Act (CEQA) during construction. Therefore, the State’s Technical Advisory identifies that construction of the proposed HMC project is unlikely to result in a substantial or measurable increase in VMT, and the transportation impact for the purposes of CEQA would be less than significant.

Project Background/Purpose and Need

In 2016, the Bay Area became the fifth largest metropolitan region in the US.¹ In 2010, the nine-county region was home to more than 7.6 million people and 3.7 million jobs. Some 300,000 jobs are located in San Francisco’s central business district alone, the fourth largest central business district in the country.² The Bay Area’s economy is healthy and growing, and downtown San Francisco is undergoing large construction projects that will increase office space and enable the city to add more jobs. By 2040, the region expects 9.3 million residents and 4.5 million jobs³ to be located here.

Prior to COVID-19, MTC conducted analysis that was profiled in Vital Signs, describing the region’s economic boom that has pushed freeway congestion levels to record highs for the fourth consecutive year⁴. Freeway delays due to congestion have increased 9 percent from 2015, averaging 3.6 minutes per commuter in 2017. Notably, regional traffic congestion is significantly worse compared to previous economic booms. Since the peak of the dot-com boom in 2000, per-commuter congested delay has skyrocketed by 64 percent, while population has grown by 13 percent and jobs have grown by 8 percent. This trend is particularly noticeable for Bay Area drivers given that nearly all of the growth in gridlock has occurred during the last four years. Commuters are likely also experiencing delays on arterials and local roads, although there is insufficient data to quantify these trends.

As the Bay Area’s second largest transit network, BART currently operates and maintains 50 stations and 112 miles of revenue track, serving over 440,000 passengers every weekday in the counties of Alameda, Contra Costa, San Francisco, San Mateo and Santa Clara.

The HMC project is a critical part of BART’s efforts to meet the long-term surge in demand. The facilities included in this proposal are vital to increasing the site’s capacity from 153 to 250 cars while also taking advantage of a rare opportunity to make use of a substantial amount of stormwater to meet onsite needs for non-potable water demand. The rainwater catchment system will displace about 2.8 million gallons of water that would otherwise come from the Hetch Hetchy Water System. The solar thermal system will displace 362 tons of CO₂ that would otherwise be generated in the boiling of 2,000 gallons of wastewater each day. These facilities will thus ensure that these vehicles are maintained in an environmentally sustainable way.

¹ Census – San Jose-San Francisco – Oakland, CA Combined Statistical Area

² As of 2010, American Community Survey 2006-2010

³ https://mtc.ca.gov/sites/default/files/2-The_Bay_Area_In_2040.pdf

⁴ <http://www.vitalsigns.mtc.ca.gov/time-spent-congestion>



Concurrence with MTC’s Regional Transportation Plan and Sustainable Communities Strategy

In July 2017, MTC adopted an update to its Regional Transportation Plan, called Plan Bay Area 2040⁵. Drawing on the priorities of the previous regional plan, Plan Bay Area 2040’s investment priorities for the next 24 years are to operate and maintain the existing transportation system, modernize transit and roadways, and expand the system in strategic locations to accommodate growing job centers and Priority Development Areas. In the Bay Area, Plan Bay Area 2040 serves as the region’s Sustainable Communities Strategy (SCS), as required by Senate Bill 375, and integrates transportation, land use and housing to meet greenhouse gas reduction targets set by the California Air Resources Board (CARB).

Plan Bay Area’s Key Transportation Strategies, Investments and Projects

Plan Bay Area 2040 develops a blueprint for short-term and long-term transportation investments to support the plan’s focused growth strategy. Investment priorities for the next 24 years reflect a primary commitment to “Fix It First.” As shown in Figure 3, approximately 90 percent of Plan Bay Area 2040’s investments focus on operating, maintaining and modernizing the existing transportation system. Plan Bay Area 2040 also directs almost two-thirds of future funding to investments in public transit, mostly to ensure that transit operators can sustain existing service levels through 2040.

