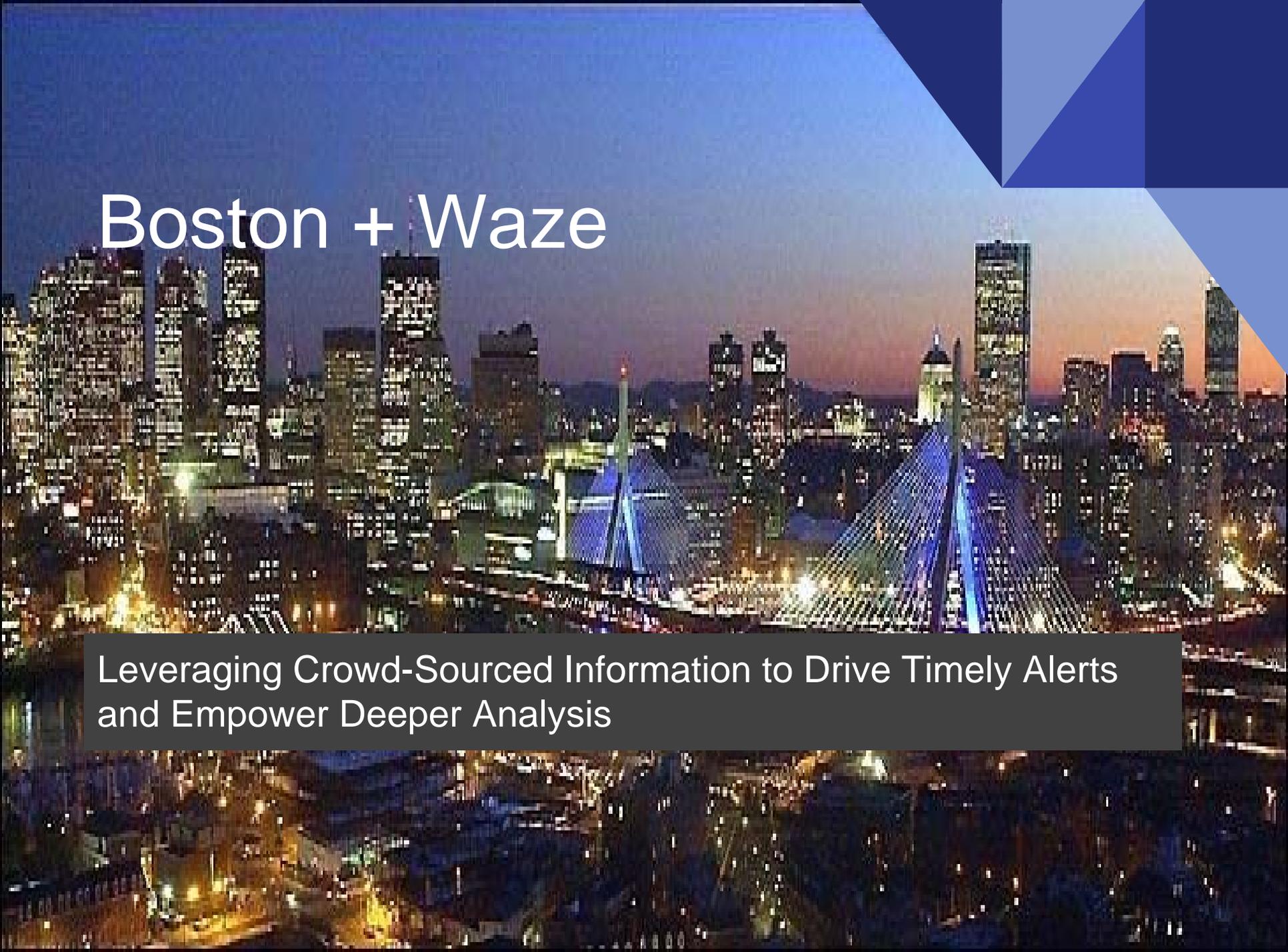


Boston + Waze

A nighttime photograph of the Boston skyline. The Zakim Bridge is illuminated with blue lights, and the city buildings are lit up against a dark blue sky. The image is framed by a blue geometric shape in the top right corner.

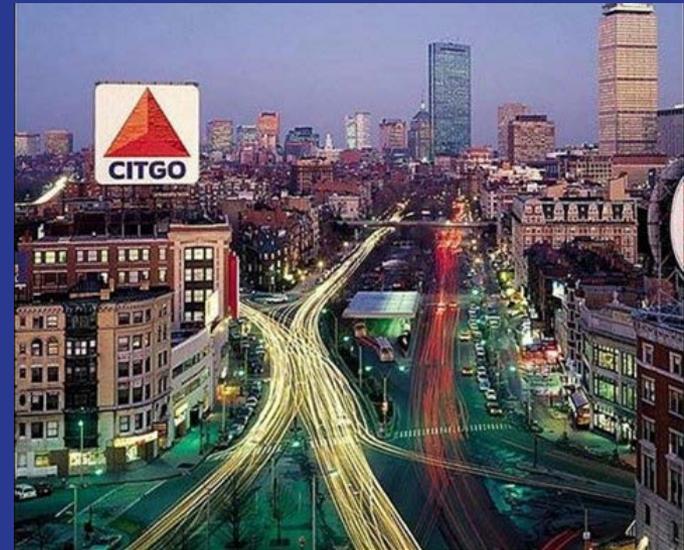
Leveraging Crowd-Sourced Information to Drive Timely Alerts
and Empower Deeper Analysis



