




SFMTA

A black and white photograph of a subway train at a platform. The train is white with dark accents and has the number '2001A' on its front. The platform is tiled and has an 'EXIT' sign. A person is walking on the platform in the distance.

Subway Performance and Train Control Upgrade

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The problem

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

Acute Delays

**Vehicle
Breakdowns**

Track Failures

**Overhead Line
Failures**

**Communication
Failures (ATCS)**

Failed Entries

**ATCS Computer
Failures**

Passenger Issues

Operator Issues

**ATCS Equipment
Failures**

Chronic Congestion

**Subway
Congestion**

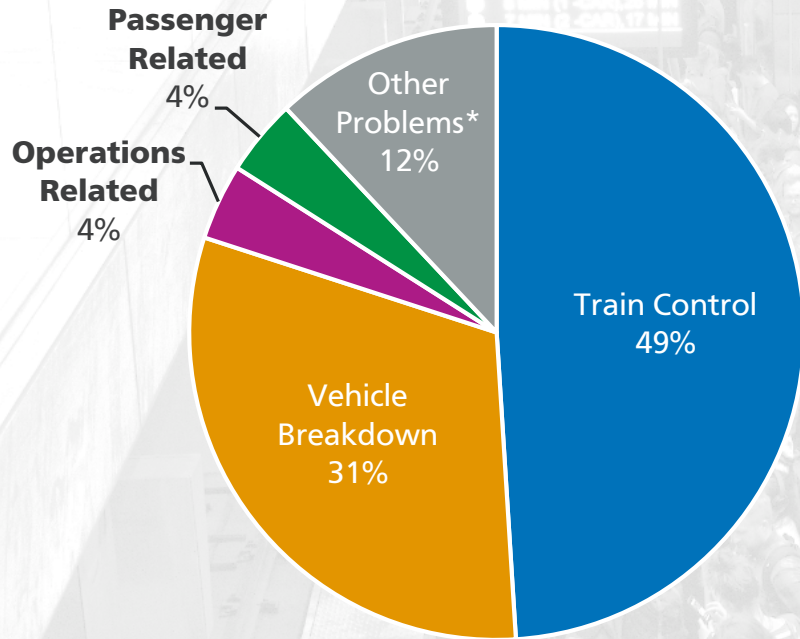
Bunching/Gaps

**Slow-moving
subway trains**

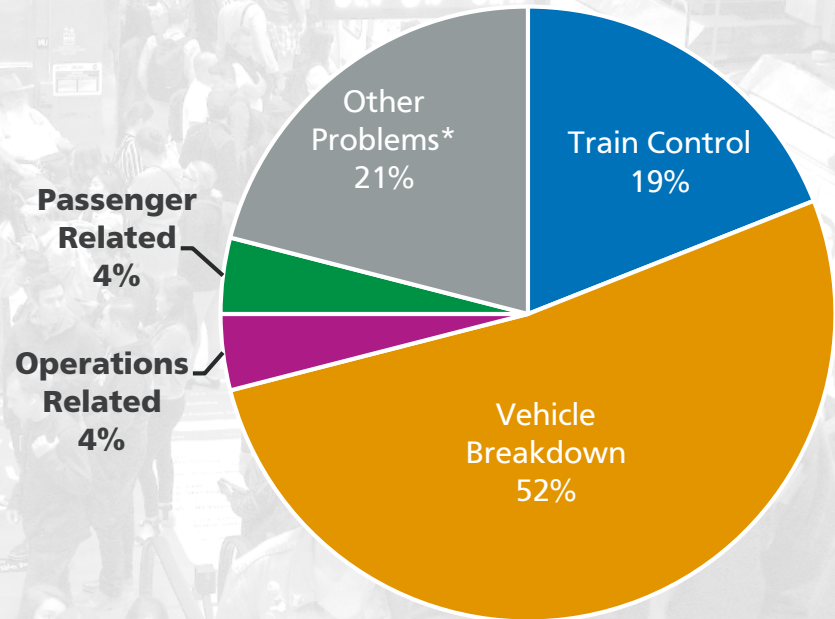
**Street
congestion**

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.