Figure 3: Plan Bay Area 2040’s top ranked projects

Rank	Project	Investment* (\$ Billions)
1	California High-Speed Rail (Bay Area Segment)	\$8.5
2	Regional Express Lanes	6.0
3	BART to Silicon Valley (Phase 2)	5.5
4	BART Transbay Core Capacity Project + BART Metro Program	4.6
5	Caltrain Extension to Transbay Transit Center**	4.1
6	Caltrain Electrification (Phase 1)	2.4
7	Clipper	1.7
8	San Francisco Muni Fleet Expansion	1.3
9	Bay Area Forward	1.0
10	Treasure Island Mobility Management Program	1.0

* Investment values are costs within the plan period and include operating expenses; shown in year-of-expenditure dollars.

** Does not include \$109 million already expended on the project.

Plan Bay Area 2040 establishes a vision for the Bay Area that closely aligns with the broad goals of the State of California. The plan’s goals to promote economic vitality, ensure social equity and protect the environment link to the policy framework established in California Transportation Plan 2040 by the California Department of

⁵ Plan Bay Area 2040: <http://2040.planbayarea.org/what-is-plan-bay-area-2040/>





Transportation. Central to both plans are carbon dioxide (CO₂) emissions reduction targets designed to tackle climate change in the years to come. Similarly, both plans prioritize fixing an aging transportation system, focusing future growth and directing increased funding toward non-auto modes of travel. Both multi-year planning efforts reflect a relatively consistent vision for moving forward for the region’s 8 million people and the state’s 39 million people. The key to implementation will be working together across local, regional, state, and federal levels to achieve these shared goals.

II. PROJECT DELIVERY PLAN

Project Schedule

BART has developed a schedule to coordinate delivery of the five Project elements to complete the HMC Sustainability and Capacity Improvements project. The Project has been sequenced to deliver all five component projects concurrently to minimize the overall Project duration and bring the benefits to fruition as quickly as possible. As shown on Figure 4, the drainage, Substation F, and Grading work contain the longest schedule duration in the Project; accordingly, the Project critical path extends through these elements.

Since they are well outside of BART’s normal purview, the Rainwater Catchment and Solar Thermal elements are better suited to be constructed through design/build contracts. The other projects, however, are quite unique to BART and are better managed with a Design, Bid, Build approach.

Figure 4: HMC Sustainability and Capacity Improvements Delivery Schedule

Project	2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Rainwater Catchment	Contract Prep		Design/Build					
Drainage Remediation	Design		Contract Prep	Construction				
Solar Thermal	Contract Prep		Design/Build					
Substation F	Design	Contract Prep	Construction					
Civil Grading	Contract Prep		Construction					

Project Status

Preliminary designs, at a minimum, have been prepared for each of the project elements.

1) Rainwater Catchment system - This will be a design-build contract. The development of the schematic design has been under development for a few years. A concept plan, cost estimate, and schedule have been prepared by HMC consultants. Within a few months of grant approval this contract could go out to bid.





2) Drainage Remediation - A preliminary design of the remaining proposal drainage work has been developed as part of the ongoing HMC drainage analysis. A final design remains to be prepared. Within a year of grant approval this design can be completed and advertised.

3) Solar Thermal - A preliminary design of the solar thermal system was done by the manufacturer of the solar collectors. A cost estimate and schedule were prepared by a solar thermal contractor. Within a few months of grant approval this contract could go out to bid.

4) Substation F - The design Substation F has been development and is currently at 90% design. Within a few months this project can be advertised and ready for bid.

5) Civil Grading – This project is at 100% design and will be ready for advertisement and bid with in the next few months. It will be ready to award shortly after grant approval.

All projects have either started or completed the environmental process requirements. It is expected that the environmental clearance of the Rainwater Catchment, other drainage can be completed before construction starts. The solar thermal system, Substation F, and the grading were included in earlier environmental reviews.

The HMC Sustainability and Capacity Improvements project will take place entirely within publicly owned transportation right-of-way, which is already owned by BART.

