**SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT**
300 Lakeside Drive, P.O. Box 12688
Oakland, CA 94604-2688
(510) 464-6000



October 31, 2016

Mr. Craig Bosman
Metropolitan Transportation Commission
375 Beale Street, Suite 800
San Francisco, CA 94105

Subject: MTC Transit Performance Initiative (TPI) Investment Round 3 Call for Projects

Dear Mr. Bosman:

The San Francisco Bay Area Rapid Transit District (BART) is pleased to submit the attached grant application in the amount of $1,888,000 (for a total project amount of $2,133,000) for Round 3 of the Transit Performance Initiative (TPI) Investment Program. BART appreciates the opportunity to apply for funds that will directly increase ridership and provide customer comfort on the BART system.

The BART Train Seat Modification Project will remove 7 seats on up to 360 existing BART cars to provide immediately relief for passengers in the peak period commute hours. Currently BART often must pass up loads of passengers waiting on the BART platforms during the peak commute hours due to extreme crowding conditions, inconveniencing hundreds of passengers per day. For those passengers able to board the trains, many experience a very uncomfortable ride. This project will provide immediate relief while BART is in the process of transitioning the new train cars currently in production. Because BART has already modified a small number of cars for this purpose, BART has the means and knowledge to quickly implement the project.

BART will provide the required local matching funds and understands that the funding available for this project is fixed and that any cost increases must be funded from local matching funds.

Once recommended for funding, BART will adopt the required resolution and begin implementing the project. Thank you for your consideration of this project. Please contact Deidre Heitman of my staff at (510) 287-4796 should you have any questions.

Sincerely,

Kerry Hamill, Assistant General Manager
Office of External Affairs

**APPLICATION**
**MTC TRANSIT PERFORMANCE INITIATIVE – MAJOR CORRIDORS**

***One Electronic Copy due October 31, 2016 by 5 p.m.***

## PART I: GENERAL INFORMATION

**a) Project Sponsor**
*Please provide the contact information of the person submitting this application.*

Name & Title: Michael Tanner, Manager, Grant Development and Advocacy

Organization: San Francisco Bay Area Rapid Transit District (BART)

Mailing Address: 300 Lakeside Drive, 16th Floor, Oakland, CA 94604

Telephone: (510) 464-6433

Fax:

Email: mtanner@bart.gov

**b) Project Manager**
*Please provide the contact information of the person to answer questions on this application and who will also act as the agency Project Manager. Leave blank if same as above.*

Name & Title: David Hardt, Chief Mechanical Officer

Organization: San Francisco Bay Area Rapid Transit District (BART)

Mailing Address: 300 Lakeside Drive, 14th Floor, Oakland, CA 94604

Telephone: 510) 464-7508

Fax:

Email: dhardt@bart.gov

**c) Project Title**
*Please provide a descriptive and distinctive name for the project.*

BART Train Seat Modification Project

**d) Other Participating Agencies/**
*Including your agency, please list all the agencies involved, the type of work (e.g/ signal priority) and the role of each agency with respect to the project. Attach evidence of project support from affected local jurisdictions.*

| Agency | Role | Corridor | Type of Work | Contact |
|---|---|---|---|---|
| | | | | |

## PART II: PURPOSE & NEED

**a) Project Description**
Please describe the project and the services being requested. Include explanation of how the project is eligible for CMAQ funds. (CMAQ Program Interim Guidance is located at https://www.fhwa.dot.gov/map21/guidance/guidecmaq.cfm.)

**The BART Train Seat Modification Project will modify the seat configuration of up to 360 existing BART cars to provide immediate relief to the peak commute period overcrowding that BART is currently experiencing, and potentially increase ridership on the system. Specifically, BART will remove 7 seats per car, on one side, or approximately 2,520 seats. This project is necessary to provide crowding relief until BART has fully replaced and added to the car fleet, which is anticipated by 2023. In addition, BART proposes a small study to investigate ways in which it can make the train trip, specifically the longer trips, more comfortable for those standing.**

