



**Massachusetts Bay
Transportation Authority**

Transit Signal Priority in Cambridge

Cambridge Transit Advisory Committee: January 13, 2022

Jay Jackson, EIT

Transit Signal Priority Coordinator

JayJackson@mbta.com

Eric Burkman, AICP

Director of Transit Priority

EBurkman@mbta.com

Agenda

- Background and Overview
 - Overview of Transit Signal Priority
 - City Priorities and Funding
- Implementation Considerations
 - Consideration #1: Working with 50+ Munis
 - Consideration #2: Data Collection Methods
 - Consideration #3: Stop Bar Arrival Time Estimates
- Next Steps for Cambridge and MBTA Collaboration



**Delivering bus
priority projects
is different:**



While MBTA operates the service . . .



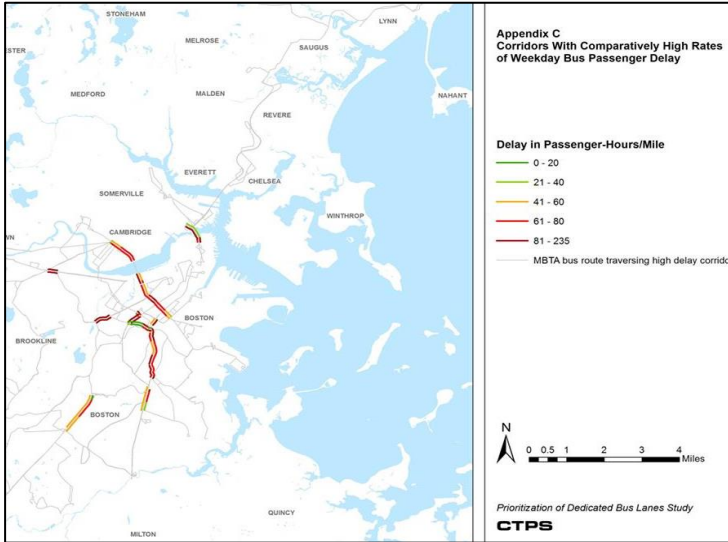
**we rely on municipality-owned signals,
streets, and curbs for every trip.**





**Every project is a collaboration
to improve travel time and
reliability.**

Transit Priority Vision



Data-driven

Founding based on successful pilots and on Prioritization of Dedicated Bus Lanes Report (CTPS, 2016)

Collaborative

Four dedicated staff working with many, many internal and external stakeholders

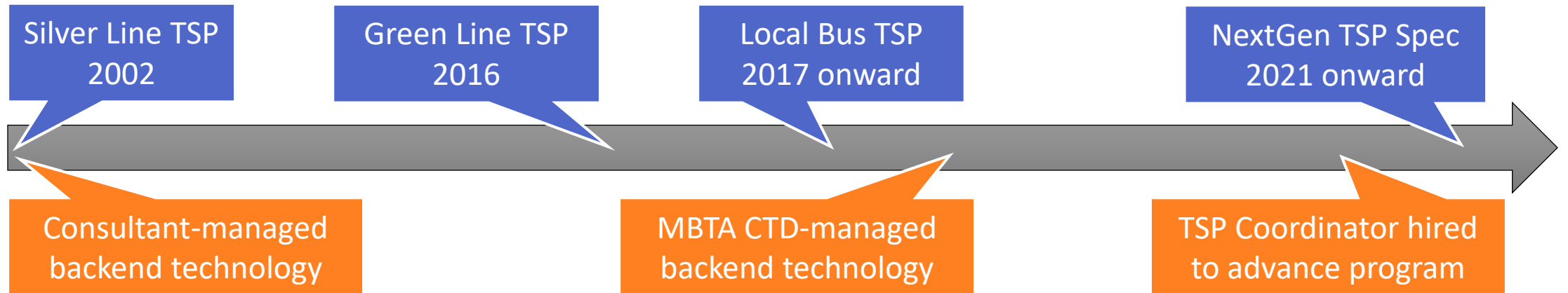
Implementation Focus

Collaborating with stakeholders to deliver projects that **improve travel time and reliability** for buses*

*and light rail TSP for at-grade signalized intersections.