The Traffic Management Center

Keith Bynum, Senior Traffic Engineer

TMC Operations



TMC Operations

Central location for the management of incidents and special events

Identify and direct the repair of malfunctioning equipment,

Detect and coordinate the removal of vehicles obstructing the roadways

Coordinate with other transportation agencies and first responders

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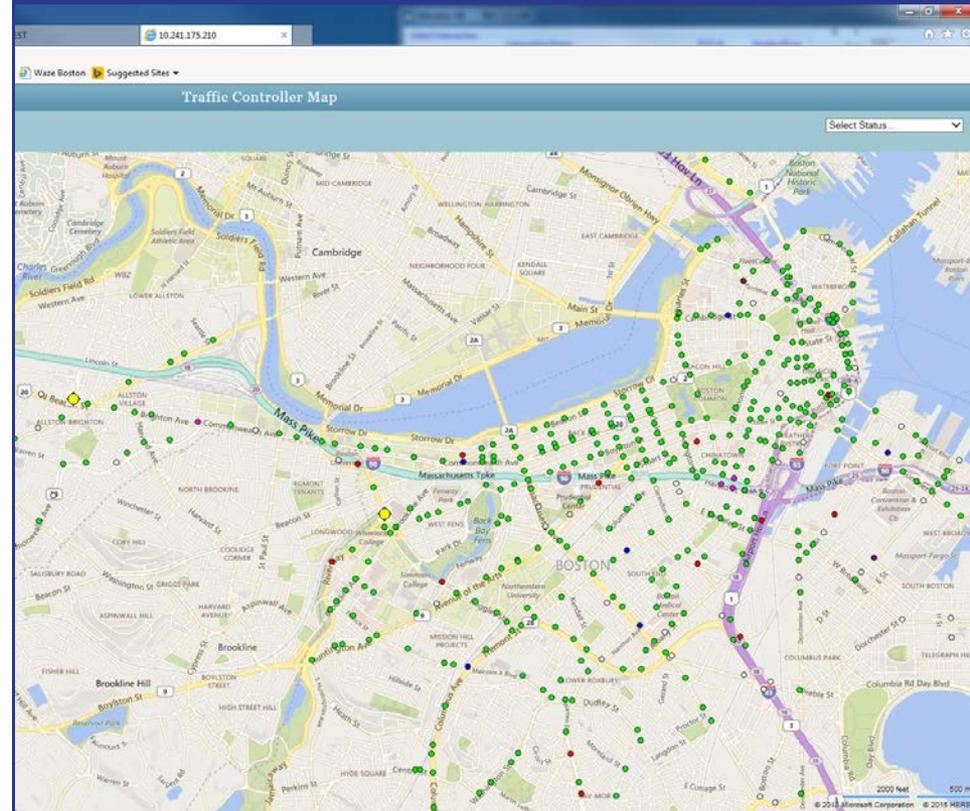
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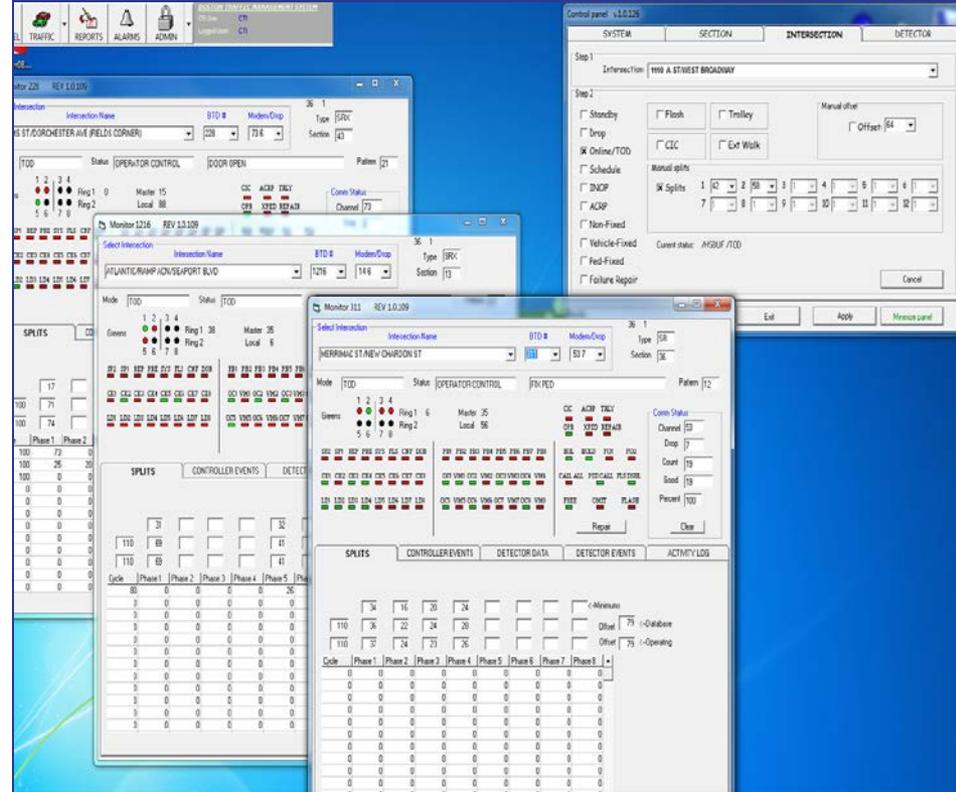
850 Signals in Boston

66% under Central Computer Control at the TMC.



