



Memorandum

AGENDA ITEM 9

DATE: October 10, 2019

TO: Transportation Authority Board

FROM: Anna LaForte – Deputy Director for Policy and Programming

SUBJECT: 11/5/2019 Board Meeting: Approval of Reprogramming \$13,752,000 in Fiscal Year 2020/21 Regional Transportation Improvement Program Funds from the San Francisco Municipal Transportation Agency's (SFMTA's) Restoration of Light Rail Lines - Axle Counters Project to the SFMTA's Communications-Based Train Control (CBTC) – Phases 1 and 2 Project

<p>RECOMMENDATION <input type="checkbox"/> Information <input checked="" type="checkbox"/> Action</p> <p>Approve reprogramming \$13,752,000 in Fiscal Year 2020/21 Regional Transportation Improvement Program (RTIP) funds from the SFMTA's Restoration of Light Rail Lines - Axle Counters project to the CBTC – Phases 1 and 2 project.</p> <p>SUMMARY</p> <p>As San Francisco's Congestion Management Agency (CMA), the Transportation Authority is responsible for programming San Francisco's county share RTIP funds. As part of the 2018 RTIP, the Board recommended, and the Metropolitan Transportation Commission (MTC) and the California Transportation Commission (CTC) approved, \$13,752,000 in Fiscal Year (FY) 2020/21 for the SFMTA's Restoration of Light Rail Lines - Axle Counters project. In September 2019, the SFMTA notified Transportation Authority staff that it would like to incorporate the scope of this project into its CBTC project, which will provide the same functionality as the axle counters in tracking train movements but with modern technology. In addition to using new technology, the CBTC project is a larger, multiphase approach that will extend benefits such as reliability, capacity, and ease of maintenance, to the entire Muni Metro, not just the subway. Phases 1 and 2 cost \$91 million.</p>	<p><input type="checkbox"/> Fund Allocation</p> <p><input checked="" type="checkbox"/> Fund Programming</p> <p><input type="checkbox"/> Policy/Legislation</p> <p><input type="checkbox"/> Plan/Study</p> <p><input type="checkbox"/> Capital Project Oversight/Delivery</p> <p><input type="checkbox"/> Budget/Finance</p> <p><input type="checkbox"/> Contract/Agreement</p> <p><input type="checkbox"/> Other: _____</p>
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DISCUSSION

Background



The State Transportation Improvement Program (STIP) is a five-year investment plan for state transportation money that is updated every two years by the CTC. Regional spending plans – developed by the MTC for the nine county Bay Area region and by other agencies elsewhere in California – account for 75% of the STIP. These are known as Regional Transportation Improvement Programs or RTIPs. The RTIPs can fund a broad range of projects from a bike path to highway redesigns or expansions to rail line extensions.

On October 8, 2019, the Board approved on its first read San Francisco's project priorities for the \$7,592,000 in new funding available in the 2020 RTIP (see Attachment 1 for details). As CMA, the Transportation Authority must submit its new 2020 RTIP priorities and any amendments to existing projects to MTC for approval by mid-November 2019.

SFMTA's Train Control.

Of the entire Muni Metro system, only the Market Street Subway has centralized train control which was installed 30 years ago. Most of the 74-mile light rail vehicle (LRV) network is governed by signals that work in isolation rather than as a connected system. SFMTA staff estimates that this outdated train control system accounts for around half of the subway's acute delay incidents due to communication failures, failed entry into the subway, computer failures, and equipment failures.

Restoration of Light Rail Lines - Axle Counters [Current Project]: Axle counters are currently used to identify the locations of trains. As approved in the 2018 RTIP, this project would upgrade 83 rail-side axle counters to more current technology and install 20 additional axle counters to improve the spacing of the counters between Forest Hill and Eureka and outbound Embarcadero to Montgomery stations. The \$13,752,000 programmed in the 2018 RTIP would have leveraged \$18,248,000 in federal funds to complete the installation of the axle counters, with a contract awarded in late 2020 and project completion by early 2024. While this project would have provided operational benefits, it would be a solution that upgraded only one component of the system with old technology rather than addressing the larger need for a systemwide and modernized upgrade.

CBTC Phases 1 and 2 [Proposed Project]: SFMTA has decided to change its approach to train control. Rather than implementing incremental improvements, it is planning to replace the existing system with a modern Communications-Based Train Control (CBTC) system that would extend to the entire light rail system rather than just the Muni Metro Subway. The CBTC system will provide better technology to track train movements using an on-board control computer and global positioning system to communicate directly with the Operations Control Center. It would also allow systemwide management of the Muni Metro system including integration with surface traffic signals. This would allow trains to travel closer together and increase allowable train speeds. SFMTA staff anticipates CBTC will reduce subway delays by 20-25%, allow for improved maintainability, reduce the variability of surface trip times, better address bottlenecks, and increase overall capacity of the system. The project will increase the number of trains through the subway from approximately 35 per hour to roughly 45 per hour in each direction.

SFMTA plans to implement the overall CBTC project in seven phases, as shown in Attachment 2. We are proposing to reprogram the RTIP funds to the first two phases of the project, leveraging \$77,283,000 in federal, state, and local funds for a project cost of \$91,035,000. Phase 1 extends from 23rd Street along the T-Third line to the subway entrance at the Embarcadero. Phase 2 will implement CBTC on the entire



Muni Metro Subway from West Portal to the Embarcadero. Construction on Phase 1 will begin in late 2020 and conclude at the end of 2021. Construction on Phase 2 will begin in late 2021 and conclude in early 2024. The project will be delivered using a design-build contracting approach. SFMTA will complete the deployment of CBTC across the entire Muni Metro System by mid-2026 with a total cost estimate of \$300 million.

Recommended Reprogramming.

We have been advised by MTC and CTC staff that we should request reprogramming the \$13,752,000 from the Axle Counter project to phases 1 and 2 of the CBTC project through the 2020 RTIP process. Attachment 3 contains a draft of the Project Programming Request form for the CBTC project, with basic information about scope, schedule, budget, and funding plan. Additional details are shown in Attachment 4, which SFMTA staff will present at the November 5 Board meeting.

Next Steps.

Subject to Board approval at its November 19 meeting, we would submit the request to the MTC as an amendment to San Francisco's 2020 RTIP. The MTC Commission will vote to approve the Bay Area's 2020 RTIP on December 18, 2019 and then will submit it to the CTC. The CTC will consider needs across the state and may adjust years of programming to match projected fund availability. The CTC is scheduled to adopt the STIP at its March 25, 2020 meeting. If approved, SFMTA would be able to allocate the funds in late 2020.

FINANCIAL IMPACT

The recommended action would not have an impact on the adopted FY 2019/20 budget.

CAC POSITION

The CAC will consider this item at its October 23, 2019 meeting.