Transit Signal Priority History at MBTA



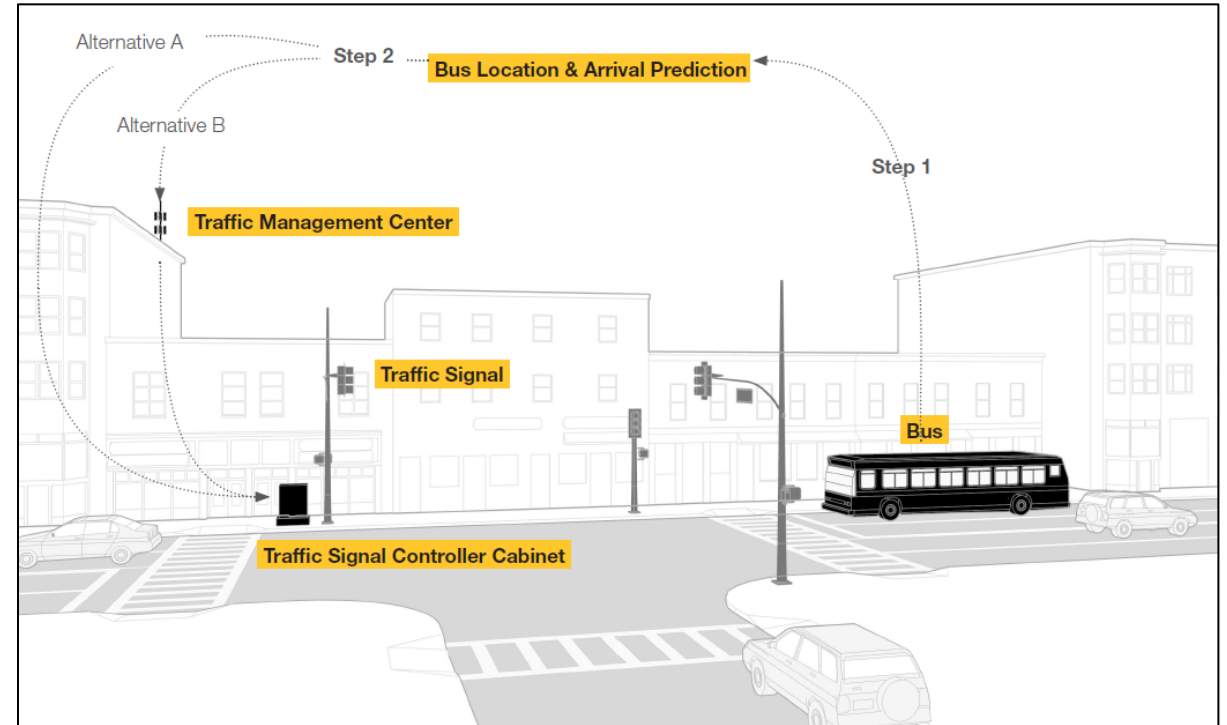
We knew that we want to expand TSP, that the current system's effectiveness is unclear, and that better technology is available.



Transit Signal Priority Overview

Transit Signal Priority reduces the time buses and Green Line wait at traffic lights.

- **Green Extension**
Extend the green phase
- **Red Truncation**
Shorten conflicting red phases to get green light sooner
- Other, less common methods



How TSP works



Strategizing NextGen TSP

Problem	Solution
What signal technology to choose?	Issued Request for Information (RFI)
How to measure TSP operations?	Developing metrics and collecting better data
Stop bar arrival predictions are cumbersome to calculate	Implement 'learning' technology
TSP recommendations based on 2015 specification	Developing updated specification

Goals:

- Measure TSP benefits at the intersection level
- Identify issues without manual measurement
- Calibrate operations remotely
- Provide updated specifications for TSP equipment to jurisdictions
- **Better operationalize implementation and evaluation for TSP**



