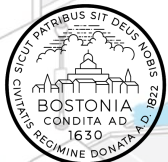




AVs in BOSTON

Shared rides, Seagulls, & Streets



City of Boston
Mayor Martin J. Walsh

Kris Carter
Mayor's Office of New Urban Mechanics
City of Boston
6.13.18

1

What is motivating Boston?

2

What do our testing efforts look like?

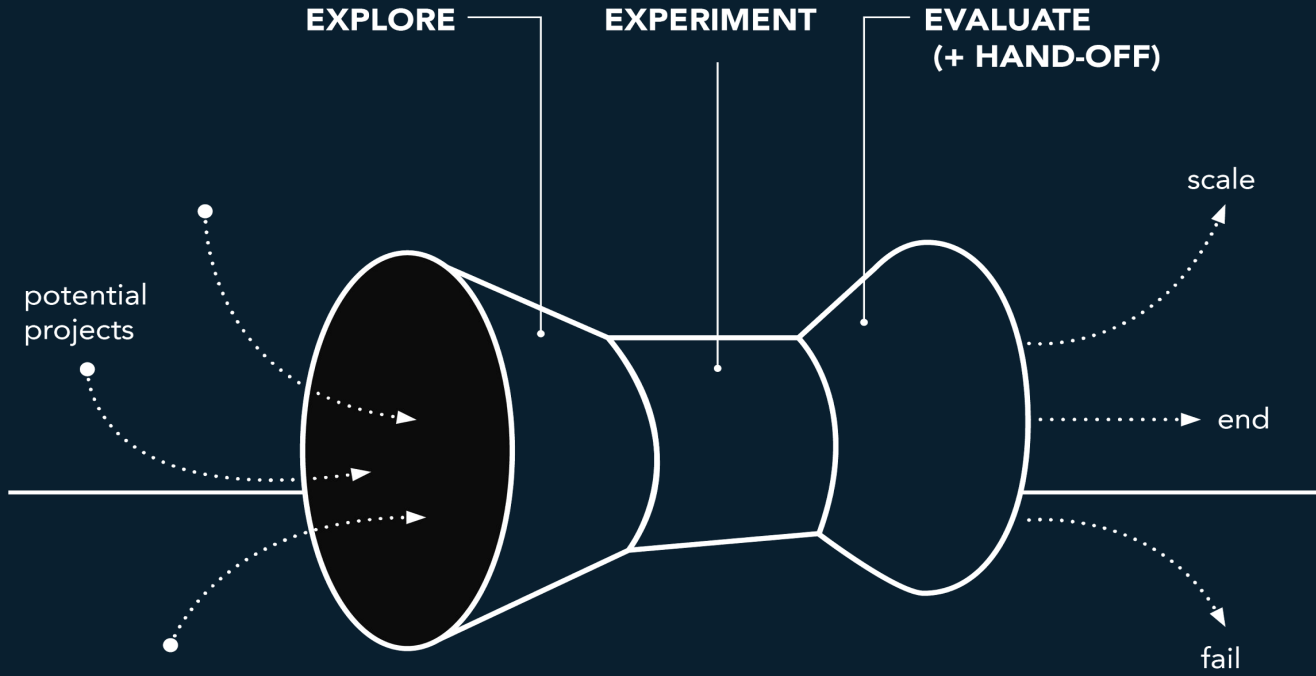
3

What is happening beyond testing?

4

What have we learned so far?