Muni's train control today

Subway

Automatic Train Control

In service 1998

- A train entering one of three portals and pings the central computer
- The system does a "handshake" with the vehicle, and routes it automatically
- System keeps vehicles safely spaced
- System controls use and activation of switches to route vehicles (first come, first serve)
- Operators open/close doors, but all other movements are automated

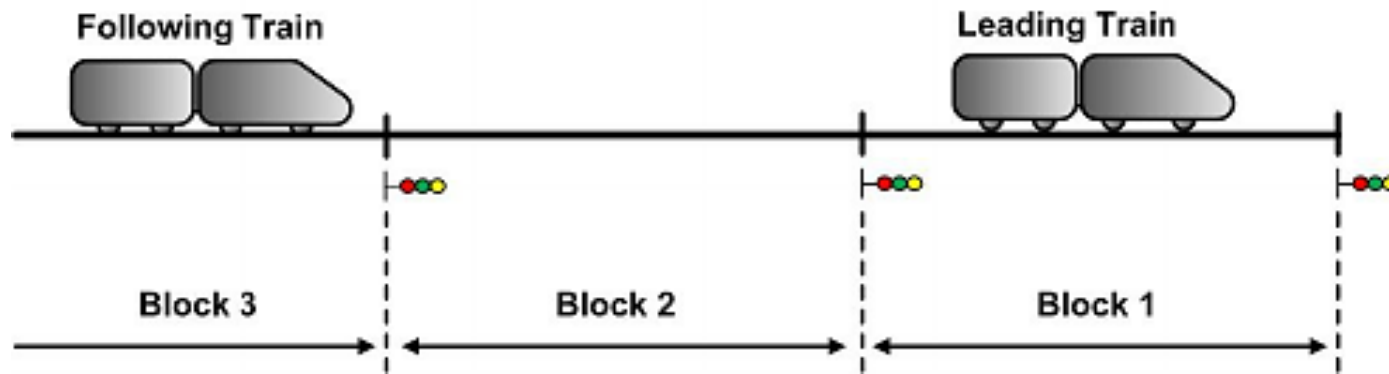
Surface

Independent Operation

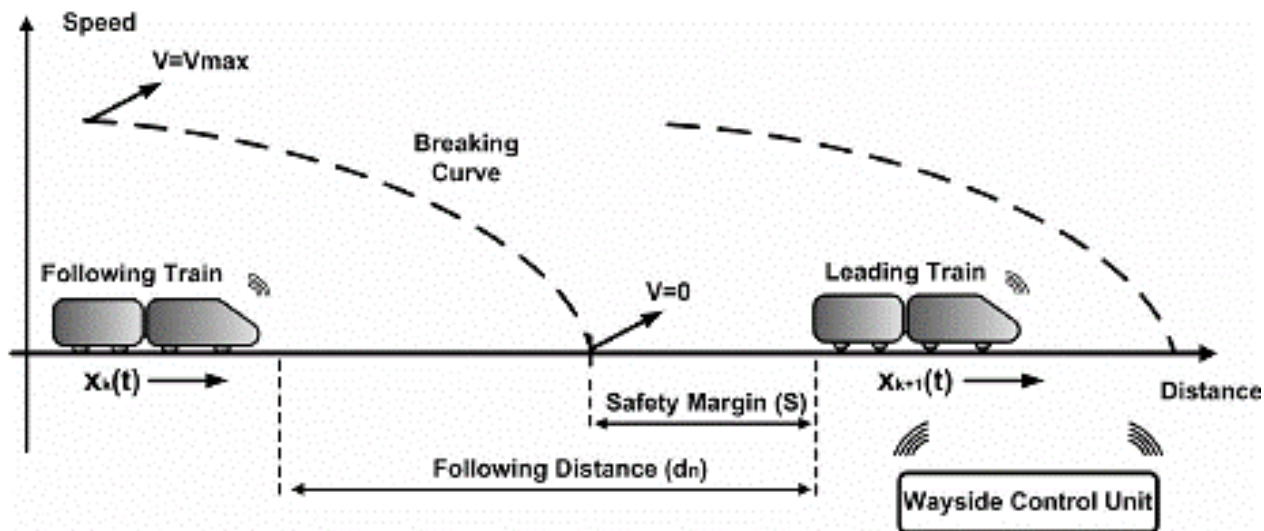
- Vehicles on the surface are fully controlled by the operator unsupervised by Central.
- Signals and switches are controlled by independent wayside computers.
- Routes are requested as trains are detected by the "VETAG" system, and assigned first come, first serve.
- No spacing management