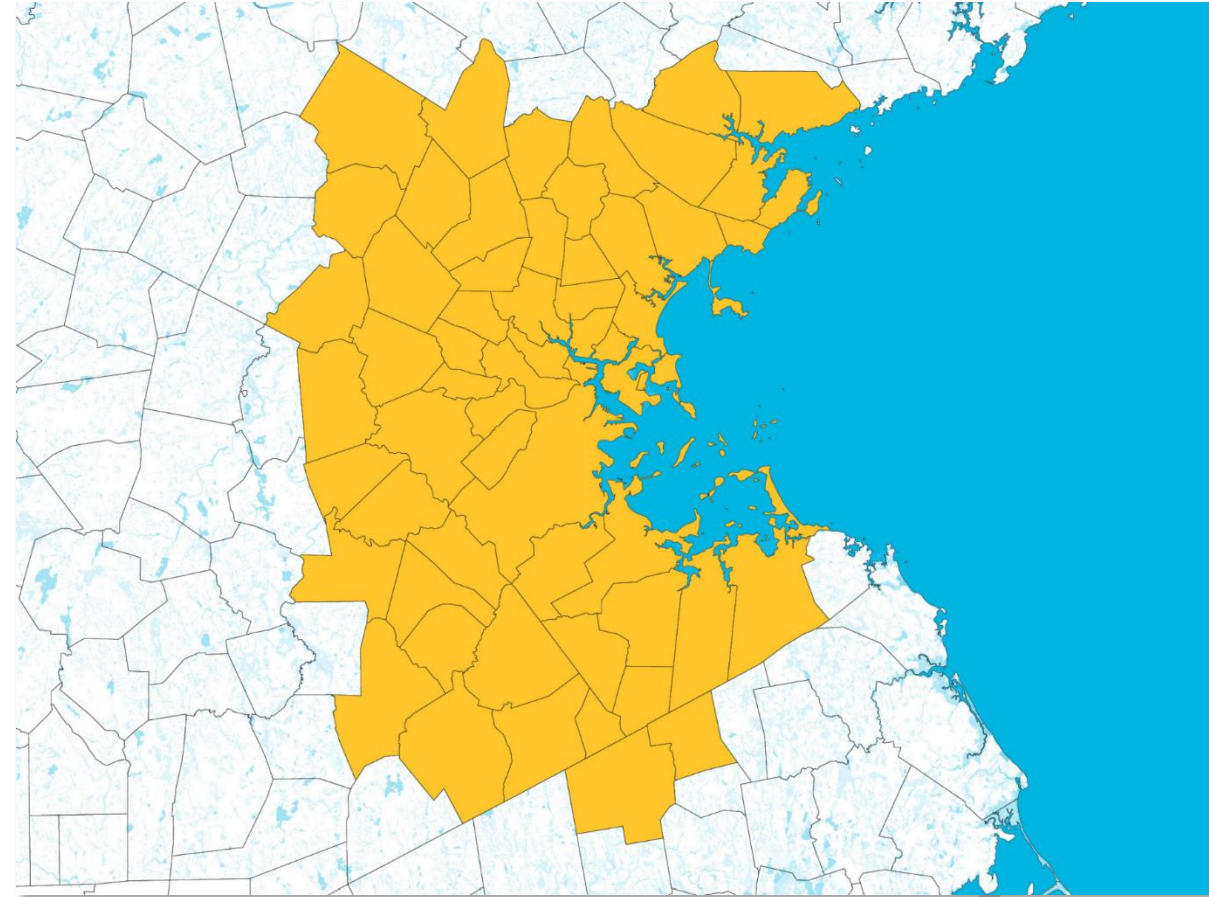
Comparison of TSP Approaches

Generation	Activation	Prediction	Evaluation	Result
Legacy Bus	Single zone	Manually estimated and field verified	Field observation; AVL (not TSP-specific)	Unable to clearly measure results and system success
Current Bus	Multiple zone			
NextGen	AVL-based and/or intersection detection	Can improve automatically over time; Context-sensitive	Semi-automated; Data feed returned from intersection	Adaptive timing and measurable results