BART Project Management Capability

Since the 1950s when planners, elected officials and engineers designed and built the original BART system, BART has amassed a proven track record of successfully delivering large-scale, complex projects, including system extensions, new stations to existing lines, a billion-dollar earthquake safety retrofit project, major system upgrades, and other state-of-good repair projects.

As a recent example, in March of 2017, BART service was extended south 5.4 miles from the Fremont Station to a new station in the Warm Springs district of Fremont in southern Alameda County (the “Warm Springs Extension”). The Warm Springs Extension alignment is mostly at-grade; however, it runs beneath Fremont Central Park in a mile-long cut and cover subway. The project funding plan for the \$890 million extension included substantial contributions from a variety of local and State sources and surplus revenues from the BART SFO Extension; the project had no federal funding. The project was implemented via two major contracts: the \$137 million Fremont Central Park Subway contract which was begun in August 2009 and completed on schedule and within budget in April 2013; and the \$299 million design-build Line, Track, Station and Systems (“LTSS”) contract which was begun in October 2011 and was completed approximately \$100 million under budget.

BART has also successfully added new rail services using non-BART technology, further demonstrating the agency's engineering and project management expertise. Both the Oakland Airport Connector (opened in 2014) which provides rail service from the Oakland Coliseum BART station to the Oakland International Airport, and a new rail service extension called the Bart to Antioch/East Contra Costa Rail Extension which extends ten miles from the Pittsburg/Bay Point BART line to the City of Antioch, operate using non-BART technology (cable-propelled people mover, and diesel multiple unit, respectively).





Project Cost Estimate

The total estimated project cost for the HMC project is approximately \$93.3 million. Of that amount, \$67.5 million is committed, and includes FTA Capital Investment Grant (CIG) and Measure RR GO bond funds. The solar thermal project is eligible for \$800,000 in California Solar Initiative (CSI) funding. These funds are acquired by the contractor by making a reservation before construction begins.

HMC consultants and a contractor developed the cost estimates in Table 1 below.

Table 1: HMC Sustainability and Capacity Improvements Project Cost Estimates

HMC Sustainability and Capacity Improvements Project Elements			
Elements	Grant Request (\$M)	Local Match (\$M) CIG/RR	CSI Fund (\$M)
Drainage Remediation	\$3.0		
Rainwater Catchment	\$5.0		
Solar Thermal	\$1.5		\$0.8
Substation F	\$15.5		
Civil Grading		\$67.5	
Total	\$25.0	\$67.5	\$0.8

Leveraged Funds

The proposed \$25 million investment in 2020 LPP funds in the HMC Sustainability and Capacity Improvements Project represents approximately 27% of the total cost of \$93.3 million. Every dollar of 2020 LPP funds spent on the HMC Sustainability and Capacity Improvements Project leverages approximately 3.7 dollars in other federal, state and local funds.

Delivery Risks

As part of the Core Capacity Program, BART has conducted a thorough analysis of the risks in fully delivering the program and has outlined specific mitigation strategies to minimize the risk. A more complete summary of the potential delivery risks can be provided upon request.

Financial Capacity

As demonstrated above, BART has the project management skills, professional expertise and financial means to deliver this project, assuming funding is secured. Any cost overruns would be born solely by BART, paid for with BART fare revenues, additional funding through its Measure RR program, or other sources.



III. Project Benefits

Cost Effectiveness

An economic benefit-cost analysis (BCA) of the Program was conducted using a model developed by WSP that incorporates the parameters outlined in Caltrans' Life-Cycle Benefit-Cost Analysis Model 7.26.2 (Cal-B/C v.6.2). Because the different components of the Program work together to generate the capacity improvements, the BCA evaluates the costs and benefits of the entire Program. The analysis shows that the Program will generate an estimated \$3.5 billion in present-value benefits (2016\$) over its expected useful life of 20 years, exceeding the expected Program costs (capital and O&M) of \$2.17 billion (discounted 2016\$). With a benefit-cost ratio (BCR) of 1.6, the total Program is expected to generate economic benefits that outweigh its costs. Table 2 outlines the results of the BCA over the full life of the Program and in its first 20 years of operation. An Excel spreadsheet of the BCA model and supporting documentation is available in Appendix III.