Over 40,000 real-time signal adjustments

In FY '15, alone



Access to over 500 cameras

250 city-owned

90 police-owned

200 MassDOT



What is Waze?

Company

“Waze is the **world's largest community-based traffic and navigation app.**”

By connecting drivers to one another, we help people create local driving **communities that work together to improve the quality of everyone's daily driving.** - *Waze, About Us*

Platform

Mobile App

Website

Apps for DOTs

ETA Tool

Live Maps

Data

Auto-Detected Jams

Features, Timestamp,
Location

User-Submitted Alerts

Jams, Construction,
Accidents, Roadway
Hazards,
Hazardous Weather
Conditions

Waze



User-Driven

>400k Users in the
Greater-Boston area

User-Driven

We retrieve and store the data every ten minutes, non-stop.

Alerts and Jams

Alerts

Subjective

Timely

Requires Action by User

Example Application:

Location of
Crashes and
Disabled Vehicles

Jams

Objective

Greater Volume

Higher Velocity

Example Application:

Location of Severe
Traffic during the
AM/PM Commute



How do we use this data?

TMC Ops

Layers

- Active Work Zones
- Jam
- Hazard
- Accident and Road Work
- All Events
- BTD Cameras

Legend

Active Work Zones

- ⊗

Jam

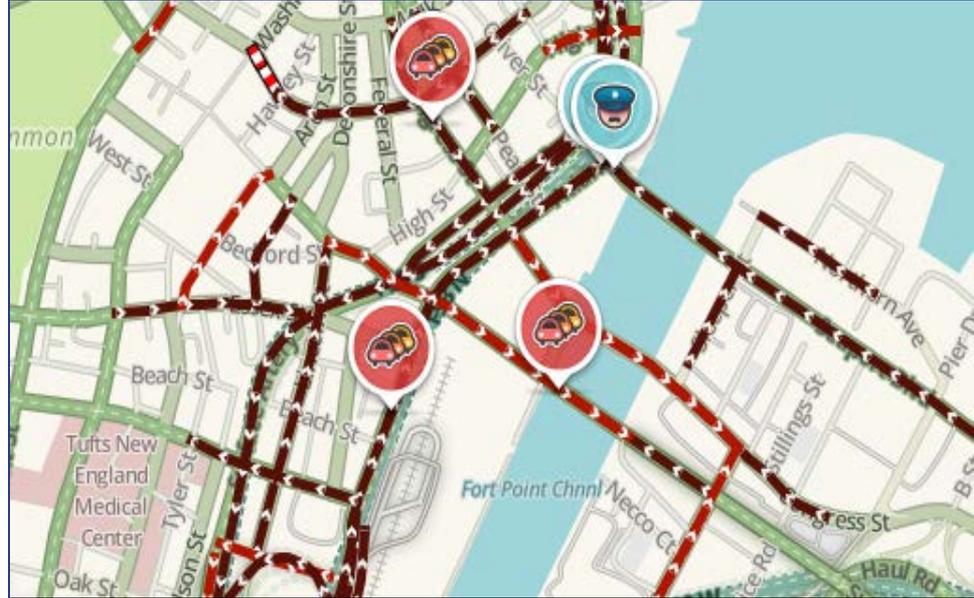
- ◊ JAM_MODERATE_TRAFFIC
- ◊ JAM_HEAVY_TRAFFIC
- ◊ JAM_STAND_STILL_TRAFFIC

Hazard

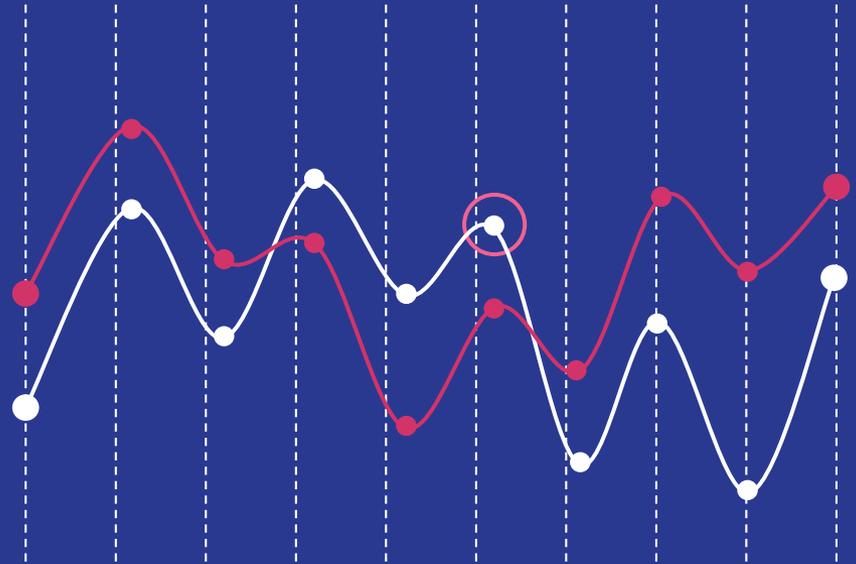
- ★ Unknown -- On Road
- ▲ Car Stopped
- ◆ Construction
- ★ Object On Road
- Lane Closed
- ▲

Unusual Traffic Alerts

Verified with CCTV



Studies and Analyses



—

Traffic Studies

Seaport Longitudinal Analysis

What does adding approximately 4,100 residents and 7,700 jobs to an area look like in terms of traffic and congestion?