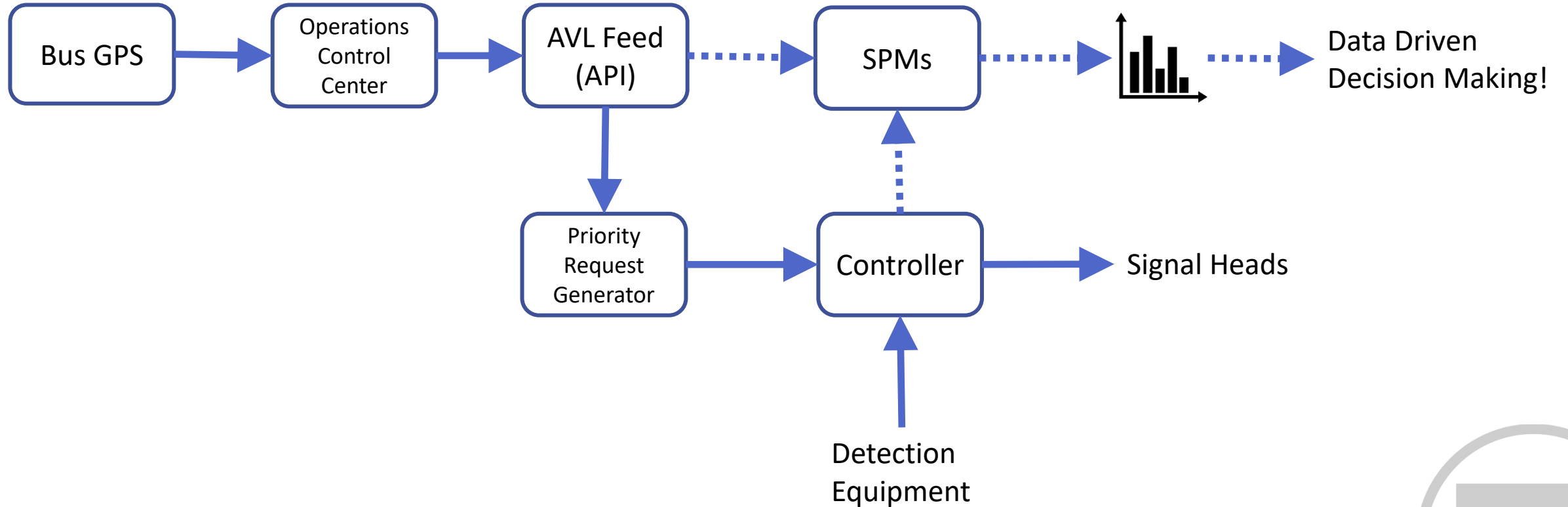
Consideration #1: Working with 50+ municipalities

- Variability across region
 - Centralized vs Decentralized
 - Signal Technology and Condition of Existing Equipment
 - Political Structure, Internal Processes and Traffic Signal “Business Rules”