SUPPLEMENTAL MATERIALS

- Attachment 1 – 2020 RTIP Program of Projects, with Proposed Amendment
- Attachment 2 – Map of CBTC Implementation by Phase
- Attachment 3 – CBTC – Phases 1 and 2 Project Programming Request Form
- Attachment 4 – SFMTA presentation on the CBTC project

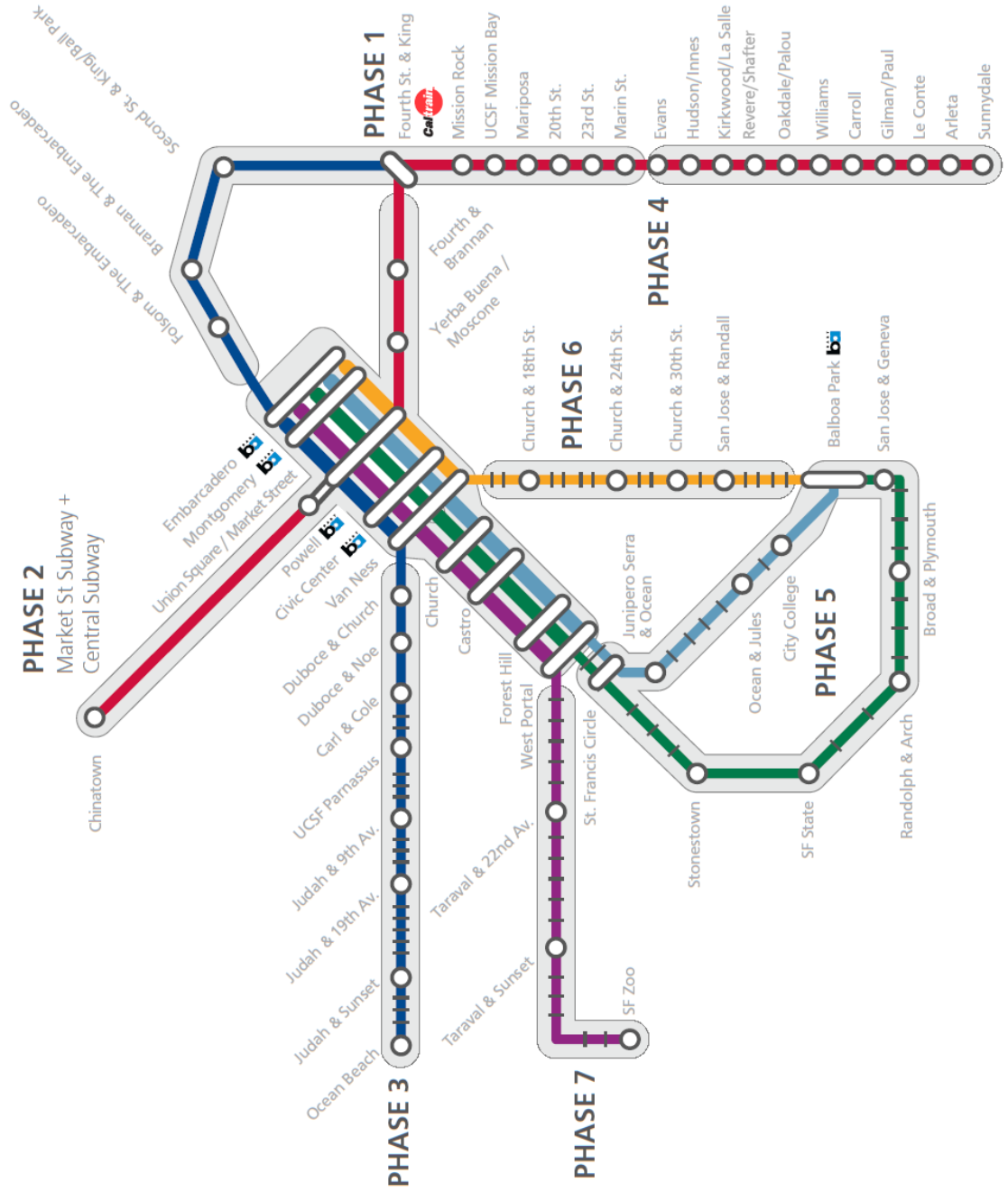
Attachment 1

San Francisco 2020 Regional Transportation Improvement Program (RTIP) Programming Priorities - Proposed Amendment

		Project Totals by Fiscal Year (\$ 1,000's)						
		CTC has advised that new programming is only available in FYs 2023/24 and 2024/25.						
Agency ¹	Project	Total	FY 2020/21	FY 2021/22	FY 2022/23	FY 2023/24	FY 2024/25	Phase
Existing 2018 RTIP Programming Priorities								
SFMTA	Restoration of Light Rail Lines – Axle Counters Communications-Based Train Control - Phases 1 and 2	\$13,752	\$13,752					Construction
SFCTA	Planning, programming, and Monitoring	\$778	\$260	\$259	\$259			n/a
MTC	Planning, Programming, and Monitoring	\$237	\$76	\$79	\$82			n/a
Existing Funds Programmed in 2018 RTIP		\$14,767	\$14,088	\$338	\$341			
New 2020 RTIP Programming Priorities								
SFMTA	New Flyer Midlife Overhaul - Phase III	\$7,174					\$7,174	Construction
SFCTA	Planning, programming, and Monitoring	\$245				\$46	\$199	n/a
MTC	Planning, Programming, and Monitoring	\$173				\$85	\$88	n/a
Proposed 2020 RTIP Programming		\$7,592				\$131	\$7,461	
Total RTIP Funds Available		\$22,359						
Surplus/(Shortfall)		\$0						

¹ Acronyms include the Metropolitan Transportation Commission (MTC), San Francisco County Transportation Authority (SFCTA), and San Francisco Municipal Transportation Agency (SFMTA).