Seaport Longitudinal Analysis

Source: *The Boston Globe*



Planned traffic changes in the Seaport District

1 I-93 North HOV lane
Open to passenger cars to keep airport traffic off local streets.

2 Street reconfigurations
Redesigning various streets and redirecting traffic to improve flow.

3 South Boston Bypass Road
Eastbound from I-93 open during morning rush hour; section along convention center open all day to passenger cars.

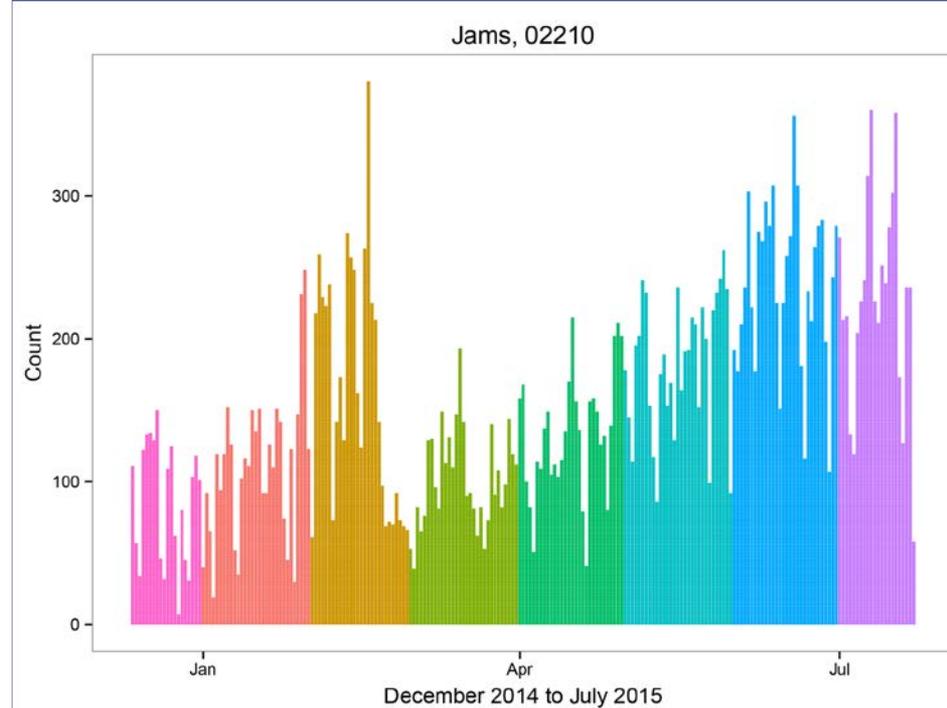
4 Proposed freight road
Dedicated corridor would remove trucks from local streets.

5 Silver Line
Traffic-light changes to speed trips; new electronic signs display upcoming buses.

6 New Hubway stations
Lawn on D, Blue Hills Bank Pavilion.

Seaport Longitudinal Analysis

What does adding approximately 4,100 residents and 7,700 jobs to an area look like in terms of traffic and congestion?



SNOW!

65" of snow in February

110.6" snowfall for the Season
(all-time record!)

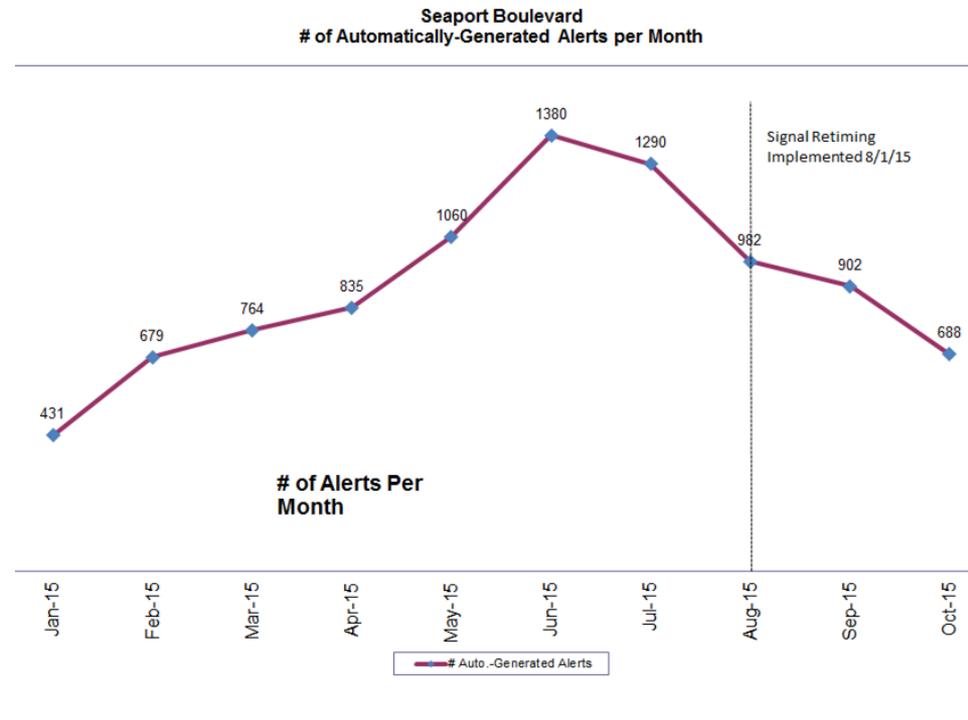
Street capacity reduced due to
several back to back storms,
snow removal unable to keep up

