Introduction to Train Control

Dan Howard
Muni Technology Systems Manager
What is Train Control?

Primarily, train control is a safety system which is designed to prevent train-to-train collisions.

Generally, train control systems do not address the risk of collision between trains and other vehicles, bicycles, or pedestrians. These capabilities are currently being researched.
Secondarily, more modern train control systems can be used to manage rail service, giving operations staff the tools to monitor and adjust trains’ speeds and dwell times to ensure the trains stay on schedule and maintain consistent headways.
Types of train control

Fixed block

Moving block
What is Train Control? (cont)

In addition, we need to control movement through junctions (called ‘interlockings’).
This includes both occupancy control (fixed block and moving block) as well as switch position.
ATCS System Overview

Operations Control Center

SMC

VCC

Station Controllers
ATCS System Overview

Central Computers
- VCC
- SMC

Operations Control Center
- TMC

Local Control Computer
- INTERSIG
- ACE

VOBC
- Propulsion
- Brakes
- Doors
- Accelerometer
- Tachometer

Loop Cable

Signal

Switch Machine

Axle Counter

EAK

SFMTA
Muni Metro Train Control
# VCC – Vital Control Computer

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PG 1
Station Controllers
Carborne Equipment (VOBC)
Wayside Equipment
SMC – System Management Center
OCC Control Center - Then
TMC Control Center - Now
Managing Service
Introduction to CAD-AVL

Katelyn Stangl
Transit Operations Systems Planner
What is a CAD-AVL system?

- Connects vehicles to scheduling & dispatching
- Allow for real-time monitoring of transit operations & adjustments to transit service
- Our system is called “OrbCAD”
What types of data does it include?

- Schedule data
- Automatic Vehicle Location Data (AVL)
- Incident log
- Automatic Passenger Counter Data (APC)
How do we use our CAD-AVL system in real-time?
## Monitoring Transit Operations

### Route & Direction

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### Operator & Vehicle Assignments

### On-Time Performance

### Vehicle Location

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**Note:** The table above shows the monitoring of transit operations with columns for route, current flow direction, operator, block, vehicle ID, vehicle type, status, time, deviation, heading deviation, delta, last stop, next stop, and intersection details.
Headway Management

Instead of using a static schedule, vehicle departures are dynamically timed to maintain a consistent spacing along the route (i.e. a bus arrives at a stop every 10 minutes).

Each large line represents one route direction. The arrow represents the direction (note that the directions are flipped as if the vehicles were driving on left side of the road). The color of each line represents the overall headway performance on the line.
- **Green**: On Headway
- **Yellow**: Off Headway
- **Red**: Very Off Headway

There are two numbers between each set of vehicles along the route. The top number represents the scheduled headway; the bottom number represents the actual headway.

The color of the line between each vehicle changes based on how close the vehicles’ headway is to the scheduled headway.
CAD-AVL On Transit Vehicles

- Send alerts to operators
- Show operator trip notes, directions
- Operators can communicate with controllers – send emergency alarms
How do we use the data created by the CAD-AVL system?

All data is archived

Data is analyzed

Data is used for transit operations, service planning, and, & Muni Forward
Crowding, vehicle capacity, & service planning

- Use archived APC data to calculate how many people are on board the vehicle
- Compare vehicle load to vehicle capacity
- Identify trips or route segments where the vehicle is crowded

% Crowded Trips

Vehicle Speeds & Muni Forward

Use archived AVL data to calculate how fast transit vehicles are traveling per street block.
Check out more of our data analysis work at sfmtna.com

https://www.sfmtna.com/muni-data

- **Muni system ridership recovery**: Includes data April 2020 to present
- **Muni ridership recovery by route**: Includes data April 2020 to present
- **Average daily Muni boardings**: By route and month, includes data pre-pandemic to present
- **Percent of daily trips crowded**: By route and month
- **Scheduled Muni service and ridership recovery**: By route
- **Subway performance data**: Metrics used to inform day-to-day Metro service
- **Strategic planning metrics**: Muni service quality
Next Generation Customer Information System

Ossmand Ruano
Customer Information Systems Planner
What is CIS?

Our Customer Information System (CIS) is a real-time transit information system, designed to provide customers with up-to-date Muni transit information.
Background

• In 1999, San Francisco piloted the first U.S. real-time information system.

• Since then, the technology and transportation landscape has rapidly evolved.

• Next-Gen CIS project began in 2020 with a focus on upgrading the CIS system.
Next-Gen CIS

Ride on.
Next-Gen CIS

- Surface Vehicle Locations
- Underground Locations
- Automatic Passenger Counters
- Stationary Digital Signs
- Mobile Platform & Website
- System Software
How is CIS data generated?

SFMTA Systems

- Data is generated by a variety of SFMTA systems.

CIS Data

- CIS predictions are generated by a computer algorithm.

Third-party Apps

- Prediction data is made available for third-party apps.
Next-Gen CIS: Stationary Signs

- New larger Liquid Crystal Displays (LCDs) at Muni shelters and stations, replacing existing signs and expanding real-time information coverage.

- Over halfway completion on the installation of new shelter signs.
Next-Gen CIS: Muni Mobile

Trip Planner
- Point-to-point directions, vehicle arrival times and other new customer information
- Live trip tracking to inform customer of changes in journey
- Customer configurable for language, accessibility and service preferences

Upgraded MuniMobile App
- Provides all-in-one mobile ticketing and trip planning functionality for transit and multimodal services
- Automatically reflects real-time service changes
How do we use CIS?

- Monitor routes/predictions
- Create rider messages/alerts