Types of train control

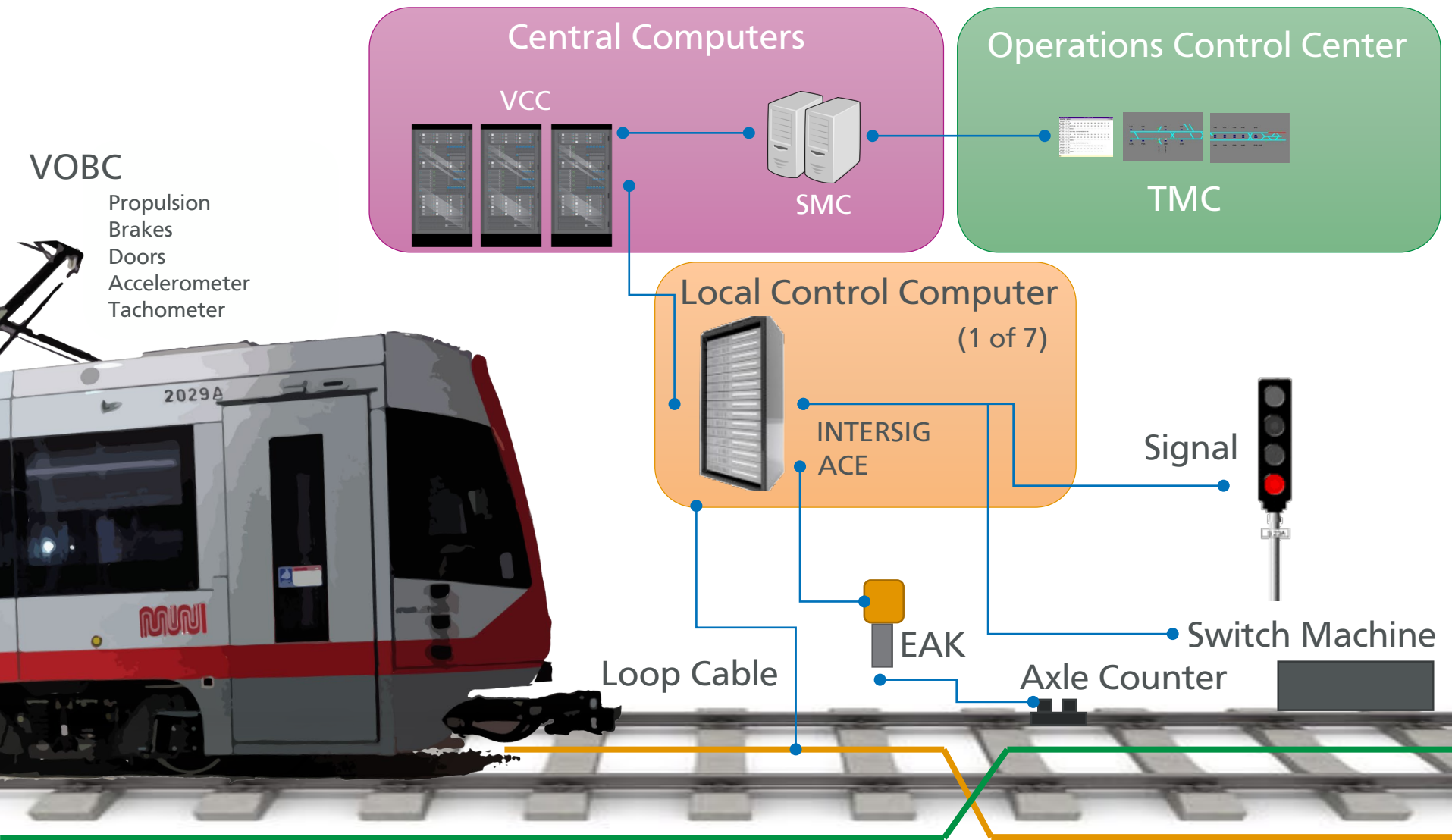
Fixed block



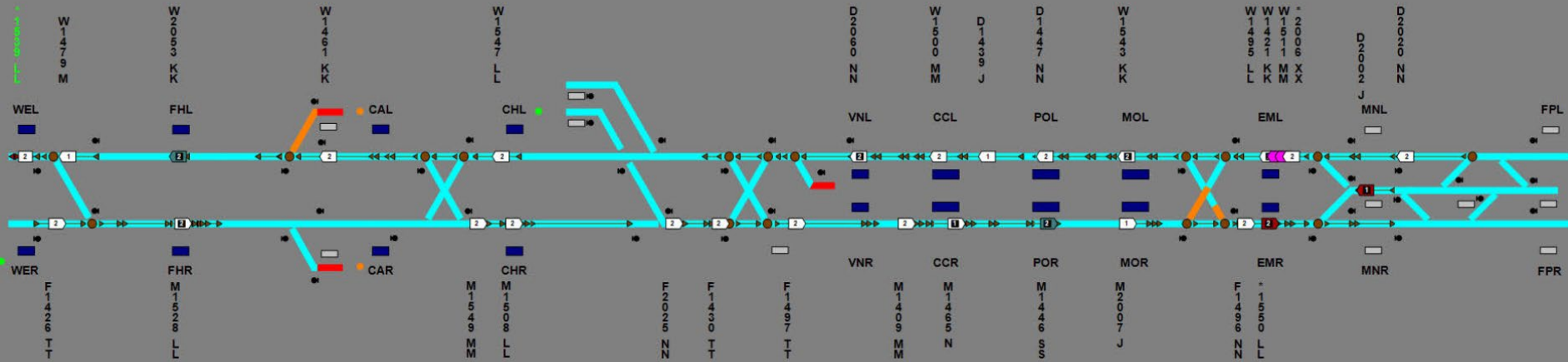
Moving block



ATCS System Overview



SMC – System Management Center



09/25/19 08:35:39 am ©SFMTA

What are the key reasons for poor train control system performance?

The present system designed in the 1980s and was rolled out in the 1990s—it experienced significant issues then, and continues to cause headaches today

Three entry portals

Multiplies the opportunity for system failures, makes systemic management of entire rail system complex

Twenty-year-old system

Components fail regularly, technology has significant capacity issues, fewer and fewer people have expertise to understand system