TD Garden
Museum of Science
USE EXIT 26 TO
North Station

Aquarium
Quincy Market
USE EXIT 23

HOV
ONLY
↙

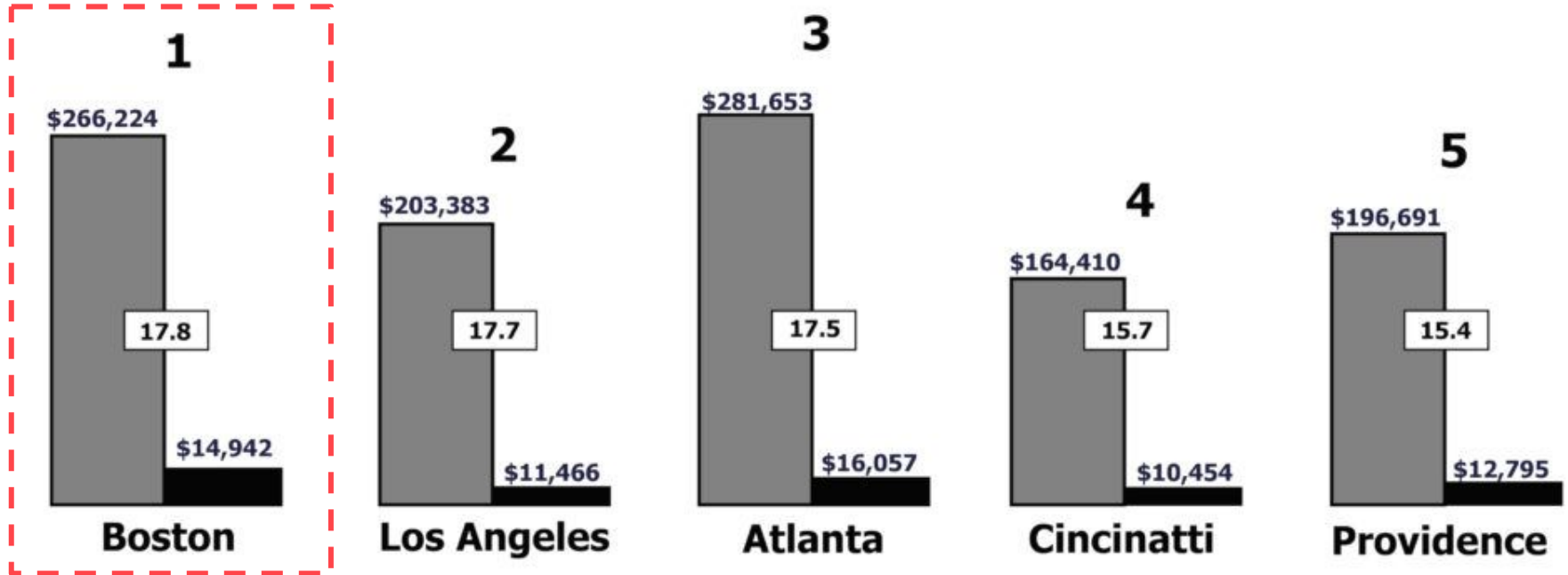
93
MILE
16



Top 5 cities for inequality

Average income of people who earn more than 95% of the population
vs.

Average income of people who earn more than 20% of the population and their corresponding ratios (95:20)



Source: Brookings Institute
Graphic by Huntington News



City of Boston
Mayor Martin J. Walsh

GoBoston 2030 Goals



ACCESS

Make Boston's neighborhoods interconnected for all modes of travel

SAFETY

Collaborate on design & education to substantially reduce collisions on every street

RELIABILITY

Prioritize making travel predictable on Boston's transit and roadway networks



SAFETY

14 | 4,537

Source: 2017 Boston Vision Zero



City of Boston
Mayor Martin J. Walsh

BETTER ACCESS

The average commute in
Boston is **28** minutes

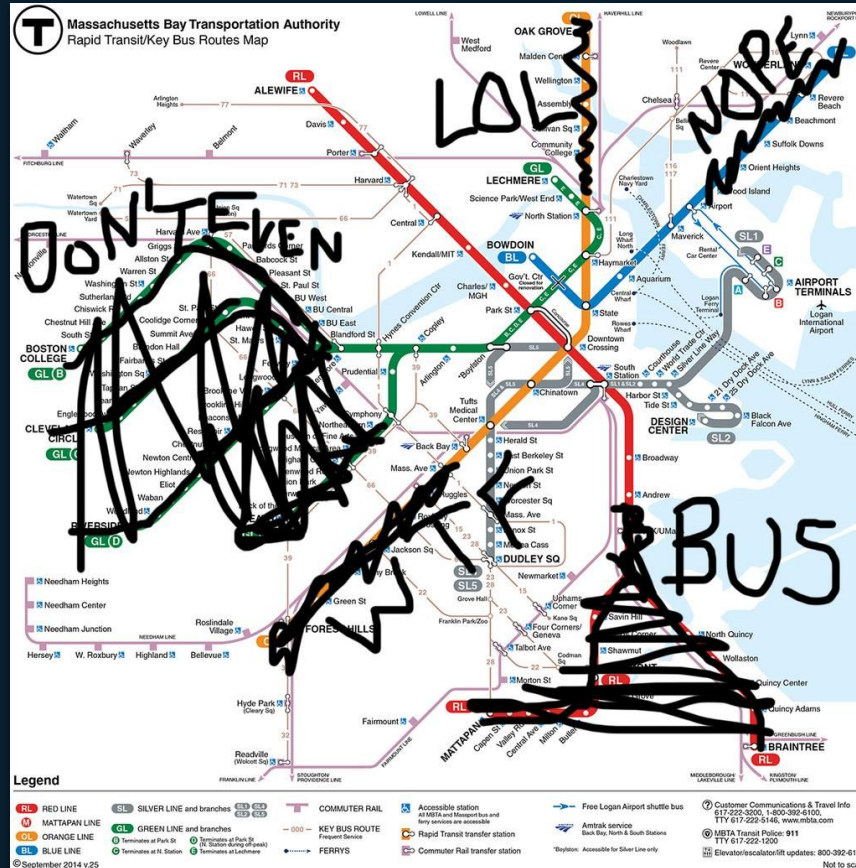
24% of Mattapan residents have
a commute over **60** minutes