Table 2: BCA Summary Results

INVESTMENT ANALYSIS		SUMMARY RESULTS			
Life-Cycle Costs (mil. \$)	\$2,167.2				
Life-Cycle Benefits (mil. \$)	\$3,553.3				
Net Present Value (mil. \$)	\$1,386.2				
Benefit / Cost Ratio:	1.6				
Rate of Return on Investment:	8.5%				
Payback Period:	7 years				
MONETIZED BENEFITS (mil. \$)		Passenger Benefits	Freight Benefits	Total Over 20 Years	Average Annual
Travel Time Savings		\$850.9	\$0.0	\$850.9	\$42.5
Veh. Op. Cost Savings		\$2,055.4	\$0.0	\$2,055.4	\$102.8
Accident Cost Savings		\$550.9	\$0.0	\$550.9	\$27.5
Emission Cost Savings		\$96.2	\$0.0	\$96.2	\$4.8
TOTAL BENEFITS		\$3,553.3	\$0.0	\$3,553.3	\$177.7
Person-Hours of Time Saved				63,543,085	3,177,153
Should benefit-cost results include:					
1) Induced Travel? (y/n)	<input checked="" type="checkbox"/> Y				
2) Vehicle Operating Costs? (y/n)	<input checked="" type="checkbox"/> Y				
3) Accident Costs? (y/n)	<input checked="" type="checkbox"/> Y				
4) Vehicle Emissions? (y/n)	<input checked="" type="checkbox"/> Y				
includes value for COze					
EMISSIONS REDUCTION		Tons	Value (mil. \$)		
		Total Over 20 Years	Average Annual	Total Over 20 Years	Average Annual
CO Emissions Saved	12,029	601	\$0.5	\$0.0	\$0.0
CO ₂ Emissions Saved	3,330,496	166,525	\$87.3	\$4.4	\$4.4
NO _x Emissions Saved	607	30	\$5.8	\$0.3	\$0.3
PM ₁₀ Emissions Saved	3	0	\$0.2	\$0.0	\$0.0
PM _{2.5} Emissions Saved	18	1			
SO _x Emissions Saved	33	2	\$1.2	\$0.1	\$0.1
VOC Emissions Saved	497	25	\$0.3	\$0.0	\$0.0

The increase in ridership and the corresponding decrease in VMT described in previous sections will result in fewer greenhouse gas emissions, fewer automobile crashes, and lower vehicle operating costs, which have been estimated and monetized using the parameters laid out in Cal-B/C v. 7.2. The travel time savings calculation assumes that the change in headway from 15 minutes to 12 minutes will result in the average current rider waiting 90 seconds fewer per trip (half of the decrease in headway). This figure does not account for additional time savings from reduced delays and reduced passenger queuing. Travel time changes for new riders were not included in the analysis.

Water Supply Benefits

Under a normal year's rainfall, the project's Rainwater Catchment system will displace 2.8 million gallons of municipal water ultimately coming from the Hetch Hetchy Water System. The HMC facilities' convergence of a



large supply of non-potable and a large demand for non-potable water represent a rare opportunity for water conservation for the region and state that should be taken advantage of.

Air Quality Benefits

For detailed methodology and results of the GHG analysis, please see Appendix IV. GHG Emissions Modeling and Methodology. The excel version of the GHG emissions model is included in this application and is named “CoreCapacity_Vehicles_calc.” Results of this analysis and some inputs are shown in this section.

Consistent with California Air Resources Board’s (ARB) *Quantification Methodology for the California State Transportation Agency Transit and Intercity Rail Capital Program*, CO₂e emissions reductions for the first operational year (Yr1 - 2031) and the final operational year (YrF - 2080) of portions of the Core Capacity Program were estimated based on Program operating data. GHG emissions reductions rely on the increased ridership estimates detailed in Appendix V. Ridership Modeling and Methodology.