Rigid infrastructure

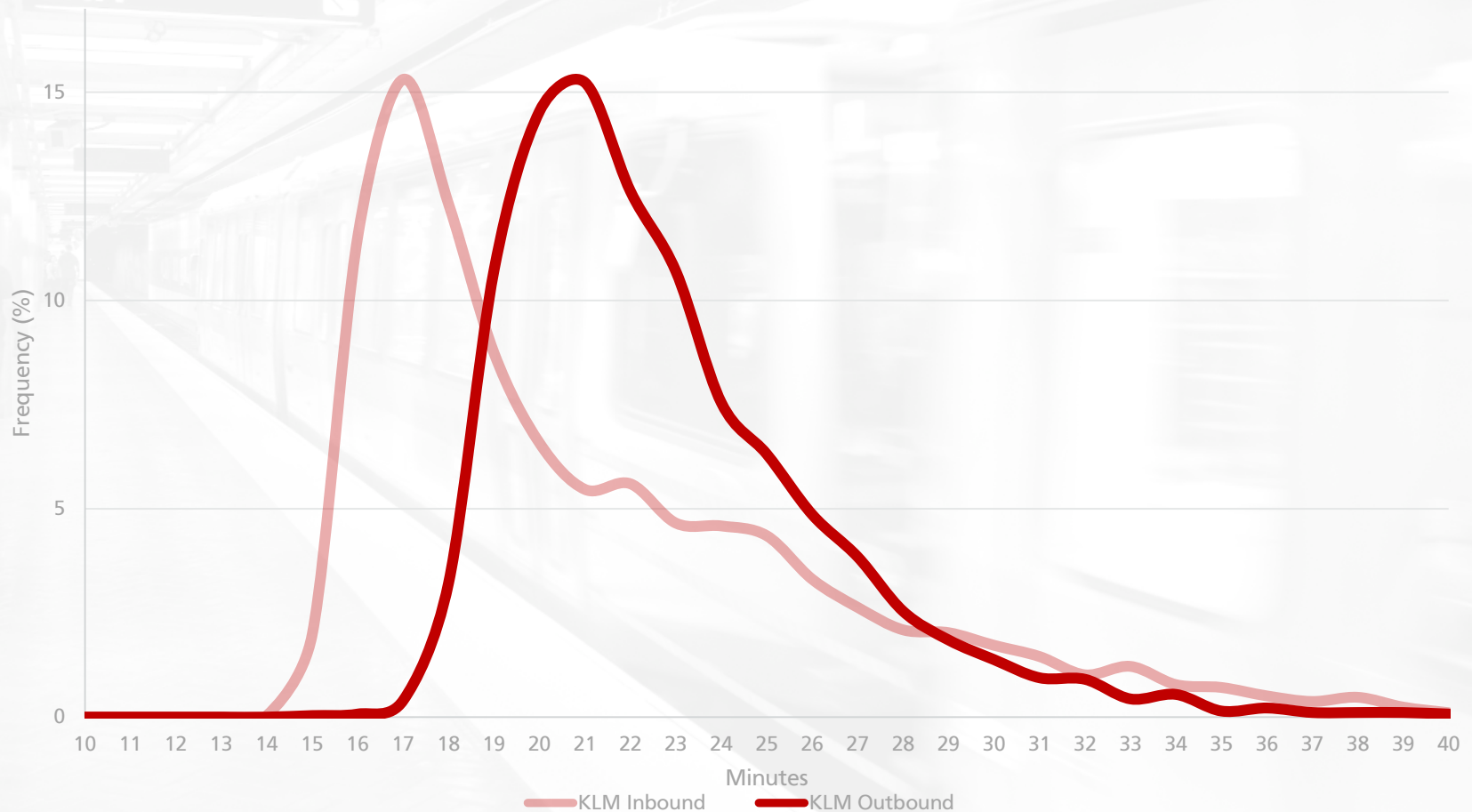
Extremely unforgiving system design, system is slow to come back up and results in delays that are disproportionate to significance of initial failure

Congestion

We are operating at (or even above) capacity of the train control system, leaves zero room for error