**As ridership has surged in the past five years, particularly during commute periods, BART has seen high levels of crowding, complaints and decreased customer satisfaction. In a Spring 2016 customer survey, 18% reported riding BART less on weekdays compared to a year earlier; the top BART-related reason was that "trains were too crowded." Many customers have been unable to board trains due to crowding, or have experienced crush load conditions. In an attempt to open up more space to accommodate the heavy demand, earlier this year BART modified 60 "B" (non-cab) cars with three new test seat configurations (20 of each type). After the test period, BART analyzed over 14,000 customer surveys and collected other data to evaluate customer feedback and to determine impacts on ridership, crowding and passenger flow. In response to this feedback, BART proposes to remove seats in up to 360 train cars as shown as Alternative 3 on Exhibit A. This configuration received the highest rating of the three alternatives and eliminates "choke points" in the middle of the cars which impede passenger flow.**

**Here's what we know about the effect of overcrowding on the BART system:**

- **Annual ridership has increased from approximately 101 million annual trips in 2010 to over 128 million annual trips in 2016, a 27% increase. In 2025, BART is forecasting ridership to be over 500,000 exits per day with approximately 20% of the increase coming from the opening of three extensions in the near future (eBART, Warm Springs and San Jose). These new trips are likely to follow existing travel patterns, thereby worsening the crowding on the trains heading for downtown San Francisco.**
- **In analyzing station exit data by line and time of day, we can extrapolate the extent of crowding on train cars. This information is used by BART staff to allocate cars to line by time of day. We can see that passenger loads often exceed – sometimes by as much as 20% -- the maximum train car capacity of 115 passengers as established by FTA. Train cars with over 140 passengers are common.**
- **Passengers report that they are routinely unable to board trains due to overcrowding, particularly in the eastbound evening commute out of San Francisco. Many passengers "backtrack" to stations further up the line (for example, Embarcadero to Civic Center is common), to find a seat or to just be able to board a**

**train.**

- **The BART Seat Modification Project will result in an additional 36 square feet per train car, allowing for more passenger comfort and easing of boarding and exiting the trains.**
- **The additional square feet and ease of movement within the cars may increase overall ridership on BART.**

**BART also proposes to conduct a study, called the Innovative Vehicle Interior Design Study, to engage consultant assistance to develop and test seating and interior design concepts on the new train cars currently on order that conserve space while preserving passenger safety and comfort. Although the new BART fleet was designed with modular seating that can be more easily reconfigured, BART needs to examine issues around rail seating, straps, leaning accommodations, and layout of bike racks and other amenities, to name a few issues, to fully maximize the use of the new cars. Although BART's Fleet of the Future is intended to meet the needs of a growing ridership, BART wants to be prepared to meet future demand, and to best accommodate large major sporting, cultural and entertainment events. Please see Exhibit C for a full scope, schedule and budget for the proposed study.**

**b) Corridor Description**
(general overview – length, land use, origins and destinations served, etc.)

**The BART Train Seat Modification Project will benefit the entire BART system as train cars are used interchangeably throughout the system.**

**c) Service Types & Levels**

| | | | Headways | | Vehicles in service | | |
|---|---|---|---|---|---|---|---|
| | Start Time | End Time | Peak | Off-peak | Peak | Off-peak | Daily Rev Veh Hrs |
| Weekday | | | | | | | |
| Saturday | | | | | | | |
| Sunday | | | | | | | |