Addressing Consideration #1: Uniform Signal Ecosystem

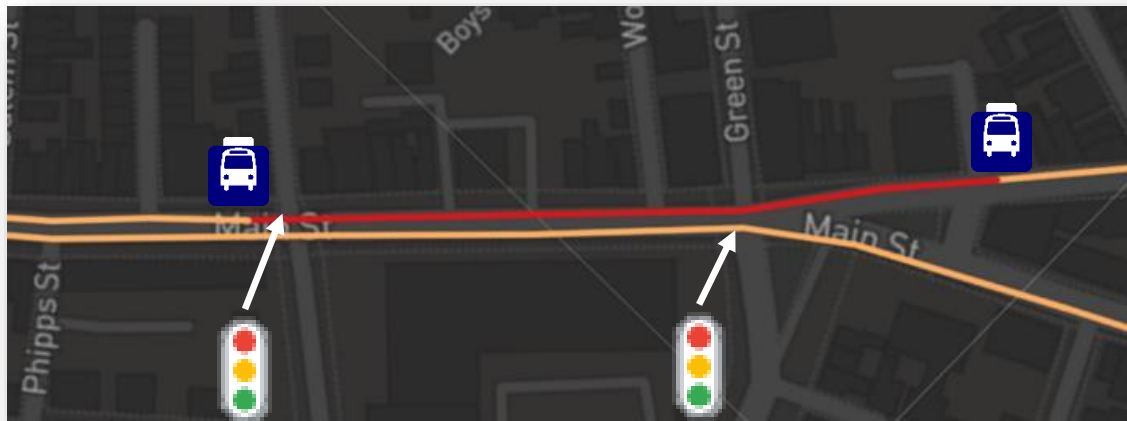
- Vendor Agnostic and Interoperable



Consideration #2: Data Challenges

- Granularity of AVL data is not sufficient for TSP measurement
- Traditional ATSPM data is not transit-focused
- Existing data collection is labor intensive

Total delay between bus stops*



Courtesy: Nick Caros, MIT

*excludes dwell

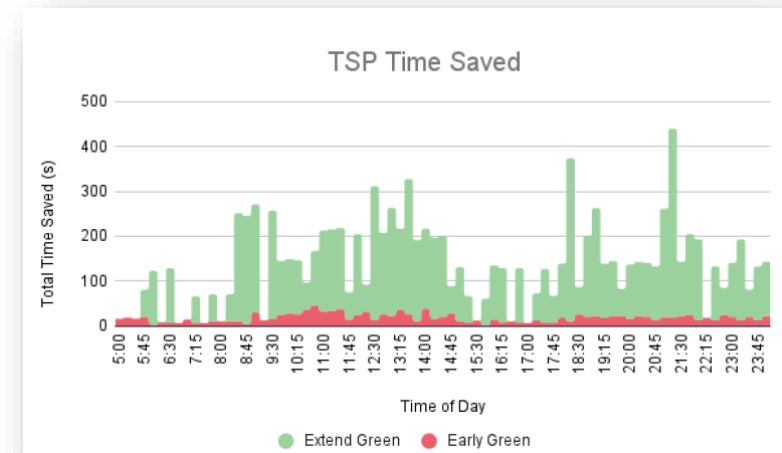
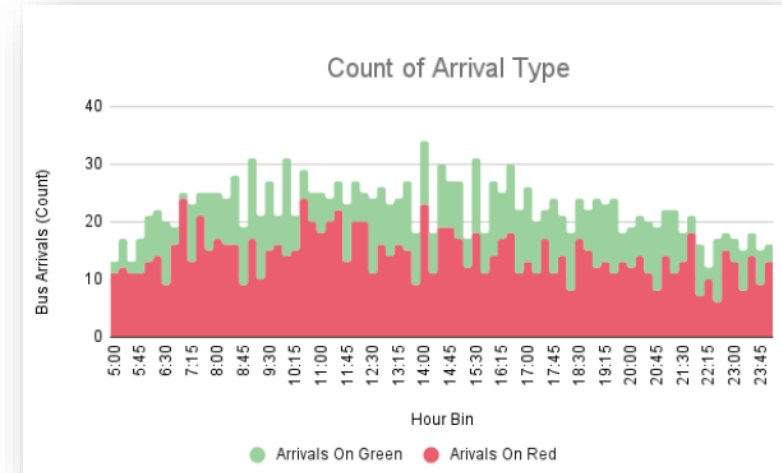
Raw Data Output File

	A	B	C
1	Time	Event	Param
1565	18:18.3	81	3
1566	18:19.5	82	3
1567	18:20.1	3	2
1568	18:20.1	3	3
1569	18:20.5	82	5
1570	18:20.5	2	4
1571	18:20.5	43	4
1572	18:21.6	81	3
1573	18:21.9	81	5



Addressing Consideration #2: Developing TSP-specific Insights

- Prospective Metrics
 - Effectiveness KPIs
 - General Travel Impacts
 - Economic and ROI calculations
 - Environmental calculations
 - Passenger benefits
 - System Health