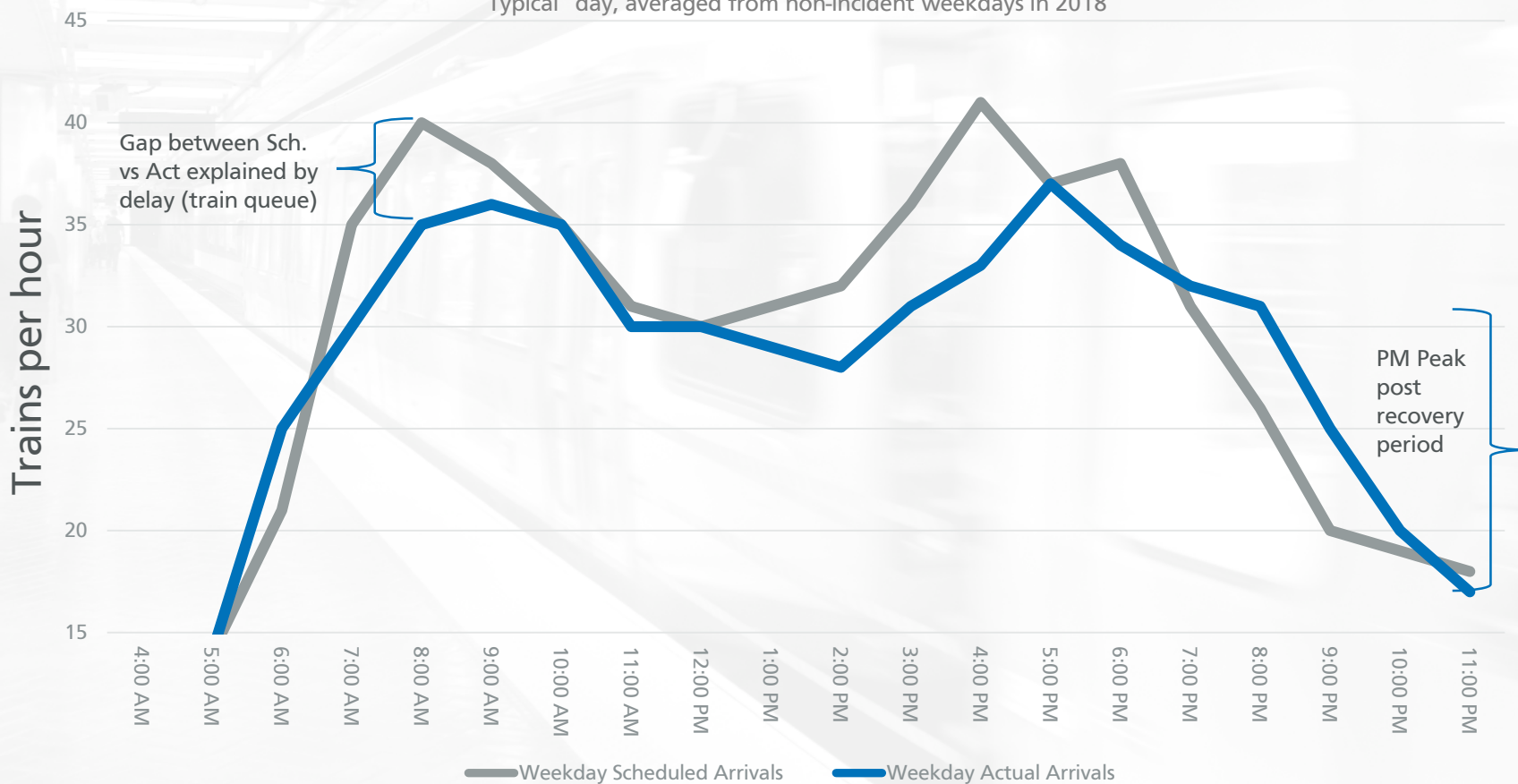
Travel Time Variability

Aug - Nov 2019 Travel Time Distribution
KLM, Weekdays

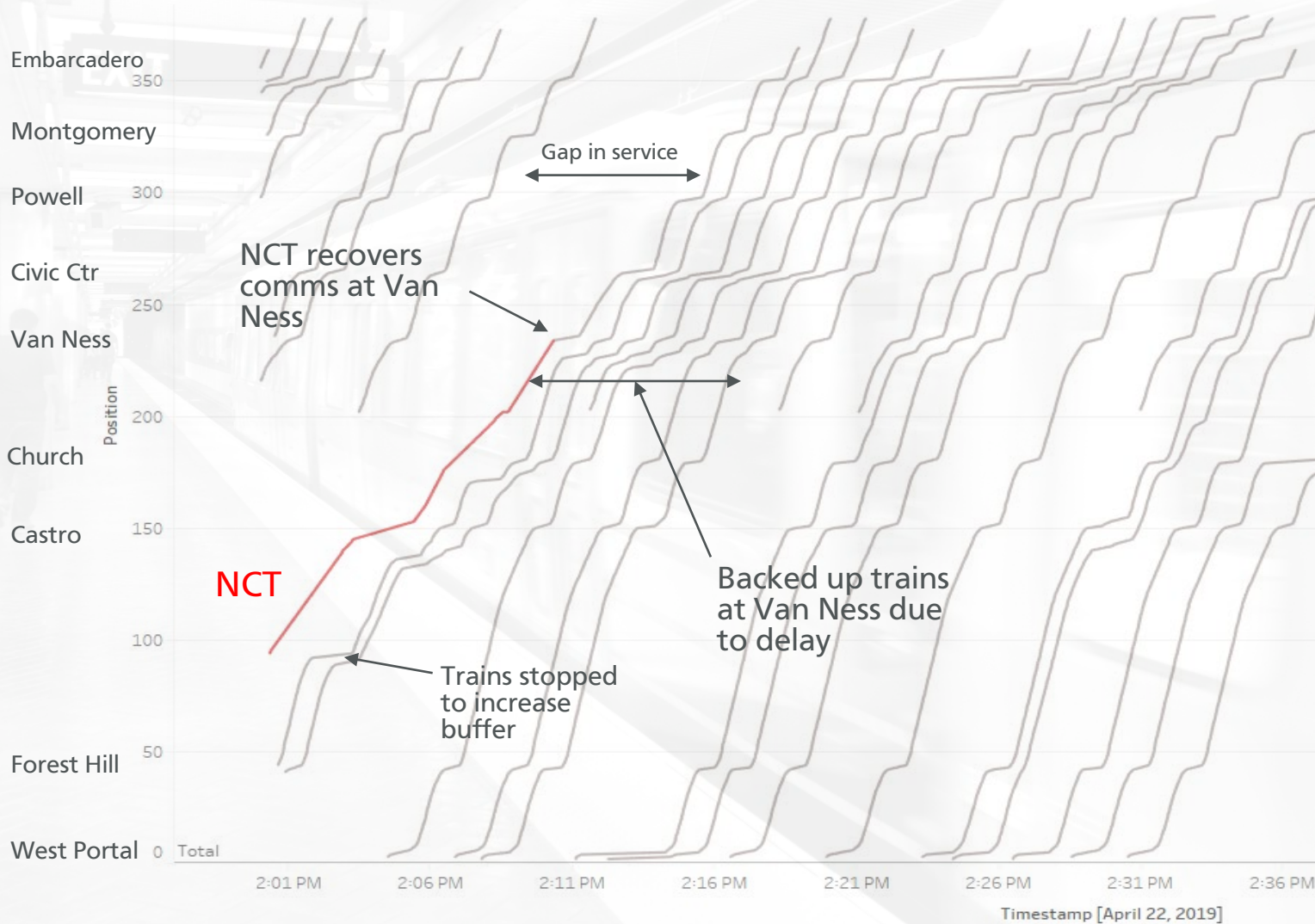


Capacity

Subway Hourly Throughput, at Embarcadero Station inbound
"Typical" day, averaged from non-incident weekdays in 2018



Non Communicating Trains (NCT)





Recent Subway Initiatives

- Service management shifted to modern Transportation Management Center – new tools enable increased focus on service management
- Reduced infrastructure issues in subway as a result of extended maintenance program and switch replacement at Church/Duboce
- Combination of parking control officers, traffic modifications and localized signal management reducing delays approaching outbound West Portal
- New radio and staff trainings have enabled better customer communications during disruptions
- Increased mobile maintenance staff in the subway for quicker response times to breakdowns

Upcoming initiatives

Subway Performance



As part of the next 90-day plan, SFMTA is developing a two-year plan to improve rail service delivery, focusing on the subway.

Highlights will include:

- Activate West Portal Crossover with three-car shuttle
- Modify service plan to reduce subway congestion
- Continue extended maintenance program
- Increased supervision throughout rail system
- Continued investment in TMC line management training

The Train Control Upgrade Project

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

Project Benefits

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

Project description



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

Project phasing

Benefits by phase

Phase 1

- Improved control center management on surface
- Traffic signal integration
- Reduced delays on N and T