Table 3 summarizes the lifetime CO₂e reductions, which were quantified assuming a 50-year Program life. The Core Capacity Program life of 50 years is based on the expected service life of all elements of the BART Core Capacity Program.

Results are presented in terms of total GGRF funds requested per metric ton CO₂e reduced and lifetime CO₂e reductions and of total GGRF funds requested.

Table 3: GHG Model Results

Pollutant	Total Project Reductions
Total GHG Reductions	6,767,159 MTCO ₂ e
Total GHG Emission Reductions/Total GGRF Funds Requested (MTCO ₂ e/\$)	.015485 MTCO ₂ e /\$
Passenger VMT Reductions	31,819,818,205 miles
Reactive Organic Gases (ROG)	205,396 lbs ROG
Oxides of Nitrogen (NO _x)	1,434,835 lbs NO _x
Fine Particulate Matter (PM _{2.5})	1,290,671 lbs PM _{2.5}
Diesel Particulate Matter (DPM)	1,598 lbs DPM

Based on the total GHG reductions over the lifetime of the Program (6,767,159 MTCO₂e), the following equivalencies are shown for the Core Capacity Program⁶:

- Over 700 million gallons of gas
- Over 7 billion pounds of coal
- Nearly 800 thousand homes’ energy use for 1 year
- Over 15 million barrels of oil
- Additionally, GHG reductions from the Core Capacity Program is equivalent to carbon sequestered by:
- Over 100 million seedlings grown for 10 years
- Nearly 9 million acres of US forests in one year



Regional 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 businesses with a larger pool of workers. Commuters traveling into San Francisco save on average 30 minutes each direction compared to driving. Commuters traveling to downtown Oakland save 7 minutes on average compared to driving and those traveling to Pleasant Hill save 30 minutes on average.¹¹ These travel time benefits 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 the West Dublin/Pleasanton station.⁶ Without investments in BART capacity to serve these important travel markets, the Bay Area’s economic competitiveness would suffer. Many new jobs would go to regions that enjoy shorter travel times and less crowding.

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 the region’s growth.

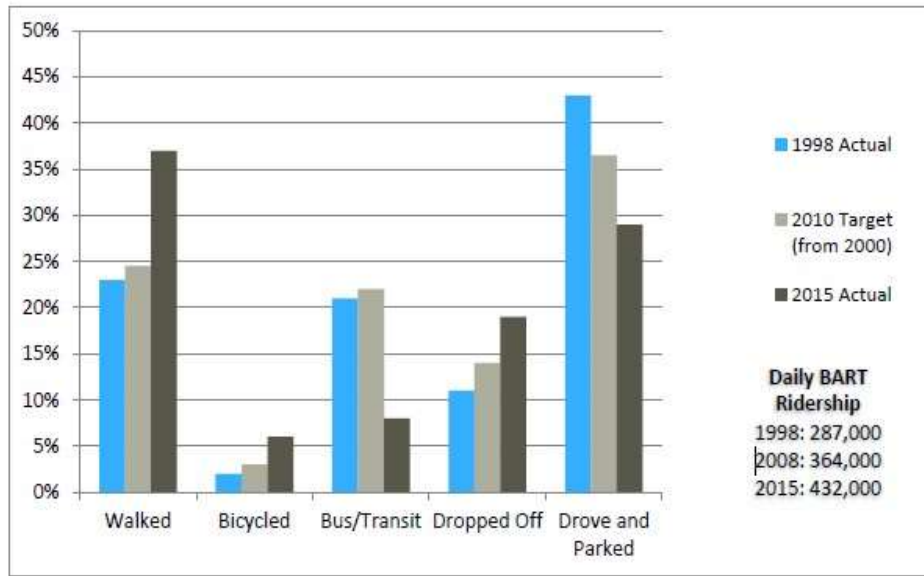


Active Transportation

BART proactively supports projects and programs that encourage and support riders to access the BART system by walking and bicycling. BART regularly uses existing revenues and grant funds to improve pedestrian walkways, lighting and signs and to provide secure bicycle parking at or near its stations. In 2018, over 35 percent of BART riders accessed stations by bicycling and walking (Figure 5). By increasing ridership, the Program will likely result in a proportional increase in bicycling/walking trips to BART stations.