**d) Average Current Speed by time of day**

**N/A**

**e) Existing Route Level Ridership**
***(Please fill out excel form attached as Appendix B)***

N/A

**f) Route Level Performance Measures**
***(Please fill out excel form attached as Appendix B)***

**N/A**

**PART III: ACTION PLAN** (estimates developed by each agency and reviewed by MTC for reasonableness)

| **a) Proposed speed improvements, travel time savings and improved reliability** ***(provide narrative, along with estimates of travel time and/or reliability improvements)*** |
|---|
| **The BART Train Seat Modification Project will result in increased train and system capacity and improved customer experience.** |
| **b) Cost savings/ change in resource requirements** ***(provide narrative, along with estimates of any change in operating costs as a result of proposed improvements; e.g., improved travel time may allow for the elimination of a vehicle from the route at the same level of service)*** |
| **This project is likely to positively impact the overall timeliness of the BART system by reducing longer dwell times caused when passengers are unable to quickly and easily exit and enter the train cars. The choke point for passengers on the currently-configured train cars makes it difficult for passengers to quickly exit the train, causing longer dwell times at stations, particularly Embarcadero and Montgomery Street stations in downtown San Francisco.**<br><br>**As anyone who travels on BART during the peak period commute can attest, the BART train cars are often at crush-level loads, so packed that there is no room available to board. Passengers are often left on platforms waiting for the next train. Riders often back-track to stations further up the line to assure themselves of space. Passengers situated in the middle of the cars often struggle to get through the crush to exit the train. Many people cluster near the train doors (even when there is space in the middle of the train) in order to not miss their stop. This clustering and back-tracking often results in unexpectedly longer dwell times which eats into the buffer time in the schedule and could result in train delay. We are currently in the field evaluating the number of passengers passed up and the delay in dwell times caused by over-packed cars, with data expected by mid- to late November, 2016.**<br><br>**Logically, however, as the modified B cars will be interspersed throughout the system, the positive impacts on the dwell times may not be fully realized until our fleet is a mixture of B cars and the new fleet of cars (each car with three doors).** |
| **c) Estimated change in ridership/revenue** |
| **It is extremely difficult to estimate the number of additional riders that may result from this project. While we know that we often carry in excess of 140 passengers in our currently-configured train cars, we can only make a few logical assumptions about whether – with the addition of the extra space – more people will squeeze into the car or the existing passengers will have more breathing room and a more comfortable ride. Either way, BART considers this a worthy expenditure of funds.** |

**Removing 7 seats will result in an additional 36 sq. ft. of space per car. Assuming that each standing passenger has 2 sq. ft. each, that would result in space for an 18 additional passengers. Subtract the number (7) of passengers who would have sat in (now removed) seats, the net gain is 11 new passengers. While 2 sq. ft. per passenger is far below the FTA standard of 5.4 sq. ft., we know that passengers are already literally cheek by jowl in our train cars at certain peak periods.**

**On a straight line basis, one could estimate 11 additional passengers in each of 360 modified train cars (for a total of 3,960 additional passengers) per commute period. However, given that many of our cars are already at 20% over capacity, we believe any anticipated increase to be lower, perhaps by half. Therefore, a conservative estimate of ridership gain from this project would be approximately 2,000 additional passengers per weekday commute period (5.5 pax X 360 cars = 1,980).**

**At an average fare of $3.85 per trip, 2,000 new riders would generate $7,700 per peak period weekday commute, or approximately $3,845,000 annually ($7,700 X 2 daily commutes X 250 weekdays). Special sporting, cultural, and entertainment events, often with crush-level crowds, would also result in increased revenue; there are over 200 of these events each year.**

**More importantly than the positive effects on ridership and revenue, this project will greatly improve the BART passengers' daily peak period commute. The value of this: <u>Priceless</u>.**

**d) Travel Time and Operating Benefits** ***(MTC will calculate a simplified benefit/cost analysis based on these inputs. You may attach calculations.)***

| | |
|---|---|
| **Annual Passenger Seconds Reduced**<br>(Annual ridership x Estimated travel time savings per run) | **N/A** |
| **Annual Operating Cost Savings ($)** | **N/A** |

We calculated the benefit/cost ratio to be 1.80. Please see attached Exhibit B.

## PART IV: BUDGET

**a) Budget Summary**

| **Request** | **($ Thousands)** | **% of Total Project Budget** |
|---|---|---|
| **Amount of funding request:** | 1,888 | 88.53% |
| **Amount of local match proposed:** | 245 | 11.47% |

| | | | |
|---|---|---|---|
| **Local match fund sources: (add rows as necessary)** | | | |
| **BART Operating** | 245 | | |
| | | | |
| **Total Project Budget** | 2,133 | 100% | |

See attached budget spreadsheet, Exhibit B

**b) Budget by Phase**

| Phase | Total Amount - Escalated - ($ Thousands) |
|---|---|
| Environmental Studies & Preliminary Eng (ENV / PE / PA&ED) | N/A, see below |
| Design - Plans, Specifications and Estimates (PS&E) | |
| Right-of-Way Activities /Acquisition (R/W) | |
| Construction / Equipment Acquisition (CON) | |
| **Total Project Budget** | |

**Because BART has already modified train cars in the way proposed (removing seven seats from each car), it is resourced to begin this project immediately upon funding obligation. This project will fund twelve Full Time Equivalent (FTEs) staff, and includes a small amount of funding for materials and tooling. We are also proposing funding for a study to develop options to utilize modular capabilities available in the new fleet that will result in a more comfortable ride for passengers, specifically those who stand. Please see Exhibits B and C for budget information.**