Phase 2

- Improved subway reliability
- Fewer subway delays
- Increased subway capacity

Phase 3

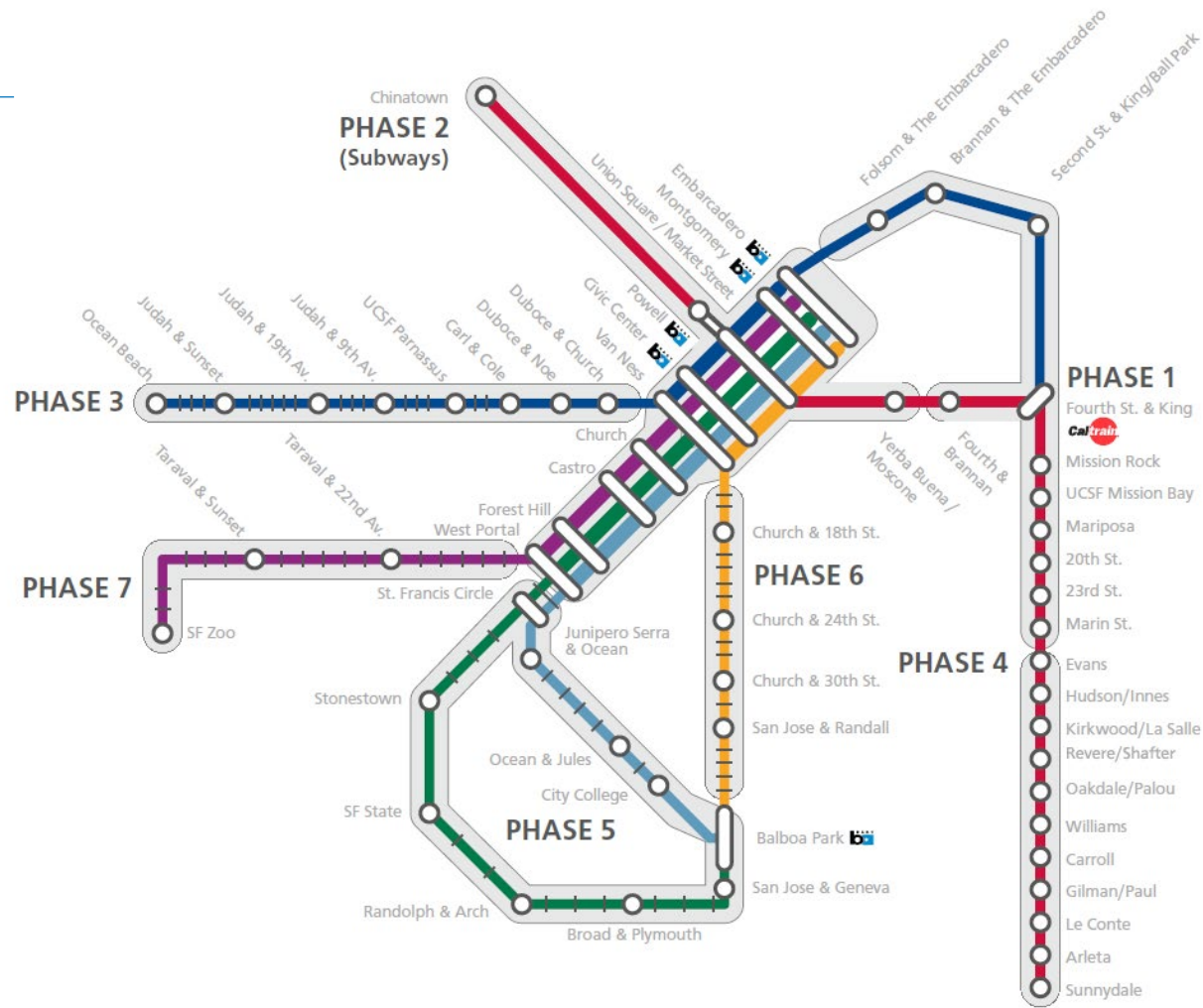
- Shorter running time for N

Phase 4

- Shorter running time for T

Phase 5-7

- Improved control center management at all key junctions
- Reduced systemwide delays



Next steps

Now

Train control upgrade strategy; provides a plan for future upgrades and investments in train control

Spring 2020

RFP for new CBTC project on surface and subway
Present two-year subway service improvement plan

2021-22

Adjustments to subway service as a result of the improvement plan

2023

First CBTC project benefits on initial segment

2026

New CBTC system fully operational in subways

2029

Entire Muni Metro system fully integrated into new CBTC



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Questions?