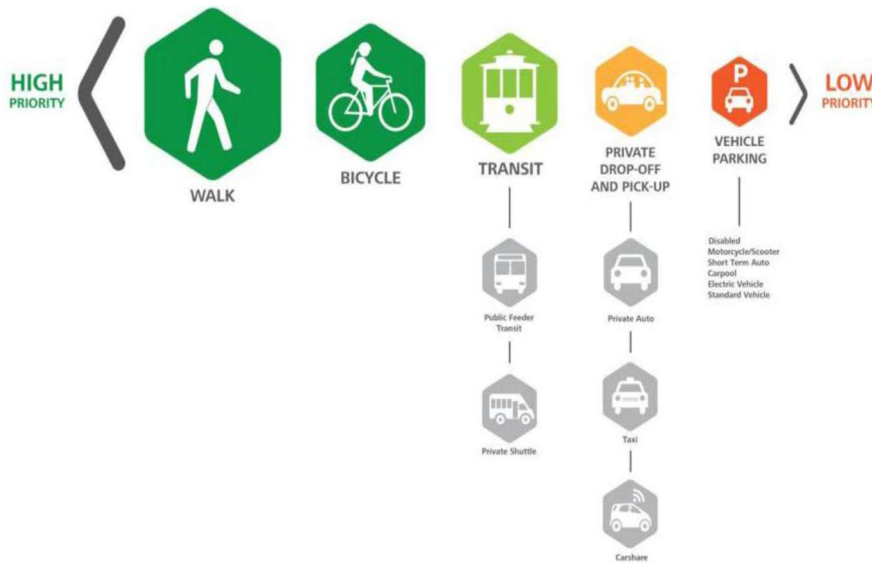
⁶ Economic Impacts of BART Operations, ALH Urban & Regional Economics, September 2015.

Figure 5: BART Station Access Mode Share



To encourage alternative access modes, BART has revised its Station Access Policy, which prioritizes investments to improve active transportation mode share and safety. With a clear focus on improved access, BART anticipates that the percentage of riders who use active transportation to reach BART will be even greater in the future. Figure 6 depicts BART’s station access investment priorities, with walking and bicycling receiving the highest investments of all access types.

Figure 6: BART Station Access Investment Priorities





In addition, the newly designed train cars include bicycle storage areas, making it easier for riders to get to their destinations by bicycle once they have arrived at their stop. This improvement will help facilitate growth in bicycle station access.

Improved Public Health

The Program will improve public health by increasing ridership and improving regional air quality. By making BART service more comfortable, reliable, and convenient, the Program will support ridership growth that displaces automobile travel. Reducing the number of miles driven by vehicles in the Bay Area improves air quality by reducing criteria pollutant emissions, which will improve respiratory health and other impacts throughout the region. Reductions in criteria pollutants is particularly important for communities located along high-traffic roadways. Since 30 percent of BART stations are located within a disadvantaged community, and many more stations serve DACs (are within a half mile), the public health benefits of the Program are largely concentrated in these areas. Overall, the increase in BART riders accessing the stations by modes other than automobile supports an active lifestyle. Please see Section III: Project Benefits, Air Quality Benefits for details on quantified GHG emissions benefits and reductions in VMTs due to the Program.

IV. Community Impact

The many disadvantaged communities (DACs), low income communities, and other minority or at-risk communities located along the BART system will benefit from the increased frequency, greater capacity and reduced crowding gained from the Core Capacity Program.

According to the California Air Resource Board’s Funding Guidelines⁷, the Core Capacity Program is classified as a Transit project, as it will achieve GHG reductions by reducing passenger vehicle miles travelled (VMT) through operational improvements, including increased service frequency and safety. Additionally, the Program qualifies for ARB funds because of the following criteria:

The Program serves multiple disadvantaged communities along or within a half mile of the BART system. See Figure 15 for a map showing DACs along the BART alignment.