**c) Operating Plan**
***(Please fill out excel form attached as Appendix B)***

**Please also see Exhibit B for our budget proposal.**

## PART V: ATTACHMENTS

**a) VICINITY MAP**
*Please include, in a separate attachment, a Vicinity Map clearly identifying the nearby jurisdictions, transit centers, highways, etc.*

**Included is a BART system map, Exhibit D**

**b) DETAILED PROJECT AREA MAP**
*Please include, in a separate attachment, a map of the project area, including proposed routes/services affected and cross streets, highways, etc.*

**Included is a BART system map, Exhibit D.**

## PART VI: DEMONSTRATION OF PARTICIPATION AND SUPPORT

**a) LOCAL AGENCY RESOURCES**

*Please describe the resources (staff time & additional funding) the sponsor agency will dedicate for the successful completion of the project.*

**BART agrees to contribute the required 11.47% local share, or $245,000 from BART Operating revenue. Staff time to manage the work crews for the seat modification portion of the project will be provided by BART and not charged to this grant. We are, however, proposing $85,000 to reimburse BART for staff time to procure and manage the consultants needed for the study.**

**b) PROJECT READINESS/ SCHEDULE**

| Phase-Milestone | Month/Year | |
|---|---|---|
| | Start Date | Completion Date |
| Environmental Document | N/A, see below | |
| Environmental Studies, Preliminary Eng. (ENV / PE / PA&ED) | | |
| Final Design - Plans, Specs. & Estimates (PS&E) | | |
| Right-of-Way Activities /Acquisition (R/W) | | |
| Construction (Begin – Open for Use) / Acquisition / Operating Service (CON) | | |

**As indicated above, BART can begin this project immediately upon funding obligation. With twelve FTEs, BART estimates it can modify up to ten train cars per week. Although BART should be able to complete this project within one year of funding obligation, issues such as hiring additional staff (if needed), and procuring consultant assistance can add a significant amount of time. Therefore, we are requesting the full two years to complete the project, although our goal would be a much shorter time frame.**

**APPLICATION SIGNATURES**

*Please sign below and have an authorized official from all participating agencies or jurisdictions sign below or attach a letter of support. By signing the application and/or providing letters of support, the signatory affirms that the statements contained in the application are true and complete to the best of their knowledge.*

**Primary Sponsor:**

Signature

Kerry Hamill
Print Name

Assistant General Manager, Office of Ext Affairs
Title

San Francisco Bay Area Rapid Transit District
Agency

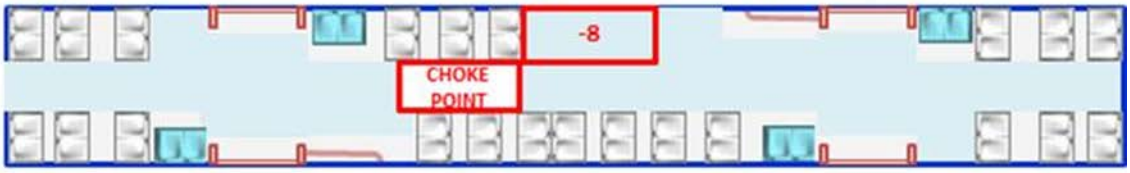
**Participating Agencies/Jurisdictions** (add as necessary)**:**

| | |
|---|---|
| Signature | Signature |
| Print Name | Print Name |
| Title | Title |
| Agency | Agency |