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Mayor Martin J. Walsh

MORE RELIABLE

(Unofficial Winter 2015 Snow Map)



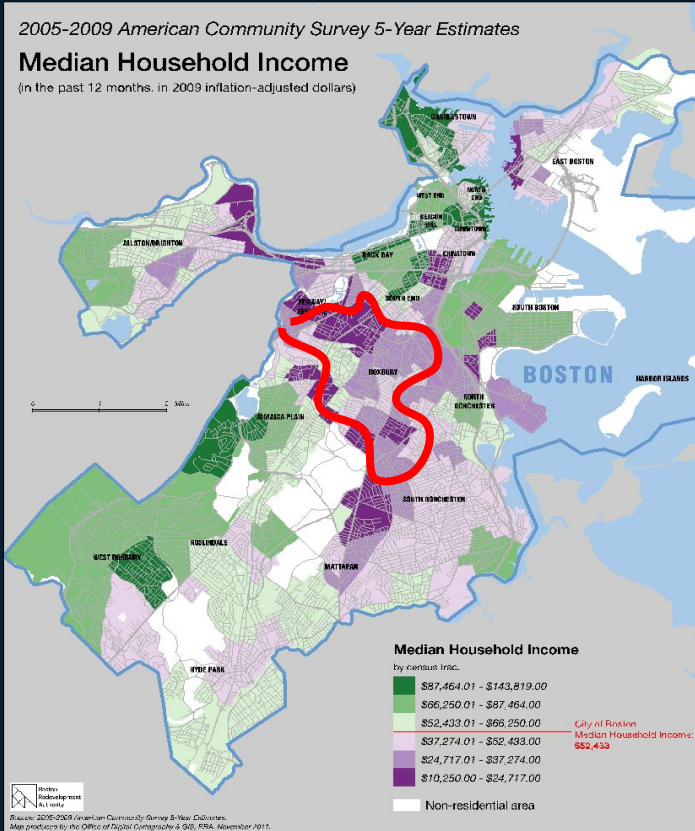
Source: MBTA Snow Map,
Sara Morrison



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Mayor Martin J. Walsh



ENSURE EQUITY



Sub-prime service

The three Boston ZIP codes that do not receive Amazon Prime deliveries:



City of Boston
 Mayor Martin J. Walsh

If you're not at the table, you're on the menu



City of Boston
Mayor Martin J. Walsh

MAYOR WALSH SIGNS EXECUTIVE ORDER ON AUTONOMOUS VEHICLES

“...that our expected preferred deployment will be **fleets of autonomous vehicles that are electric and shared...**ensure equitable access to opportunity for those least well served by transportation options today, including seniors, youth, and those with physical disabilities.”



Our Five Areas of Research

1

AV Testing

2

Business Models

3

Street Design & Infrastructure

4

Workforce

5

Governance



City of Boston
Mayor Martin J. Walsh

What Have We Been Doing?

Set Policy Priorities

Formed Research Partnerships

Technology Testing



CITY OF BOSTON • MASSACHUSETTS

OFFICE OF THE MAYOR
MARTIN J. WALSH

EXECUTIVE ORDER

ESTABLISHING A POLICY FOR AUTONOMOUS VEHICLES IN THE CITY OF BOSTON

WHEREAS, the City of Boston has engaged thousands of residents in developing Go Boston 2030 -- a long term transportation plan to increase equity, unlock growth and improve resiliency; and

WHEREAS, those residents, have clearly articulated that our transportation options need to be safer, more accessible and more reliable; and

WHEREAS, autonomous vehicles could help us meet those goals by significantly reducing roadway fatalities & serious crashes, by expanding transportation choices, and by using our roads more efficiently; and

WHEREAS, those benefits should only accrue in Boston if they come with the reduction of emissions, with the improvement of the public realm, by complementing mass transit services, and with a serious commitment to those whose jobs may change if autonomous vehicles are adopted; and

WHEREAS, Boston's deep history of technical innovation, transportation entrepreneurship, and progressive leadership make it an ideal international leader in the development of autonomous vehicle technology and policy; and

WHEREAS, the cost of not leading will mean these vehicles may not work safely on our streets, the business models may not work for our residents and the benefits from this technology are not realized here;

NOW, THEREFORE, pursuant to the authority vested in me as chief executive officer of the City of Boston by St. 1948, c. 452, § 11, and every other power hereto enabling, I hereby order and direct that:

1. The Boston Transportation Commissioner lead the oversight of autonomous vehicles in the City of Boston; and, that
2. The Boston Transportation Department, with support from the Mayor's Office of New Urban Mechanics, publish guidelines for the testing of autonomous vehicles; and, that