BART has and will continue to host community meetings, as part of the planning process to engage residents and community groups for input on community and household needs and will continue to provide documentation showing how the input will be considered and addressed.

The Program provides improved transit service for stations and stops within multiple AB 1550 communities on the BART system.

BART utilizes MTC’s definition of “communities of concern” in defining Disadvantaged Communities (DAC). MTC’s definition is intended to represent a diverse cross-section of populations and communities that could be considered disadvantaged or vulnerable in terms of both current conditions and potential impacts of future growth. For Plan Bay Area 2040, the definition of communities of concern included all census tracts that have a

⁷ https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2017_draft_funding_guidelines.pdf



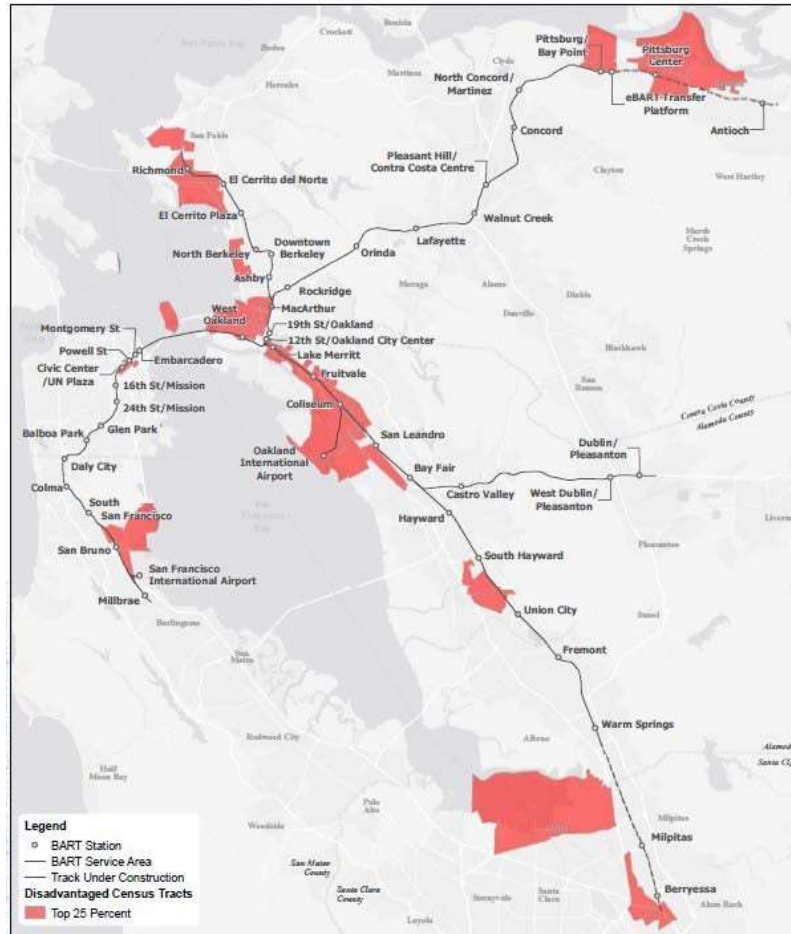
concentration of BOTH minority AND low-income households at specified thresholds of significance, or that have a concentration of three or more of six additional factors if they also have a concentration of low-income households. Among the additional factors are people with disability, seniors 75 years and over, and cost-burdened renters.

The Core Capacity Program includes fifteen BART stations located directly within disadvantaged communities, which is equal to 30% of all stations.

Figure 7: Disadvantaged Communities located within half mile of BART System

Program Benefits to Disadvantaged or Low-Income Communities

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. Likewise, riders are as racially and ethnically diverse as the Bay Area’s population. Moreover, BART offers an essential travel option for people with disabilities, for youth and seniors, for those living in households without access to a car, and 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 is accessible to all.