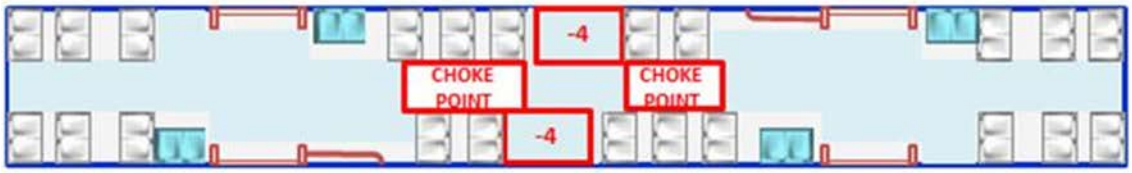
# Exhibit A

## Alternative Interior Arrangements (shown for A2/B2 Cars)

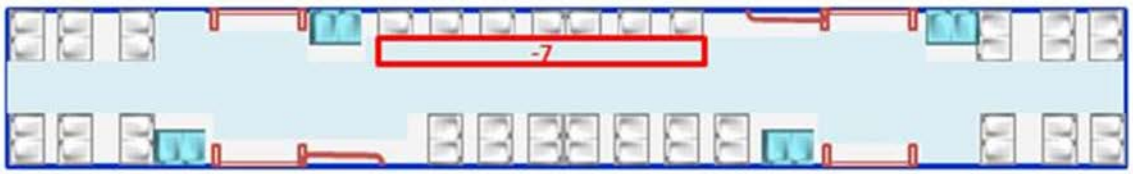
MOD 1 (A2/B2:52 seats, C1/C2:48 seats): Remove 4 seat pairs (8 seats) from one side of car; expand door vestibule standing space at one end into center of car




MOD 2 (A2/B2:52 seats, C1/C2:48 seats): Remove 2 seat pairs (4 seats) from each side in center (8 seats total); open center standing space and anticipate center door vestibules in new cars




MOD 3 (A2/B2:53 seats, C1/C2:49 seats): Divide 7 seat pairs through center of one side of car into single seats; open center standing space and improve circulation




MODS 1 and 2 create additional standing space, but do not offer the same spaciousness and circulation as does MOD 3. Both MODS 1 and 2 retain sections of original center aisle width, demonstrated to limit both circulation and capacity. Furthermore, both MODS 1 and 2 create differentiated standing space that does not invite access as does the continuous wide center aisle of MOD 3. Circulating between the doors and the center of the car is a more natural movement in the MOD 3 configuration, rather than traversing from at least one door (MOD 1) or both (MOD 2) via narrow aisles to use the standing space, and subsequently to exit the car.

# Exhibit B

BART Train Seat Modification
Project

| | |
|---|---|
| Labor | 1,443,000 |
| Tooling and Materials | 255,000 |
| **SUB-TOTAL** | **1,698,000** |
| Innovative Vehicle Interior Design Study | 435,000 |
| **TOTAL** | **2,133,000** |
| Requested Amount | 1,888,345 |
| Local Match 11.47% | 244,655 |
| TOTAL | **2,133,000** |

Benefit/Cost Ratio:
Assuming an annual revenue increase of $3,845,000, and a total project cost of $2,133,000, the benefit/cost ratio would be 1.80.
If one only considers the car modification piece of the proposed project, at $1,698,000, the benefit/cost ratio is 2.28.

# Exhibit C

## I. TITLE: Innovative Vehicle Interior Design Study to Accommodate More Customers More Comfortably

## II. SCOPE

The proposed capacity improvements of BART's existing fleet will expand capacity and greatly improve the riding experience for BART riders. However, continued demand growth is expected to challenge the BART system for years to come. Fortunately, BART's new fleet was designed with modular seating that can be more easily reconfigured than the old fleet. Interior rails embedded in the inside wall of the new cars allow seats, bike racks, and other amenities to plug in to the wall in any location.

This grant application includes funding to develop options to utilize these modular capabilities to accommodate more passengers more comfortably in future train car reconfiguration efforts. In particular, the grant funds would be used to re-examine rail seating, leaning accommodations, and interior layouts to identify ways to accommodate more passengers more comfortably.


*Photo: Michael Short / Special To The Chronicle*

For this project, BART will engage a design firm to engage an interdisciplinary team of biomechanics professionals, seating and vehicle design engineers, and experts in advanced materials to develop and test new seating and interior design concepts that conserve space while preserving passenger safety and comfort. The project will culminate in consumer testing and research to identify the most promising concepts for deployment in future train car reconfigurations.

*Photo: Santiago Mejia, The Chronicle*

## Phase 1 – Discovery

The design firm will conduct a discovery process to clarify project objectives and identify technical requirements including structural load limits, and fire, smoke, and toxicity (FST) limits for materials. The firm will use this information to define the design envelope and ensure that outcomes are viable.