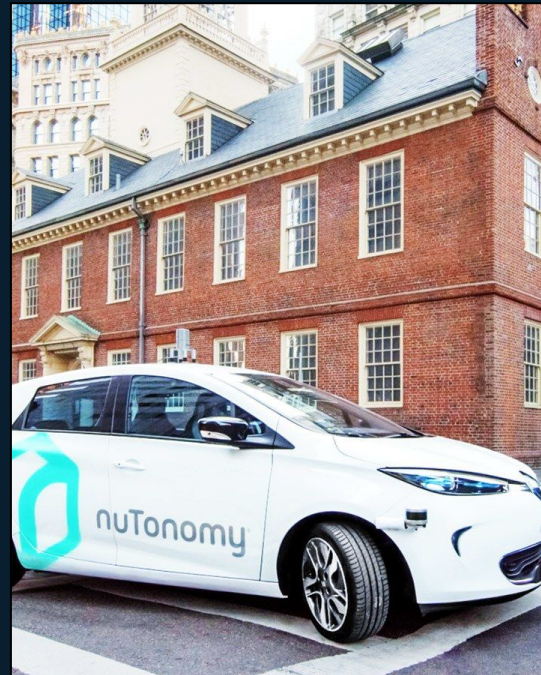
WORLD
ECONOMIC
FORUM

BCG

THE BOSTON CONSULTING GROUP

U.S. Department
of Transportation

Volpe



City of Boston
Mayor Martin J. Walsh

Governance

Executive Order(s)

MOU

Testing Plans



CITY OF BOSTON • MASSACHUSETTS

OFFICE OF THE MAYOR
MARTIN J. WALSH

EXECUTIVE ORDER

ESTABLISHING A POLICY FOR AUTONOMOUS VEHICLES IN THE CITY OF BOSTON

WHEREAS, the City of Boston has engaged thousands of residents in developing Go Boston 2030 -- a long term transportation plan to increase equity, unlock growth and improve resiliency; and

WHEREAS, the City of Boston has identified that our transportation system needs to be

MEMORANDUM OF UNDERSTANDING

Safety, Access, Reliability. Over the last year, this was the resounded refrain from the people of Boston when asked what values they would like their transportation system to embody. It is with that lens through which the City of Boston begins this partnership in testing the most transformative innovation of a generation - autonomous vehicles.

Safer Streets: The overwhelming majority of crashes on our streets are caused by human error. The promise of autonomous vehicles is to eliminate over 90% of those crashes, saving dozens of lives and thousands of serious injuries incurred by people in Boston each year. This work directly supports the City of Boston's Vision Zero Initiative goals to eliminate serious crashes from the streets of Boston.

Better Access: Autonomous vehicles make mobility possible for many who are limited by the

Phase A - Off-Road or Off-Site Testing	
Place	Milestone
Testing must not occur on a City street.	A partner must document or demonstrate the following before moving to Phase B1: <ul style="list-style-type: none"> Ease of manual takeover from AV Emergency braking and emergency stop functionality Safety alert system for the driver to take over control Automatic braking upon detection of an obstacle Basic driving capabilities, such as staying within a lane.

Phase B1 - The Raymond L. Flynn Marine Park			
Time	Place	Manner	Milestone
Testing must occur in	Testing can only	Vehicle must have a	After documenting

All Documents Available at [Boston.gov/Boston-AV](https://www.boston.gov/boston-av)

emissions, with the improvement of the public realm, by complementing mass transit services, and with a serious commitment to those whose jobs may change if autonomous vehicles are adopted; and

WHEREAS, Boston's deep history of technical innovation, transportation entrepreneurship, and progressive leadership make it an ideal international leader in the development of autonomous vehicle technology and policy; and

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- The Boston Transportation Department, with support from the Mayor's Office of New Urban Mechanics, publish guidelines for the testing of autonomous vehicles; and, that

modes of travel. Fewer vehicles results in less congestion and a more predictable travel experience - whether by traveling by foot, train, bus, bicycle, or car.

This Memorandum of Understanding (the "MOU") is entered into this 16 day of November, 2016 by and between the City of Boston, a municipal corporation organized and existing under the laws of the Commonwealth of Massachusetts acting by and through its Transportation Department (the "City"), the Massachusetts Department of Transportation (MassDOT), an agency of the Commonwealth of Massachusetts, and nuTonomy Inc., a Delaware corporation ("nuTonomy") (collectively, the signatory parties). This MOU is intended to document the understanding between the City, MassDOT and nuTonomy with respect to nuTonomy's operation of its autonomous vehicles (AVs) on roads and public ways and other public property in the City of Boston and the Commonwealth of Massachusetts for testing purposes.

Upon approval of the Application to Test Autonomous Vehicles, the City of Boston and MassDOT hereby agree to permit nuTonomy to test, by the authority granted by this MOU, its AVs on public ways and other public property in the City of Boston and Commonwealth of

Time	Place	Manner	Milestone
Testing must occur in both during daytime and nighttime hours. Testing must include periods during precipitation.	Testing can only occur within the Marine Industrial Park, an area defined in attachment	Vehicle must have a safety driver behind the wheel.	After documenting 100 miles logged in Phase B2, the partner may request to move to Phase C1.