Transit shutdown or severely
disrupted.



Traffic Signal Retiming

Rephase and retime traffic signals at Atlantic Avenue/Seaport Blvd and at Oliver St/Purchase Street to improve bidirectional traffic flow between I-93 and Seaport as well as reduce queues on Atlantic Avenue and Seaport Boulevard.

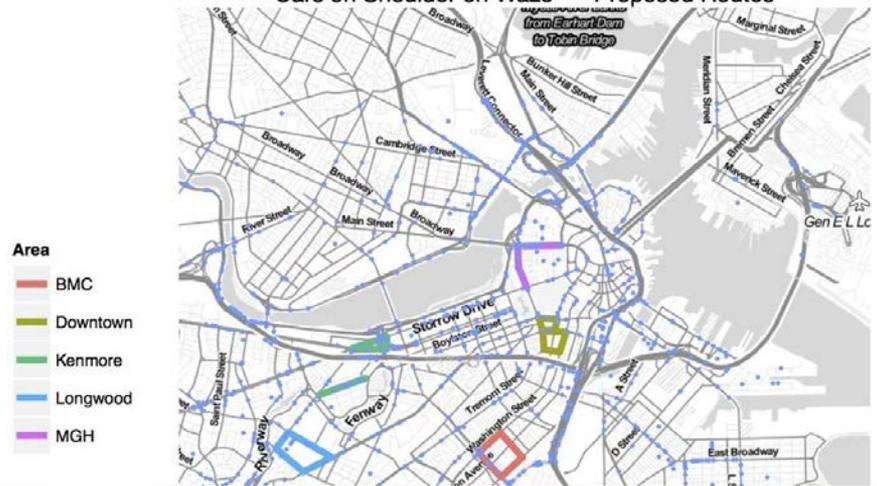


Experiment Evaluation

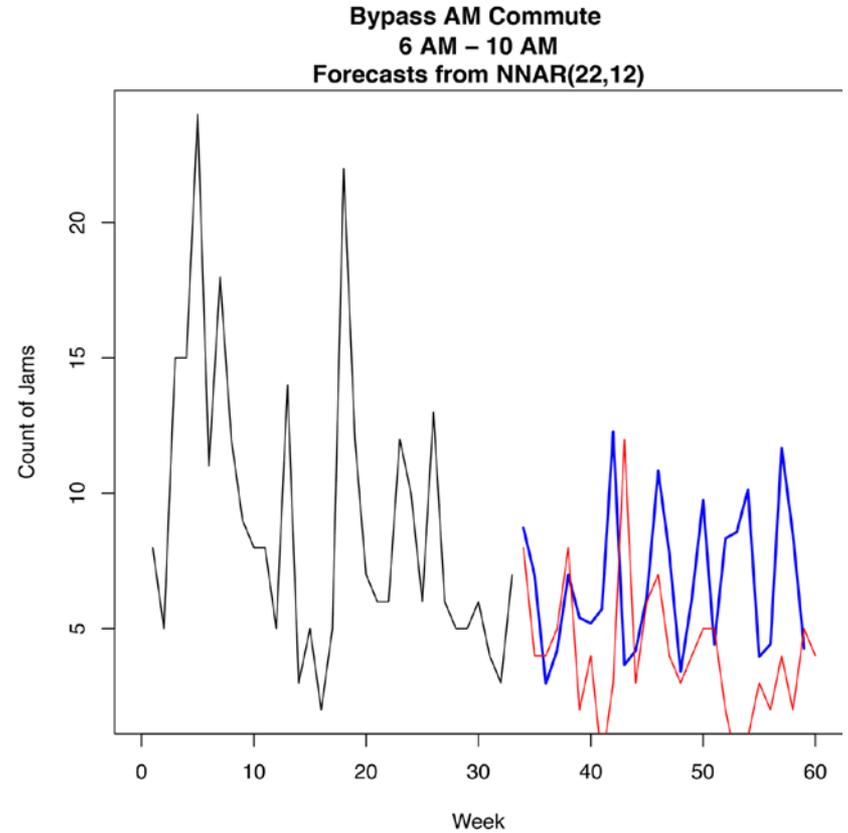
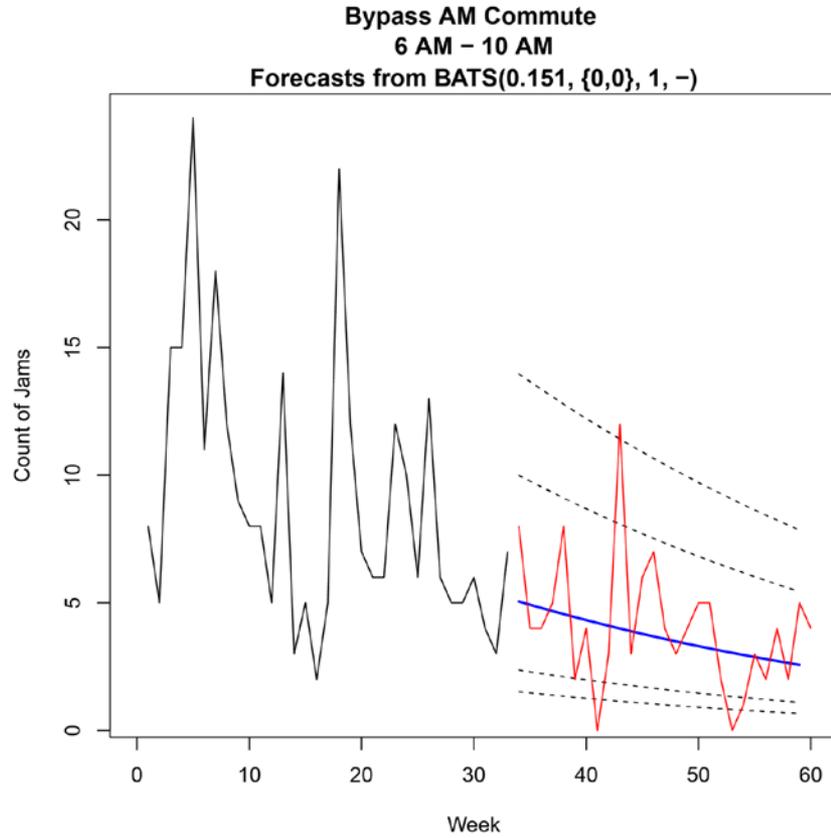
Bike 'Strike Team'