Preliminary Project Phasing



PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised Mar, 1 2018 v7.08)

General Instructions

Amendment (Existing Project) Yes					Date:	08/16/19					
District		EA		Project ID		PPNO		MPO ID		Alt Proj. ID / prg.	
04						2137					
County		Route/Corridor		PM Bk		PM Ahd		Project Sponsor/Lead Agency			
SF								SFMTA			
								MPO		Element	
								MTC		MT	
Project Manager/Contact				Phone				E-mail Address			
Alex Hallowell				(415) 646-4112				Alexandra.Hallowell@sfmta.com			
Project Title											
Communications-Based Train Control - Phases I & 2											
Location (Project Limits), Description (Scope of Work)											
A new Communications-Based Train Control (CBTC) system possesses the greatest potential of any single investment to bolster SFMTA Muni's light rail system's efficiency and reliability. The SFMTA will install a new CBTC system, starting with Phase 1 between 23rd Street and the subway portal at Market Street. Phase 2 will include the Market Street tunnel between Embarcadero and West Portal Stations and along the Central Subway alignment. CBTC will include the functionality of the Axle Counters project while taking advantage of newer technology and equipment. Five subsequent phases of the project will deploy CBTC throughout the entirety of the SFMTA's 75 miles of light rail service (full text on next tab).											
Component		Implementing Agency									
PA&ED		SFMTA									
PS&E		SFMTA									
Right of Way		NA									
Construction		SFMTA									
Legislative Districts											
Assembly:		17,19		Senate:		11		Congressional:		12,14	
Project Benefits											
To grow ridership while increasing safety and reliability the SFMTA will install a state-of-the-art Communications Based Train Control System (CBTC) along 9 bidirectional miles of light rail lines and six transit lines. CBTC benefits are improved reliability, safety, line capacity, and decreased travel times for the most heavily-traveled segments of the light rail system.											
Purpose and Need											
The SFMTA Muni Metro system uses a centralized train control in the Market Street tunnel (the core segment described in Phase 2 above). The system was installed more than two decades ago and relies on outdated technology and equipment. The train control system provides two critical benefits to our operations (continues on next tab):											
Category			Outputs/Outcomes					Unit		Total	
Intercity Rail/Mass Trans			Operational improvements					Miles		18	
ADA Improvements N			Bike/Ped Improvements N					Reversible Lane analysis N			
Inc. Sustainable Communities Strategy Goals			Y					Reduces Greenhouse Gas Emissions		Y	
Project Milestone							Existing		Proposed		
Project Study Report Approved							11/30/19				
Begin Environmental (PA&ED) Phase							03/01/2019		NA		
Circulate Draft Environmental Document				Document Type		CE/CE					
Draft Project Report											
End Environmental Phase (PA&ED Milestone)							06/30/2019		03/31/20		
Begin Design (PS&E) Phase							07/01/2019		03/31/20		
End Design Phase (Ready to List for Advertisement Milestone)							06/01/2020		03/31/20		
Begin Right of Way Phase									NA		
End Right of Way Phase (Right of Way Certification Milestone)									NA		
Begin Construction Phase (Contract Award Milestone)							12/01/2020		11/15/20		
End Construction Phase (Construction Contract Acceptance Milestone)							12/01/2023		11/15/23		
Begin Closeout Phase							01/01/2024		11/15/23		
End Closeout Phase (Closeout Report)							01/01/2026		05/15/24		

ADA Notice

For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento,

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised Mar, 1 2018 v7.08)

Date: 08/16/19

Additional Information

LOCATION (PROJECT LIMITS), DESCRIPTION (SCOPE OF WORK) (Full language):A Communications-Based Train Control (CBTC) system possesses the greatest potential of any single investment to bolster SFMTA Muni's light rail system's efficiency and reliability. The SFTMA will install a new CBTC system, with phasing as follows: Phase 1 between 23rd Street and the subway portal at Market Street. This segment of nine stations serves the new Chase Center (Warriors arena), Oracle Park (Giants stadium) as well as Muni Metro East, one of SFMTA's two light rail maintenance facilities. Following this installation, Phase 2 will be installed throughout the Market Street tunnel between Embarcadero and West Portal Stations and along the Central Subway alignment. Phase 2 serves 9 underground Muni Metro subway stations and represents the heart of the light rail system along which all lines converge. It will also include Central Subway's two surface and two subway stations. CBTC is envisioned as a multi-phase project with previously programmed STIP funds to be spent on the project's Phases 1 and 2. CBTC will include the functionality of the "Restoration of SFMTA Light Rail Lines - Axle Counters" project while taking advantage of newer technology and equipment. These two phases are part of a larger seven-phase project to deploy CBTC throughout the entirety of the SFMTA's 75 miles of light rail service.

PURPOSE & NEED (Full language): The SFMTA Muni Metro system uses a centralized train control in the Market Street tunnel (the core segment described in Phase 2 above). The system was installed more than two decades ago and relies on outdated technology and equipment. The train control system provides two critical benefits to our operations:

- 1) essential safety features to ensure light rail vehicles never collide while operating underground.
- 2) higher travel speeds under a computerized system.

This system keeps vehicles safely and evenly spaced, permitting lower headways than could be achieved under manual operation. Today's SFMTA train control system is beyond its useful life and over capacity. The majority of the LRV network, including the Phase 1, 9-station segment, is governed by line-of-sight rules and signals working in isolation. The full CBTC system installation will expand the centralized vehicle control beyond the Market Street tunnel and along all surface lines. This will permit a more coordinated and centralized management of the entirety of our light rail system by using integrated signals to better manage vehicle flows along the surface. Additionally, CBTC will incorporate decades of technological improvements resulting in more flexible operations, lower operating and maintenance costs, and a better and more intuitive user interface.

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PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised Mar, 1 2018 v7.08)

Date: 08/16/19

District	County	Route	EA	Project ID	PPNO	Alt. ID
04	SF, ,	, ,			2137	
Project Title: Communications-Based Train Control - Phases I & 2						

Existing Total Project Cost (\$1,000s)									Implementing Agency
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)									SFMTA
PS&E									SFMTA
R/W SUP (CT)									NA
CON SUP (CT)									SFMTA
R/W									NA
CON		32,000						32,000	SFMTA
TOTAL		32,000						32,000	
Proposed Total Project Cost (\$1,000s)									Notes
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)	2,435	6,000	500					8,935	
PS&E		8,569	4,856	1,475				14,900	
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON		13,752	40,072	12,551	825			67,200	
TOTAL	2,435	28,321	45,428	14,026	825			91,035	

Fund No. 1:	STIP								Program Code
Existing Funding (\$1,000s)									Funding Agency
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)									CTC
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON		13,752						13,752	
TOTAL		13,752						13,752	
Proposed Funding (\$1,000s)									Notes
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)									
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON		13,752						13,752	
TOTAL		13,752						13,752	

Fund No. 2:	FTA §5337 State of Good Repair								Program Code
Existing Funding (\$1,000s)									Funding Agency
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)									FTA (programmed by MTC)
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON		18,248						18,248	
TOTAL		18,248						18,248	
Proposed Funding (\$1,000s)									Notes
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	
E&P (PA&ED)									
PS&E		2,760						2,760	
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON			816	403				1,219	
TOTAL		2,760	816	403				3,979	

Fund No. 3:		Operating/Population Baseline							Program Code	
		Existing Funding (\$1,000s)								
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	Funding Agency	
E&P (PA&ED)									SFMTA	
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL										
		Proposed Funding (\$1,000s)							Notes	
E&P (PA&ED)	2,435	4,243	500					7,178		
PS&E		690	3,856	1,475				6,021		
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON			1,782	4,328				6,110		
TOTAL	2,435	4,933	6,138	5,803				19,309		