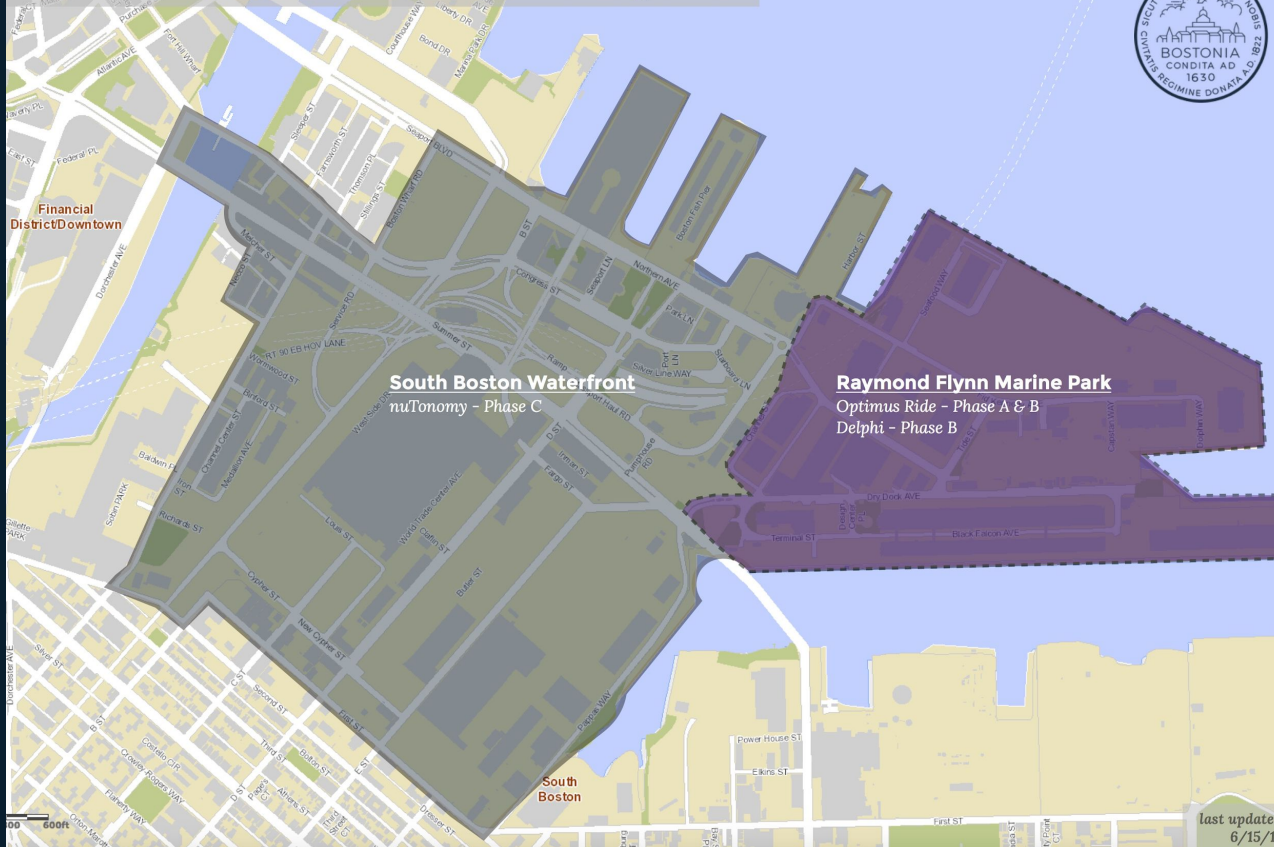
Phase C1 - A Second, Mutually-Agreed Upon Geography			
Time	Place	Manner	Milestone
Testing must occur in daylight hours only during weather without precipitation.	Testing can only occur within the South Boston Waterfront, an area defined in attachment	Vehicle must have a safety driver behind the wheel.	After documenting 200 miles logged in Phase C1, the partner may request to move to Phase C2.