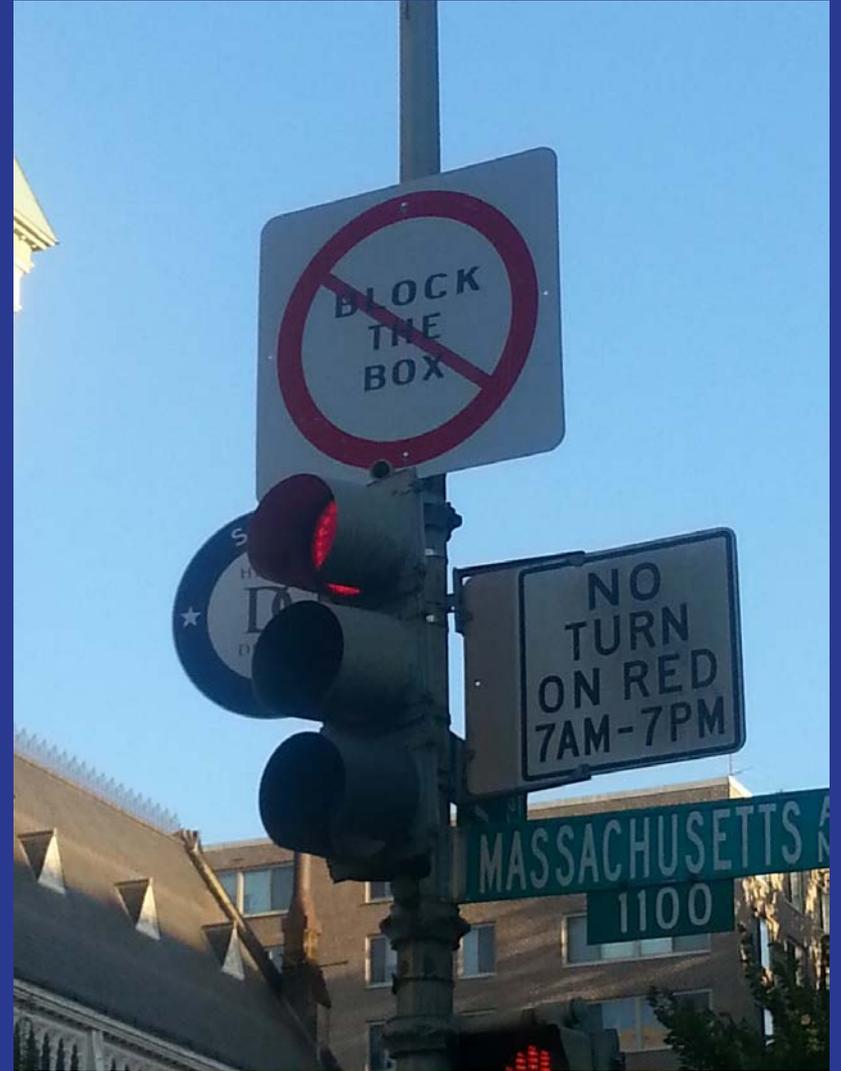
Cars on Shoulder on Waze --- Proposed Routes