Fund No. 4:		Low Carbon Transit Operations Program							Program Code	
		Existing Funding (\$1,000s)								
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	Funding Agency	
E&P (PA&ED)									Caltrans	
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL										
		Proposed Funding (\$1,000s)							Notes	
E&P (PA&ED)		1,757						1,757		
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL		1,757						1,757		

Fund No. 5:		General Funds							Program Code	
		Existing Funding (\$1,000s)								
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	Funding Agency	
E&P (PA&ED)									SFMTA	
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL										
		Proposed Funding (\$1,000s)							Notes	
E&P (PA&ED)										
PS&E		1,000						1,000		
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL		1,000						1,000		

Fund No. 6:		SB1 State of Good Repair							Program Code	
Existing Funding (\$1,000s)										
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	Funding Agency	
E&P (PA&ED)									Caltrans	
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL										
Proposed Funding (\$1,000s)									Notes	
E&P (PA&ED)										
PS&E		1,993	1,000					2,993		
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON			13,507	4,750	825			19,082		
TOTAL		1,993	14,507	4,750	825			22,075		

Fund No. 7:		Other FTA / Match Programming (MTC discretion)							Program Code	
Existing Funding (\$1,000s)										
Component	Prior	20-21	21-22	22-23	23-24	24-25	25-26+	Total	Funding Agency	
E&P (PA&ED)									MTC	
PS&E										
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON										
TOTAL										
Proposed Funding (\$1,000s)									Notes	
E&P (PA&ED)										
PS&E		2,126						2,126		
R/W SUP (CT)										
CON SUP (CT)										
R/W										
CON			23,967	3,070				27,037		
TOTAL		2,126	23,967	3,070				29,163		

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised Mar, 1 2018 v7.08)

Complete this page for amendments only

Date: 08/16/19

District	County	Route	EA	Project ID	PPNO	Alt. ID
04	SF				2137	

SECTION 1 - All Projects**Project Background**

As with the original 2018 STIP project, the SFMTA continues to work to grow light rail ridership and expand service frequency. Our outdated centralized train control system is under constant pressure and is operating beyond the capacity for which it was designed three decades ago. The risk to service disruption is growing with the recent expansion of our light rail fleet by 68 vehicles (45%) and with the incredible growth in development particularly along the Mission Bay corridor (which corresponds to the Phase 1 geography). To increase rail network capacity, the SFMTA proposes implementing a new Communications-Based Train Control (CBTC) system: a CBTC system possesses the greatest potential of any single investment to improve our light rail operations. The CBTC updates the scope of the Restoration of SFMTA Light Rail Lines - Axle Counters project with new technology. CBTC is envisioned as a multi-phase project with previously programmed STIP funds to be spent on the

Programming Change Requested

The SFMTA will complete its Restoration of SFMTA Light Rail Lines - Axle Counters project, which is currently programmed to receive \$13.752 M in the STIP, by folding its scope and purpose into its larger CBTC Phases 1 and 2 project. The requested scope amendment (and related amendments to project milestones) incorporates the train 'tracking' feature of the Axle Counter project as a core function of the new CBTC system. Essentially, the Axle Counter functionality as originally proposed would have been to enhance the original and old train control system, and investment in CBTC would instead replace it with a new system with a multitude of additional benefits to speed up and improve reliability in an expanded service area. Note the project sponsor has been and remains "SFMTA," not "San Francisco County MTA / Dept. of Parking and Traffic", and this is now reflected throughout the PPR.

Reason for Proposed Change

The SFMTA has developed a vision for the train control system and has determined that the most beneficial path is to replace and expand the existing system due to its limitations and remaining life cycle. This CBTC project replaces the previous plan of staged upgrades to the legacy system. This legacy project was of smaller scope, and would deliver limited benefits as compared with this new project. Based on project development that has occurred since the approval of the 2018 STIP, the SFMTA will launch the full CBTC system in phases. The 2018 STIP funds will be devoted to Phase 1 and 2 improvements on light rail's surface corridor from 23rd Street and the Portal leading to the Market Street subway and the Market Street subway itself along with Central Subway. This includes and expands the geography of the original Axle Counter project, and will provide far superior benefits to the public. It also leverages significantly more federal, state, and local funds than the original

If proposed change will delay one or more components, clearly explain 1) reason the delay, 2) cost increase related to the delay, and 3) how cost increase will be funded

There would be no delay. The cost increase is due to the expanded scope of work and will be funded with non-STIP funds as shown in the "Funding Info" tab (federal, state and local funds).

Other Significant Information**SECTION 2 - For SB1 Projects Only**

Project Amendment Request (Please follow the individual SB1 program guidelines for specific criteria)

SECTION 3 - All Projects**Approvals**

I hereby certify that the above information is complete and accurate and all approvals have been obtained for the processing of this amendment request.*

Name (Print or Type)	Signature	Title	Date

Attachments

- 1) Concurrence from Implementing Agency and/or Regional Transportation Planning Agency
- 2) Project Location Map



SFMTA

A black and white photograph of a Muni train at a station platform. The train is the central focus, with the number '2001A' visible on its front. The platform is on the right, with a person walking away from the camera. The background shows the station's architecture with arched windows.

Muni Communications-Based Train Control Project STIP Funding Proposal

San Francisco County Transportation Authority Citizens Advisory Committee
October 23, 2019

The Problem

Muni Metro service regularly experiences delays and crowding, resulting in an overall poor quality of service

Acute Delays

Vehicle
Breakdowns

Communication
Failures (ATCS)