- Deliverables: Draft and Final Design Brief

### Phase 2 – Secondary Research

Comprehensive research will be performed to identify best practices and emerging concepts from transit systems around the world. The research will build upon previous vertical seating concepts designed to preserve scarce floor space within transit vehicles, aircraft, and public buildings. Space utilization concepts to date include saddle seat, stool-like seating, and leaning post concepts which encourage a more vertical and less horizontal manner of seating. The project will also explore innovative seating layouts, the use of advanced materials to reduce the depth of seat backs, scalloping techniques to tighten the pitch between seats while maintaining leg room, leaning pads, and other design concepts.

- Deliverables: Secondary Research Report

### Phase 3 – Development of Multiple Design Options

This design brief will be utilized to guide the work of designers who have deep experience in vehicle interior design and innovative seating and leaning bars. Interior layouts explored in this project will take into account passenger circulatory patterns, passenger information needs, and strategies to expedite boarding and alighting to minimize dwell times at stops. The project will examine ergonomics and human factors to create solutions that meet diverse passenger needs ranging from short hop to long distance riders, passengers with disabilities, various body types and sizes, seated, standing, and leaning positions, and passengers with shopping bags, strollers, luggage, or in the case of some rail systems, bicycles.

- Deliverables: Renderings of at least five design concepts that accommodate more passengers more comfortably.  Structural and FST calculations to demonstrate viability of concepts.

**Phase 4 – Mockups and Prototypes**
A portion of the designs will be selected to move to a mockup and prototype phase.

- Deliverables: 3D CAD drawings and physical mockups and prototypes of three concepts that have the most potential and practicality.

**Phase 5 – Evaluation**
For each mockup, the consultant will measure capacity improvements, and will conduct qualitative and quantitative research to obtain consumer feedback.

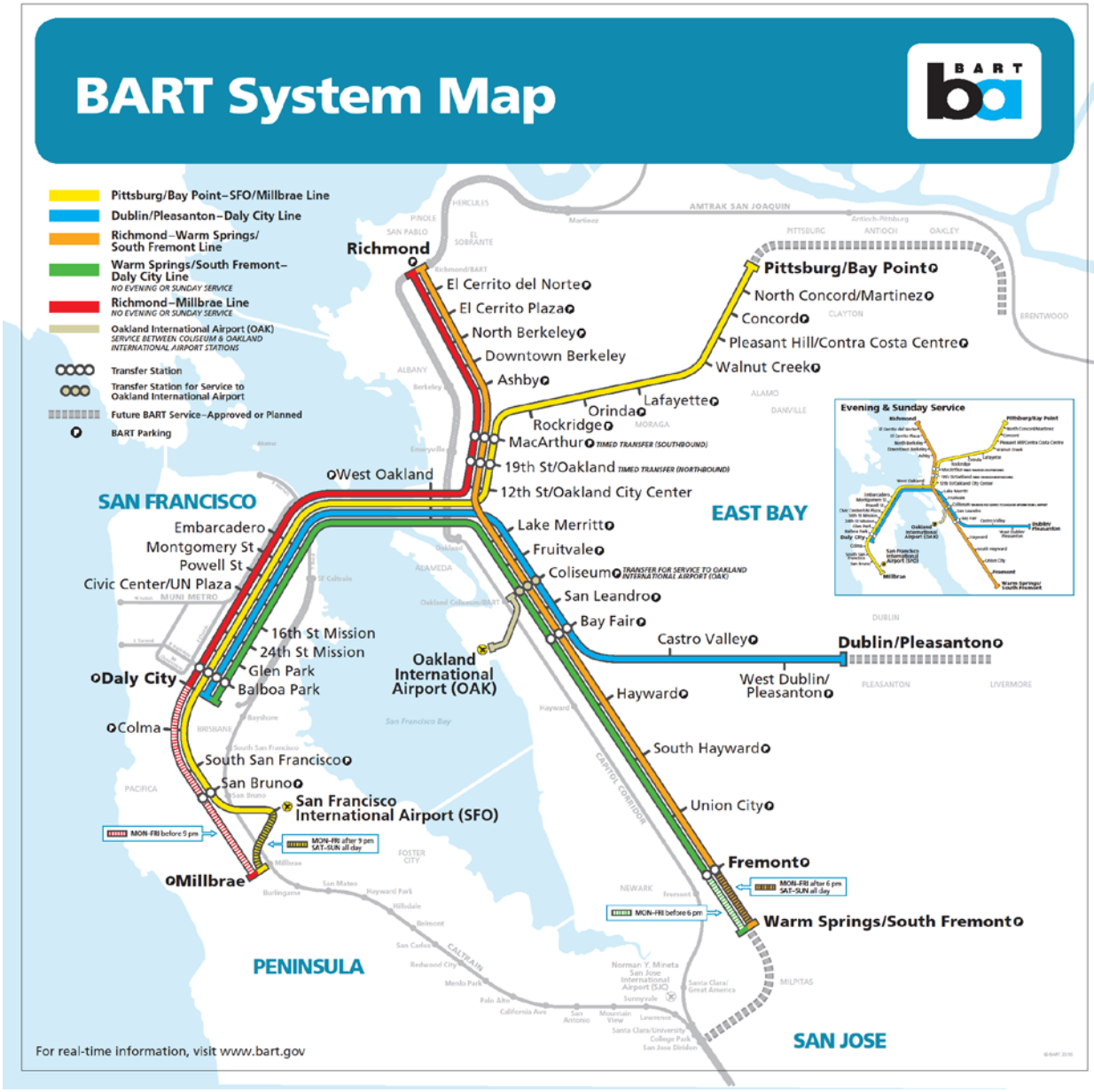
- Deliverables: Reports summarizing a comprehensive qualitative and quantitative evaluation of the mockups, including measurement of seating and standing capacity changes, as well as consumer evaluations of comfort.