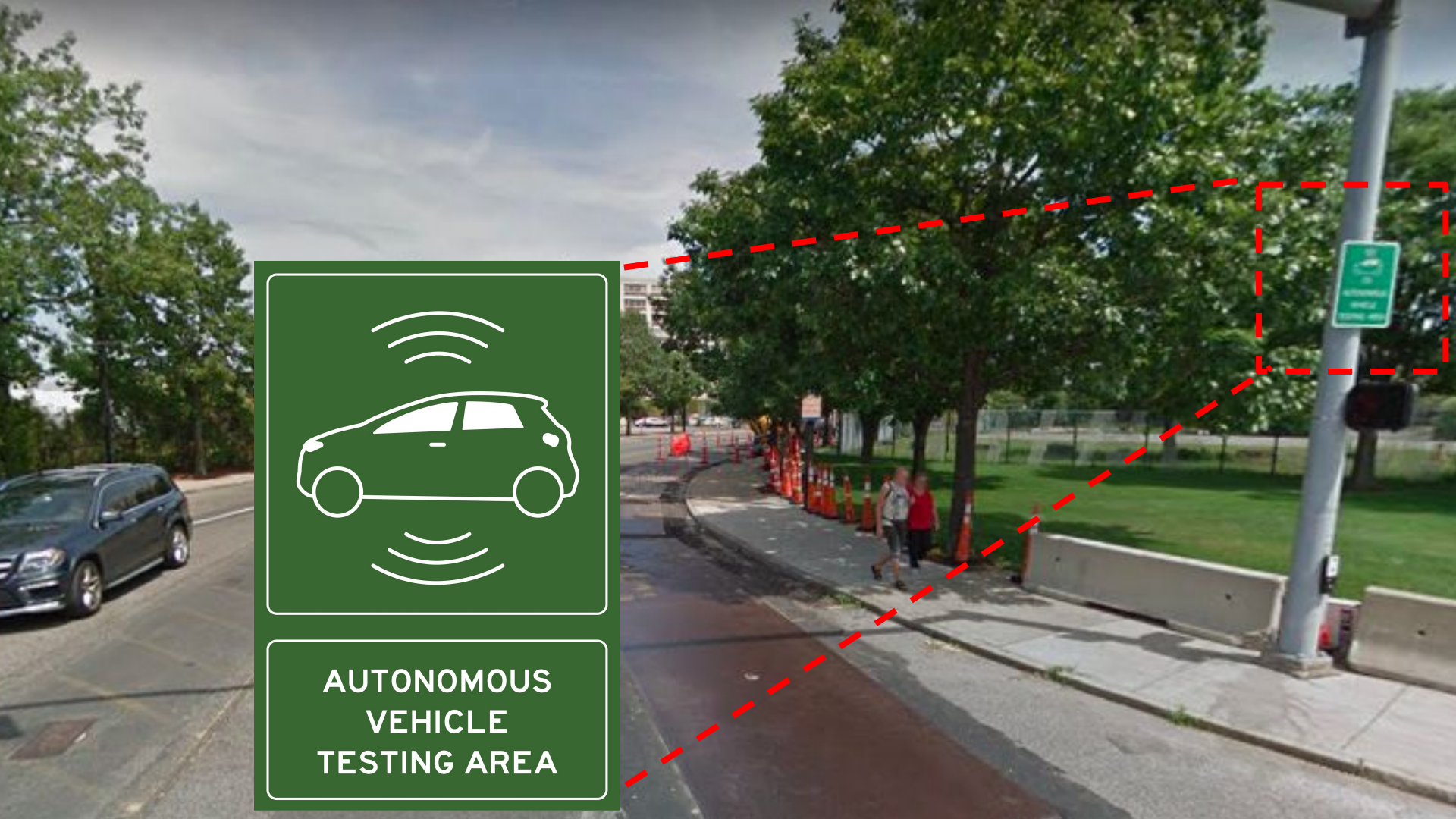


Mayor Martin J. Walsh

Testing: 1,000 Acre Innovation District

City of Boston Autonomous Vehicle Testing Area





**AUTONOMOUS
VEHICLE
TESTING AREA**

Three Partners

nuTonomy



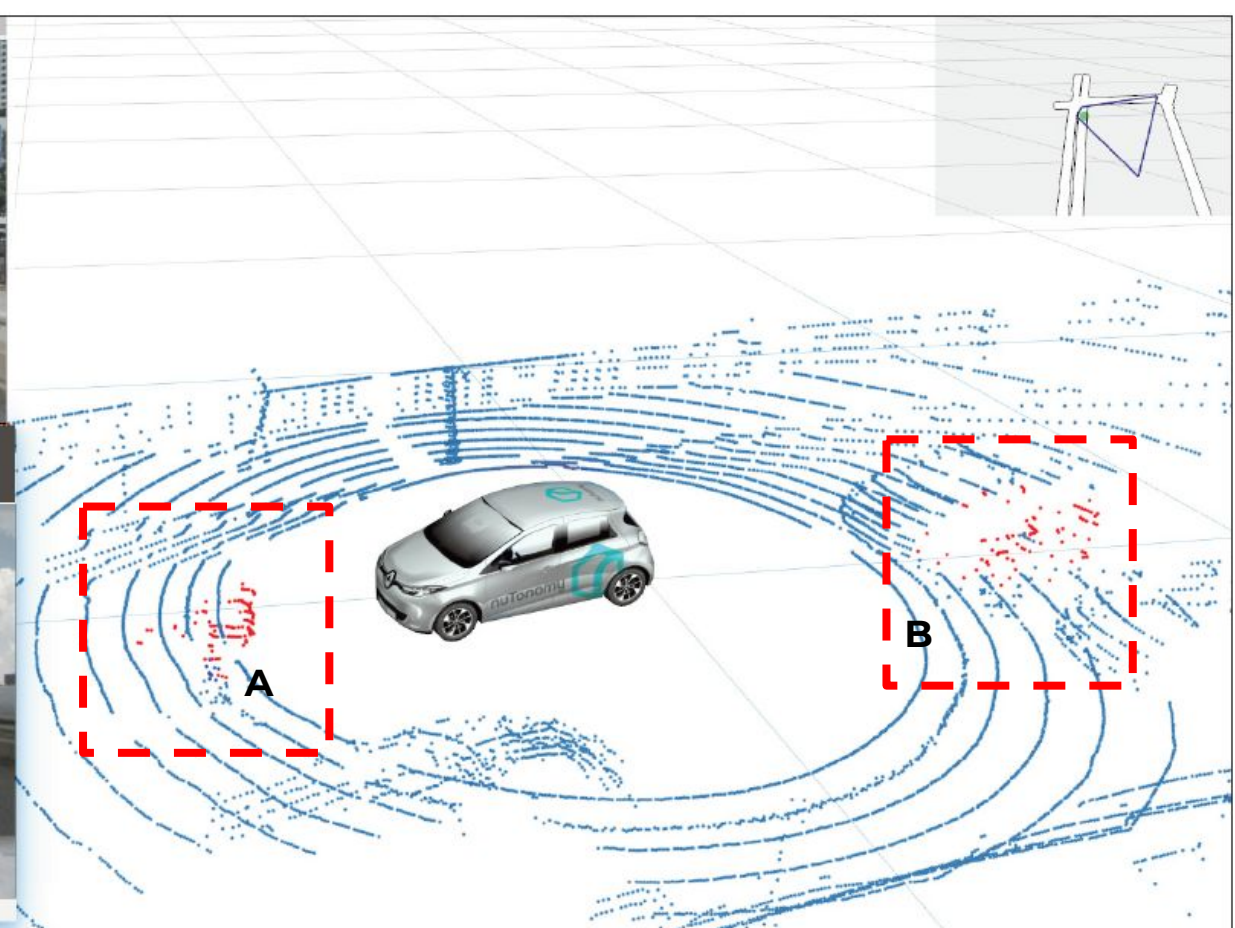
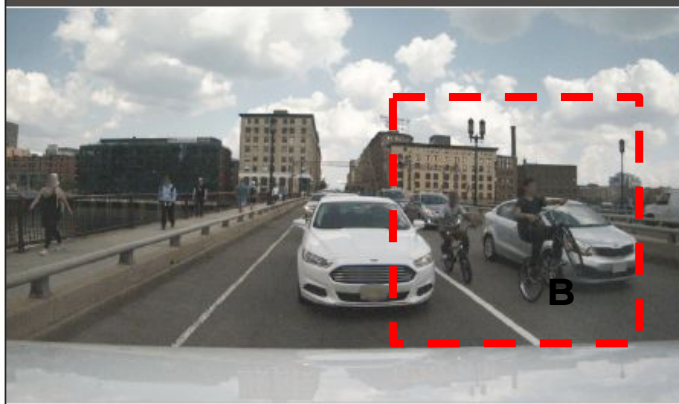
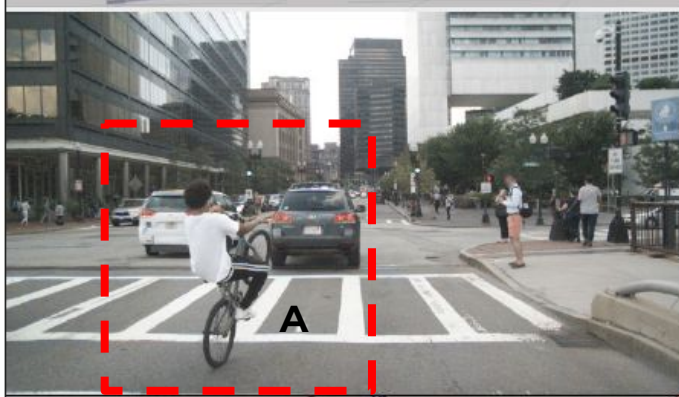
optimus ride



aptiv (delphi)



City of Boston
Mayor Martin J. Walsh



Testing: *Learning by Doing*

Fahckin' Seagulls Menace Boston's Self-Driving Cars



Ryan Felton

2/07/17 4:16pm • Filed to: CAR TECHNOLOGY ▾

8.1K

5



City of Boston
Mayor Martin J. Walsh

Getting AV- Ready: *Digitizing our curbs*

Prototype Completed to date:

- 37.9 linear miles of curb
- 9,372 assets



City of Boston
Mayor Martin J. Walsh

Socializing: The AV Petting Zoo

Boston's First
**ROBOT
BLOCK
PARTY**

Come see the largest collection of autonomous vehicles and robots ever assembled in Boston!