Passenger Issues

Track Failures

Failed Entries

Operator Issues

Overhead Line
Failures

ATCS Computer
Failures

ATCS Equipment
Failures

Chronic Congestion

Subway
Congestion

Bunching/Gaps

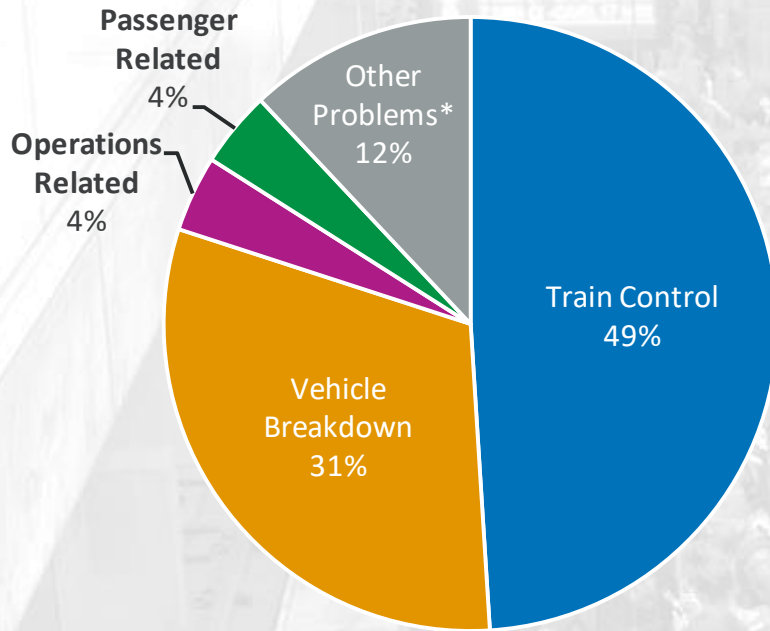
Slow-moving
subway trains

Street congestion

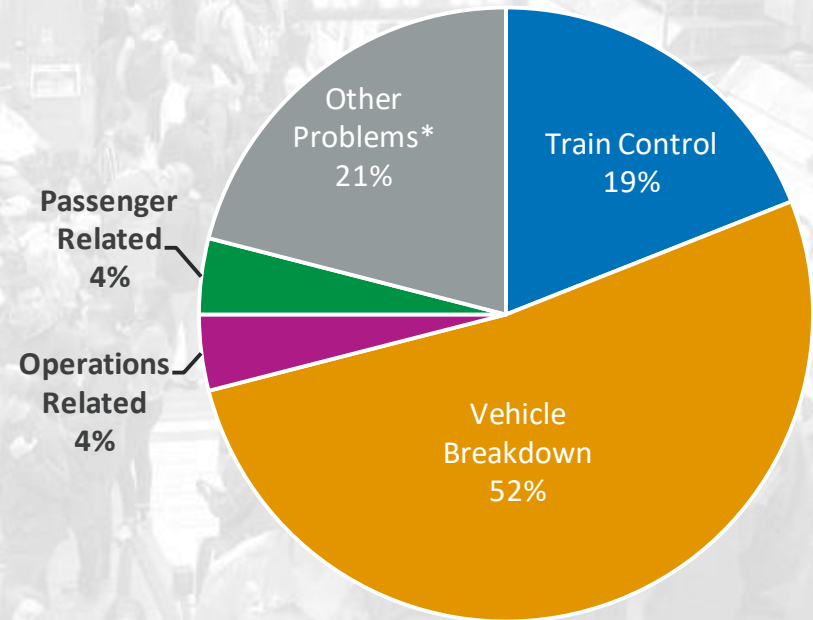
Sources of Acute Delays

(Jan-Dec 2018)

Delays by Quantity



Delays by Impact (minutes)

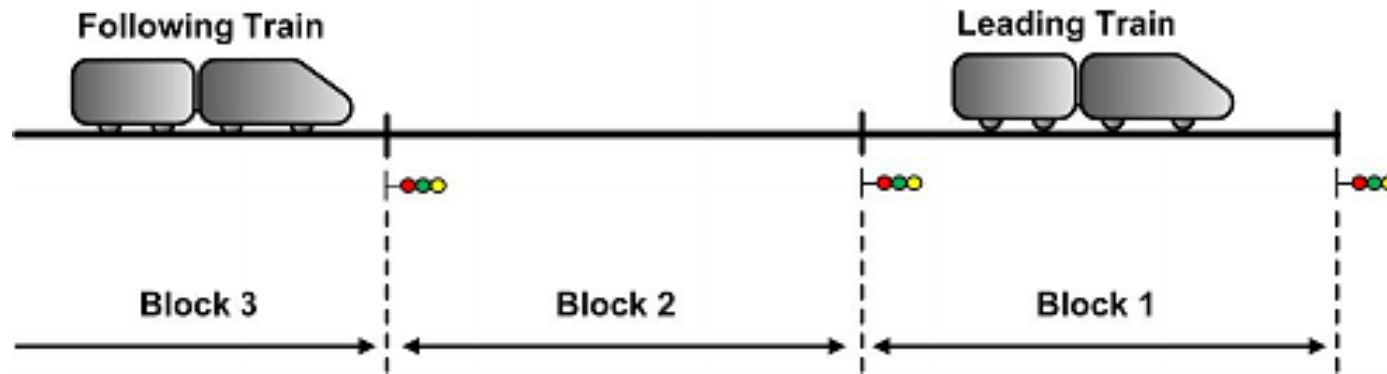


Source: Muni Central Control Log

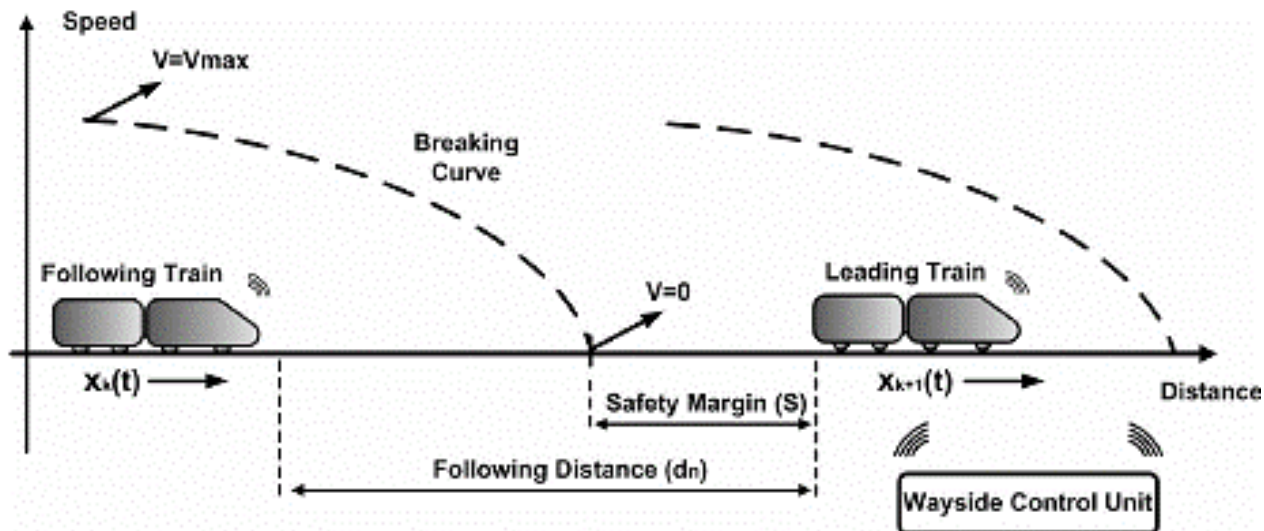
*Other problems include wayside infrastructure failures in addition to delays that were uncategorized in the control log. These figures do not include delay due to congestion, only the acute delay associated with each incident.