## III. BUDGET AND SCHEDULE

Photo: Paul Chinn / The Chronicle

| PHASE | BUDGET | SCHEDULE |
|---|---|---|
| **Phase 1 – Discovery** | $10,000 | 2 weeks |
| **Phase 2 – Secondary Research** | $20,000 | 4 weeks |
| **Phase 3 – Development of Multiple Design Options** | $100,000 | 20 weeks |
| **Phase 4 – Mockups and Prototypes** | $150,000 | 20 weeks |
| **Phase 5 – Evaluation** | $70,000 | 6 weeks |
| Project Management | $85,000 | |
| **TOTAL:** | **$435,000** | **52 weeks** |

# EXHIBIT D


BART System Map
Pittsburg/Bay Point–SFO/Millbrae Line
Dublin/Pleasanton–Daly City Line
Richmond–Warm Springs/ South Fremont Line
Warm Springs/South Fremont–Daly City Line
NO EVENING OR SUNDAY SERVICE
Richmond–Millbrae Line
NO EVENING OR SUNDAY SERVICE
Oakland International Airport (OAK)
SERVICE BETWEEN COLISEUM & OAKLAND INTERNATIONAL AIRPORT STATIONS
Transfer Station
Transfer Station for Service to Oakland International Airport
Future BART Service–Approved or Planned
BART Parking
Richmond
El Cerrito del Norte
El Cerrito Plaza
North Berkeley
Downtown Berkeley
Ashby
Pittsburg/Bay Point
North Concord/Martinez
Concord
Pleasant Hill/Contra Costa Centre
Walnut Creek
Orinda
Lafayette
Rockridge
MacArthur
TIMED TRANSFER (SOUTHBOUND)
19th St/Oakland
TIMED TRANSFER (NORTHBOUND)
12th St/Oakland City Center
West Oakland
SAN FRANCISCO
EAST BAY
Embarcadero
Montgomery St
Powell St
Civic Center/UN Plaza
Lake Merritt
Fruitvale
Coliseum
TRANSFER FOR SERVICE TO OAKLAND INTERNATIONAL AIRPORT (OAK)
San Leandro
Bay Fair
Castro Valley
Dublin/Pleasanton
West Dublin/ Pleasanton
16th St Mission
24th St Mission
Glen Park
Balboa Park
Daly City
Oakland International Airport (OAK)
Hayward
Colma
South San Francisco
San Bruno
South Hayward
Union City
San Francisco International Airport (SFO)
MON-FRI before 9 pm
MON-FRI after 9 pm SAT-SUN all day
Millbrae
Fremont
MON-FRI after 6 pm SAT-SUN all day
MON-FRI before 6 pm
Warm Springs/South Fremont
PENINSULA
SAN JOSE
Evening & Sunday Service
For real-time information, visit www.bart.gov