Haul Road Pilot



Don't Block the Box



Don't Block the Box

Jam Metrics

Intersection	Intervention	Metric	Mean Improvement	p-value	n
Brookline and Riverway	Officer	Delay	0.73 minutes	0.142	39
Brookline and Riverway	Officer	Speed	0.93 mph	0.053	39
Congress and Purchase	VMS Board	Delay	0.13 minutes	0.292	108
Congress and Purchase	VMS Board	Speed	0.84 mph	0.019	108
Longwood and Riverway	VMS Board	Delay	0.3 minutes	0.266	33
Longwood and Riverway	VMS Board	Speed	0.5 mph	0.239	33

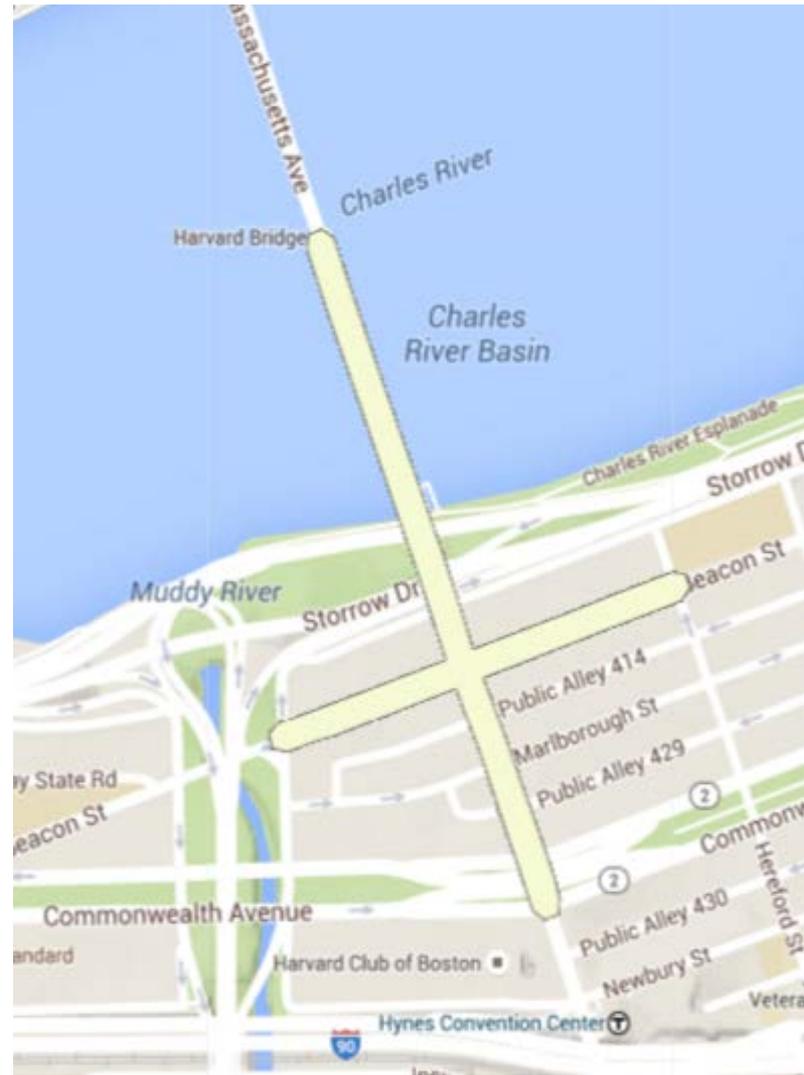
Don't Block the Box

Delay

Intersection	Intervention	Pre/Post	Variance
Brookline and Riverway	Officer	Pre	0.23
Brookline and Riverway	Officer	Post	0.423
Congress and Purchase	VMS Board	Pre	0.022
Congress and Purchase	VMS Board	Post	0.039
Longwood and Riverway	VMS Board	Pre	0.082
Longwood and Riverway	VMS Board	Post	0.098

Mass and Beacon

Addition of protected bike lane,
removal of full lane of traffic



Changes Made in Boston

Removed a full lane of traffic

Installed lane markings for a dedicated bike lane overnight between

Later, flex-posts were also installed, making this lane a protected bike lane

Question remains: Does this improve traffic? If the data indicates it does, is this a statistically significant improvement or just the result of random chance?

Significance

p-Value : The probability of getting a result *at least as extreme* as the observed result, *given the null hypothesis is true*. Lower p-values mean there is less chance that the results are the product of pure chance.

Null Hypothesis : ‘The addition of a protected bike lane does not improve traffic metrics.’

Findings

The data suggests that the protected lane contributed to an improvement of jam metrics, indicating a net positive effect on traffic after the lane alterations were made.

Intervention	Mean Number of Jams Per Day	Mean Speed in Jams	Mean Delay in Jams	Mean Length of Jams
Pre-Intervention	60.1	7.37	3.01	2549.7
Flex Posts	51.5	7.68	2.42	2442.65

Findings

Assuming the standard threshold for significance of $p < .05$, the addition of a protected lane has a statistically significant and net-positive effect on jam segments.