Types of Train Control

Fixed block



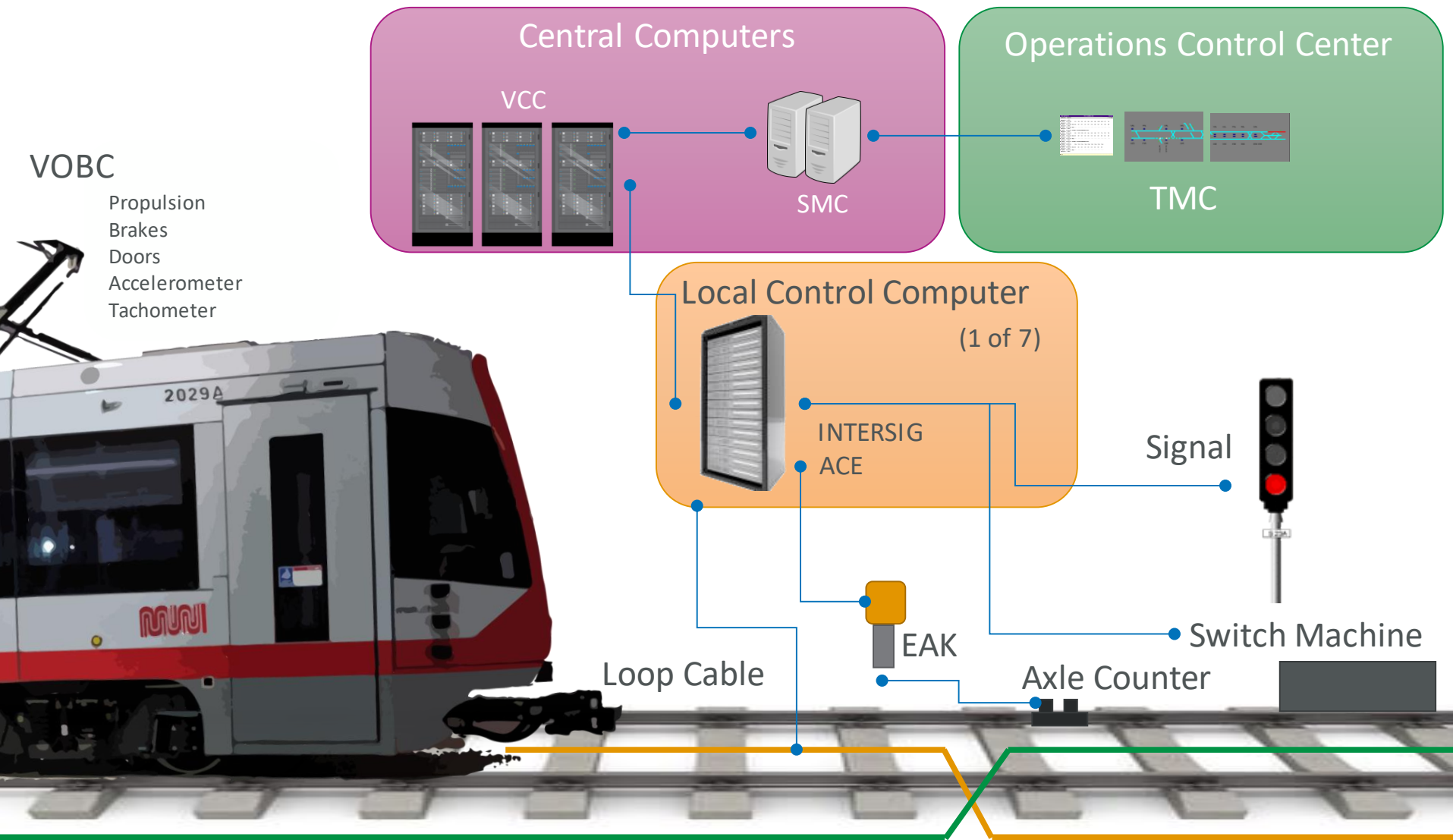
Moving block



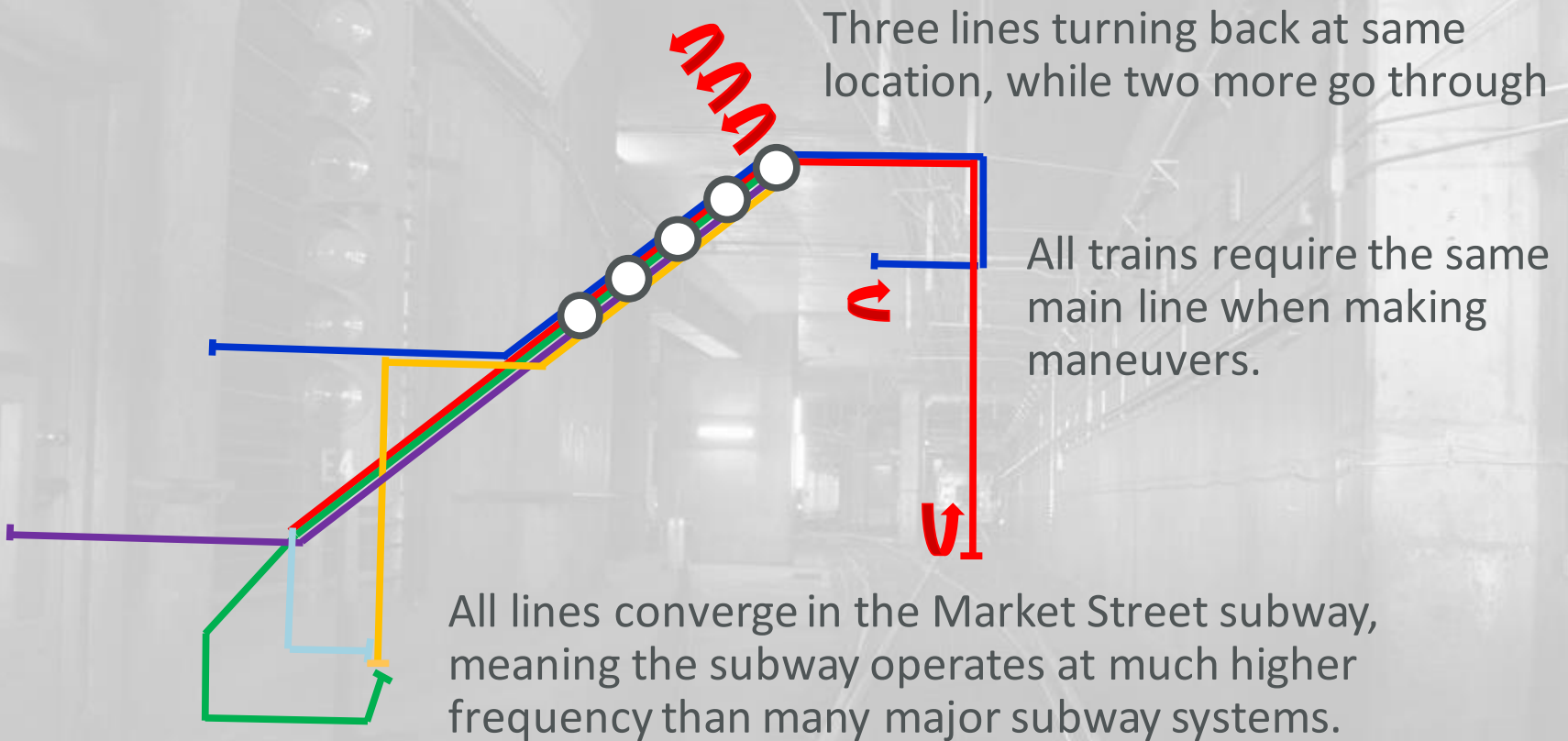
Axle Counter Replacement vs ATCS

- Axle counters are needed for the old fixed block train control system
 - They are used to count train axles to identify the locations of trains
- The new CBTC project will provide better technology to track train movements and would deliver the same functionality the axle counters had provided in the past
- ATCS allow trains to safely travel at closer distances
 - 45 trains/hour is demonstrated maximum today
 - 25 trains/hour was maximum throughput before ATCS

ATCS System Overview



Structural Limitations



Max trains per hour, peak hour

SF Muni

40

BART

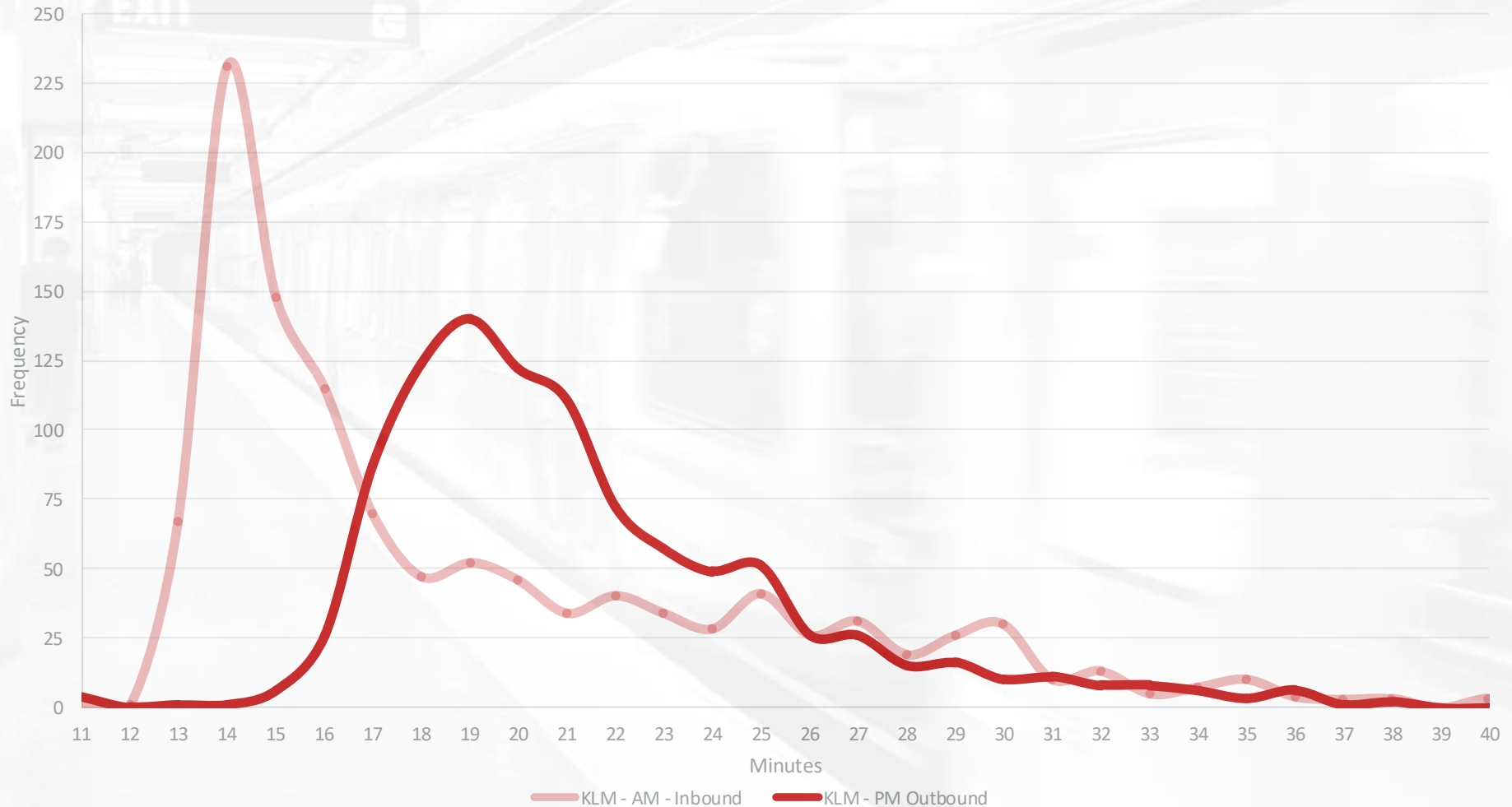
22

Boston

15

Travel Time Variability

January 2019 Travel Time
KLM



The Project

10-year upgrade and expansion of communications-based train control (CBTC) to improve Muni light rail service.

Reduced Delays

Subway delays reduced by 20-25% through reduced train control failures and reduced congestion

Improved Maintainability

System monitors redundant components for faults so preventative action can be taken before service is affected

Consistent trip times

Expanding system to surface and integrating with traffic signals means trip times are less variable

Greater capacity

System enables better supervision and management of trains, addressing bottlenecks and increasing capacity

The Project



Upgrades loop-cable based system in subway to redundant, reliable wireless communications



Installs same wireless communications equipment along the surface right of way



Ties isolated surface signals and switches into the same single, centrally controlled network as the subway



Replaces central computers, local computers, and onboard computers with latest technology