Courtesy: Miovision



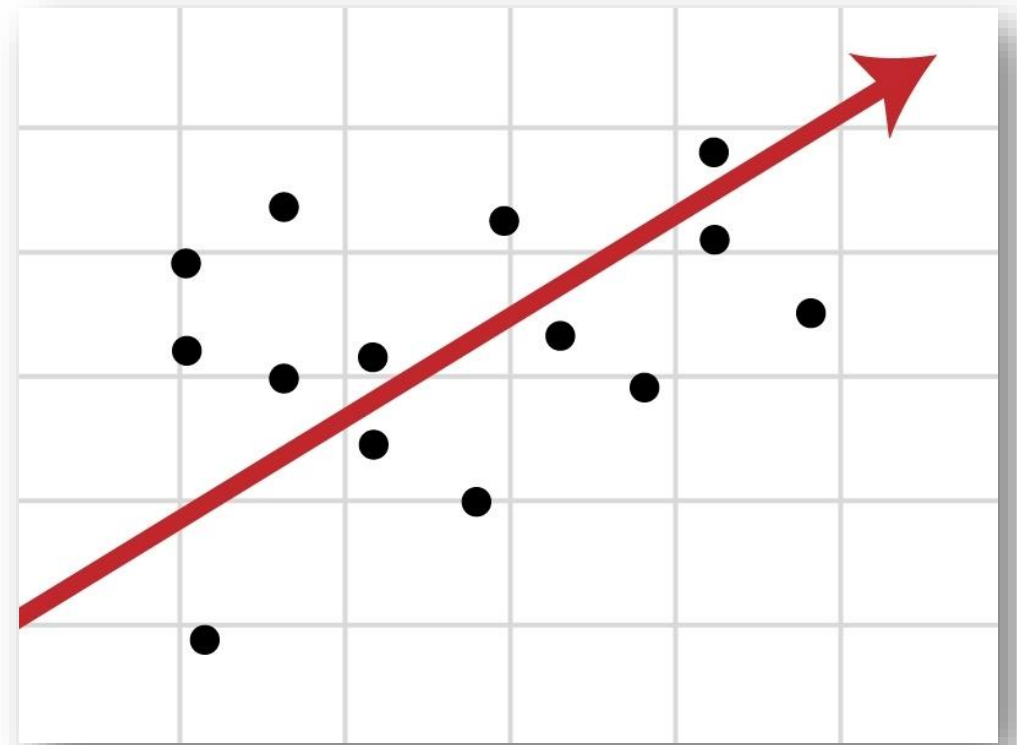
Consideration #3: Manual Stop Bar ETA Calculation

- Step 1: Place geofence downstream of nearest upstream intersection
- Step 2: Measure distance between geofence and stop bar
- Step 3: Estimate travel time based on assumptions



Addressing Consideration #3: “Learning” ETA calculation

- **Predictive, continually improving**
- Start with simple travel time
- test adding factors to improve ETA:
 - Historical ETA
 - Temporal
 - Weather
 - Traffic
 - Dwell Predictions
- Iterate



Current Cambridge TSP Priorities

- City Grants for Participatory Budgeting:
 - Issued: 2016
 - \$250,000
 - Location: TBD, but likely Mass Ave
- Community Connections Grant (MPO):
 - Issued 2019
 - \$140,000
 - Location: Concord Avenue (9 signals)
- Other Opportunities for Ongoing Implementation
 - MBTA capital funding
 - Bus Network Redesign
 - Discretionary grant programs



Conclusion

- Transit Priority Group Focus
 - Data Driven
 - Collaborative
 - Implementation Focus
- Opportunities for TSP
 - Vendor Agnostic & Interoperability
 - Transit Specific SPMs
 - Predictive and Adaptive Stop Bar ETAs
- MBTA as an Implementation Resource





Thank you!

Eric Burkman, AICP
Director of Transit Priority
eburkman@mbta.com

Jay Jackson, EIT
Transit Signal Priority Coordinator
jayjackson@mbta.com