Considerable evidence for a relationship between the addition of the lane and a decrease in the mean length of jams

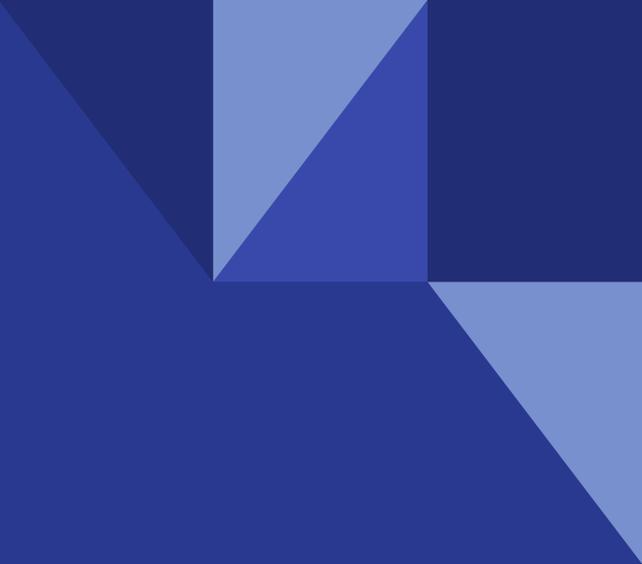
Metric	p-value
Delay	< 0.01
Speed	0.043
Length	0.084

Considerations

The metrics included in this study relate to existing traffic jams detected by a single source.

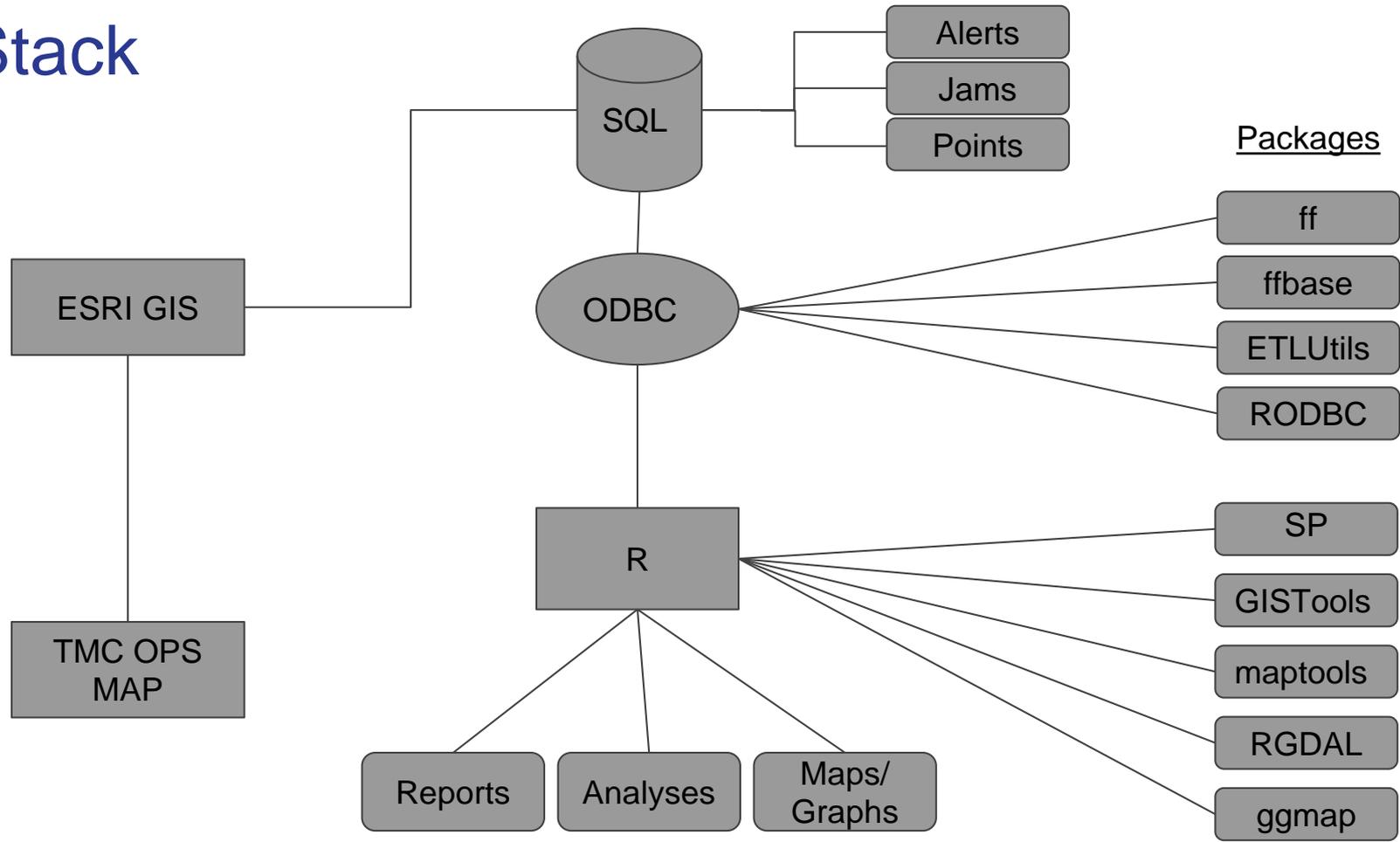
It does not include travel times along the corridor, nor injury rates.

Although there is a demonstrably positive effect on auto-detected jam metrics, there is an observed increase in both the volume and severity of user-submitted jam alerts - a subjective measure of the roadway.



What tools are we using?

The Stack



Thank You

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