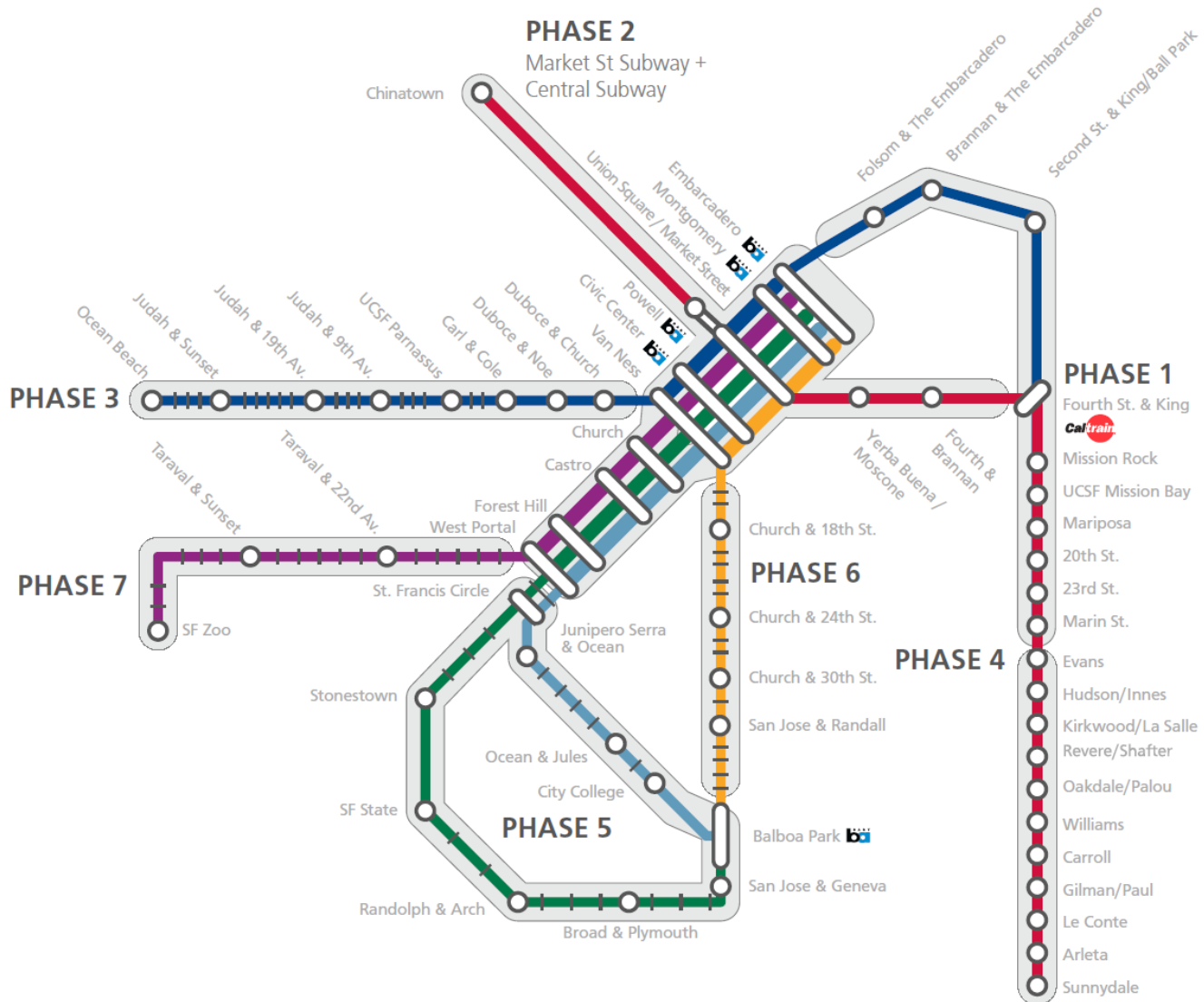


Interfaces with traffic signals to provide train priority (trains don't get stopped at red lights)



Provides central control with tools to adjust train dwell and speeds anywhere on the system to manage bunches and gaps

Preliminary Project Phasing



Schedule

Phase 1

Detail Design: 3/1/19-11/1/20; Construction: 9/1/20-12/31/21

Phase 2

Detail Design: 11/2020-11/2021; Construction: 11/2021-01/2024

Phase 3

Detail Design: 11/2021-9/2022; Construction: 8/2022-12/2023

Phase 4

Detail Design: 9/2022-7/2023; Construction: 7/2023-01/2024

Phase 5

Detail Design: 7/2023-4/2024; Construction: 4/2024-1/2025

Phase 6

Detail Design: 4/2024-1/2025; Construction: 1/2025-8/2025

Phase 7

Detail Design: 1/2025-10/2025; Construction: 10/2025-5/2026

Schedule Detail

	Start Date	End Date	Q2- FY20	Q3- FY20	Q4- FY20	Q1- FY21	Q2- FY21	Q3- FY21	Q4- FY21	Q1- FY22	Q2- FY22	Q3- FY22	Q4- FY22	Q1- FY23	Q2- FY23	Q3- FY23	Q4- FY23	Q1- FY24	Q2- FY24	Q3- FY24	Q4- FY24	Q1- FY25	Q2- FY25	Q3- FY25	Q4- FY25	Q1- FY26	Q2- FY26	Q3- FY26	Q4- FY26	
Phase 1 Detail Design	3/1/2019	11/1/2020																												
Phase 1 Construction	9/1/2020	12/31/2021																												
Phase 2 Detail Design	11/2020	11/2021																												
Phase 2 Construction	11/2021	11/2024																												
Phase 3 Detail Design	11/2021	9/2022																												
Phase 3 Construction	8/2022	12/2023																												
Phase 4 Detail Design	9/2022	7/2023																												
Phase 4 Construction	7/2023	1/2024																												
Phase 5 Detail Design	7/2023	4/2024																												
Phase 5 Construction	4/2024	1/2025																												
Phase 6 Detail Design	4/2024	1/2025																												
Phase 6 Construction	1/2025	8/2025																												
Phase 7 Detail Design	1/2025	10/2025																												
Phase 7 Construction	10/2025	5/2026																												

Budget & Funding Plan*

Phase 1 Budget

Detail Design	\$3,450,000
Construction	<u>\$23,250,000</u>
Total	\$26,700,000

Phase 2 Budget

Detail Design	\$11,450,000
Construction	<u>\$43,950,000</u>
Total Budget	\$55,400,000

Funding Plan

Fund Source	Amount
FTA 5337	\$3,576,000
Transit Capital Priorities (MTC)	\$4,344,000
STIP	\$13,752,000
Population Baseline GF	\$3,271,000
SB1 State of Good Repair	\$1,757,000

Funding Plan

Fund Source	Amount
FTA 5337	\$403,000
Transit Capital Priorities (MTC)	\$24,820,000
General Funds	\$1,000,000
Population Baseline GF	\$8,860,000
SB1 State of Good Repair	\$20,317,000

**An additional \$8,935,000 will be devoted to Pre-Phases 1 and 2 project development.*

Full Project (Development, Phases 1-7)

Conceptual Budget: \$300,000,000

- Includes escalation
- Possible future funding sources for full project:
 - **Federal:** Capital Investment Grant program
 - **State:** Transportation Infrastructure and Rail Capital Program, Affordable Housing / Sustainable Communities, Caltrans State of Good Repair funds
 - **Local:** GO Bond, Population Baseline funds, Developer fees, future revenues (ex: TNC)



SFMTA

Questions?