All riders will benefit from increased service, fewer system delays and less crowded trains. Members of disadvantaged communities often depend on transit services more than other populations for access to work, medical appointments, school and social activities, and therefore stand to benefit greatly by the increased service. Potential impacts of the construction of the project will be minimized by a robust outreach program notifying residents of construction activity, the implementation of “bus bridges” when stations are temporarily out of service, and other measures that will assist our riders with their BART journey.





Community Engagement

BART's Public Participation Plan (PPP) was developed in 2011, with an update in 2015, and followed extensive outreach throughout the BART service area and guides the organizations ongoing public participation endeavors. The PPP ensures that BART utilizes effective means of providing information and receiving public input on transportation decisions from low income, minority and limited English proficient (LEP) populations.

As recommended in the PPP, BART has implemented a variety of outreach techniques for projects related to the Core Capacity Program. In 2014, BART launched its "Fleet of the Future" outreach campaign to obtain public feedback on the design of BART's new vehicles. A series of ten events were held at BART stations and in local communities throughout the San Francisco Bay Area. Approximately 17,500 people attended the events and a total of 7,666 surveys were collected. BART staff consulted regularly with members of the disability community including its the BART Accessibility Task Force (BATF), on the design and functionality of the new BART trains. The BATF provided hands-on feedback on all aspects of the car design.

Outreach related to the 2014 BART Vision Plan engaged over 2,000 people in exploring the tradeoffs involved in considering how BART can meet its future needs. The public helped BART staff narrow down future projects and investments BART should focus on by determining which ones are most important to the public and fit best into BART's goals of serving the Bay Area for years to come. A total of ten in-station events were held and a total of 2,551 surveys were collected.

BART's Title VI/Environmental Justice Advisory and Limited English Proficiency Advisory committees meet regularly to assist BART on all issues of policy with a focus on meeting the needs of minority and disadvantaged communities and riders. In November 2017, both committees received a presentation on the Program.

In 2017, BART also partnered with MTC to conduct outreach on its Core Capacity Transit Study, a collaborative effort to improve public transportation to and from the San Francisco core. Outreach activities consisted of two public meetings to identify investments and improvements to increase transit capacity to the San Francisco Core. Approximately 80 people participated in the public meetings.

Outreach to Disadvantage or Low-Income Communities

- The PPP outlines strategies to engage disadvantaged and low-income communities, including: Translation of flyers and other meeting materials and interpretation services
- Outreach to Community Based Organizations (CBOs)
- Providing notification using Ethnic Media
- Hosting meetings in accessible locations

Additional Outreach activities include:

- Fleet of the Future New Train Car Model
- BART Vision – Future BART
- Embarcadero-Montgomery Capacity Implementation and Modernization Study
- Better BART
- MTC Plan Bay Area 2040





- MTC Core Capacity Transit Study
- Hayward Maintenance Complex Noise Study
- Hayward Maintenance Environmental Study

V. Conclusion

BART's HMC Sustainability and Capacity Improvements project, a component of the larger Core Capacity Program, is a cost-effective project that provides important congestion relief, air quality, economic, and quality of life benefits for the San Francisco Bay Area, its residents and businesses, as well as for the State of California. The proposed project is a key component of the region's Sustainable Communities Strategy for both reducing greenhouse gas emissions as well as providing intra- and inter-regional access, and mobility for millions of residents to jobs, social activities, medical care, school and university, shopping and other destinations. The BART system has served the Bay Area for over 40 years, and this project is critically needed to allow BART to continue its mission of providing the Bay Area with quality rail service for many years to come.

VI. Appendices and Other Information

With this application, we are providing appendices:

Appendix I: Project Programming Request

Appendix II: Performance Indicators and Measures

Appendix III: An Excel spreadsheet of the BCA model and supporting documentation

Appendix IV: GHG Emissions Modeling and Methodology

Appendix V: Ridership Modeling and Methodology

Appendix VI: Metropolitan Transportation Commission RTP Letter