The City of Boston and MassRobotics have partnered to host our first Robot Block Party and Autonomous Vehicle Petting Zoo, presented by HUBweek! Come by City Hall Plaza for a family-friendly, educational day!



**Sunday
October 15, 2017
11:00AM - 5:00PM**

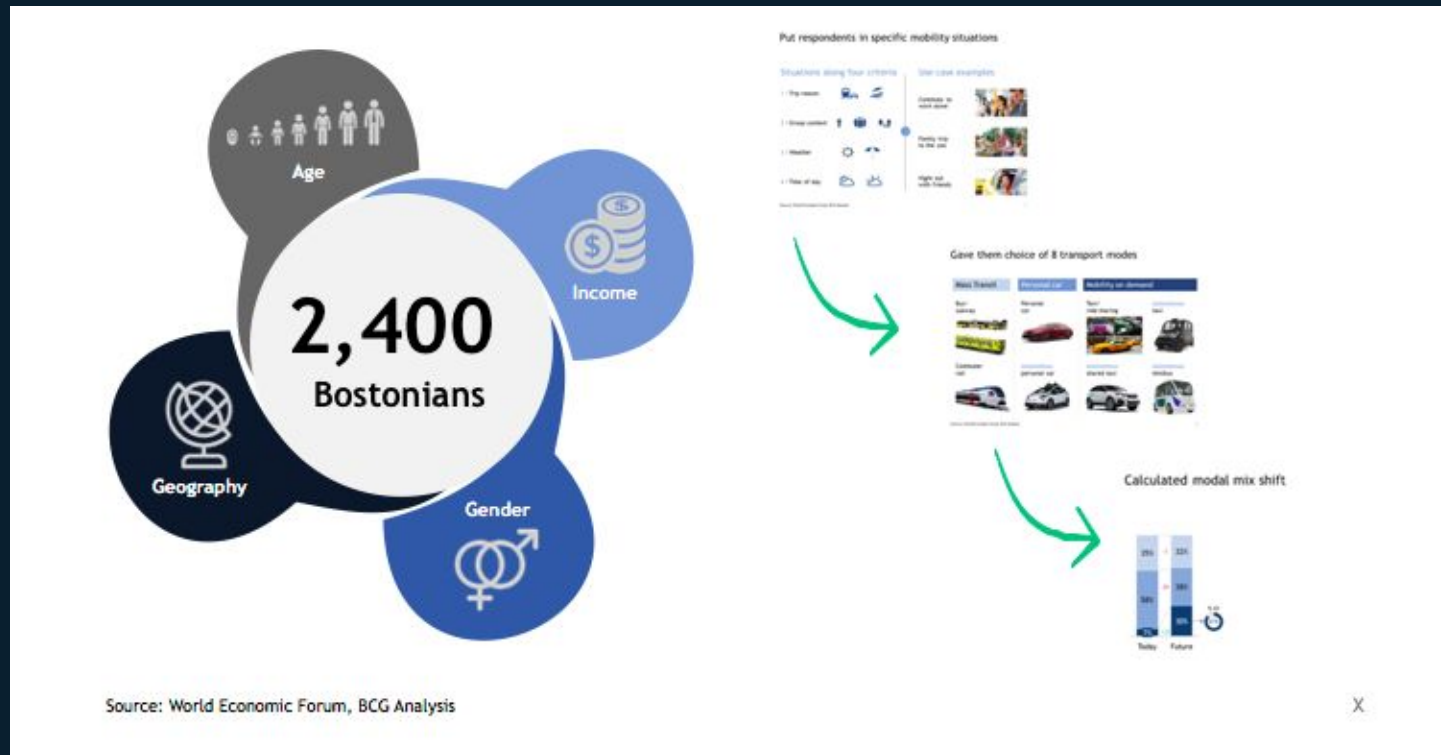
**The HUB
City Hall Plaza
Boston, MA 02201**



City of Boston
Mayor Martin J. Walsh



Research: Citizen Behaviors



source: World Economic Forum & BCG analysis, 2018



City of Boston
Mayor Martin J. Walsh

Situations along four criteria

1 Trip reason



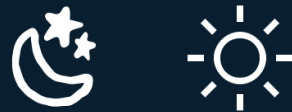
2. Group context



3. Weather



4. Time of day



Use case examples

Commute to
work alone

Family trip
to the zoo

Night out
with friends



source: World Economic Forum & BCG analysis, 2018



City of Boston
Mayor Martin J. Walsh

Mass Transit

*Bus/
Subway*



*Commuter
rail*



Personal car

*Personal
car*



*Autonomous
personal car*



Mobility on demand

*Taxi/
ride sharing*



*Autonomous
shared taxi*



*Autonomous
taxi*



*Autonomous
minibus*



$\frac{1}{3}$ of trips will be through mobility on-demand service
(mostly shifted from *private vehicles*)

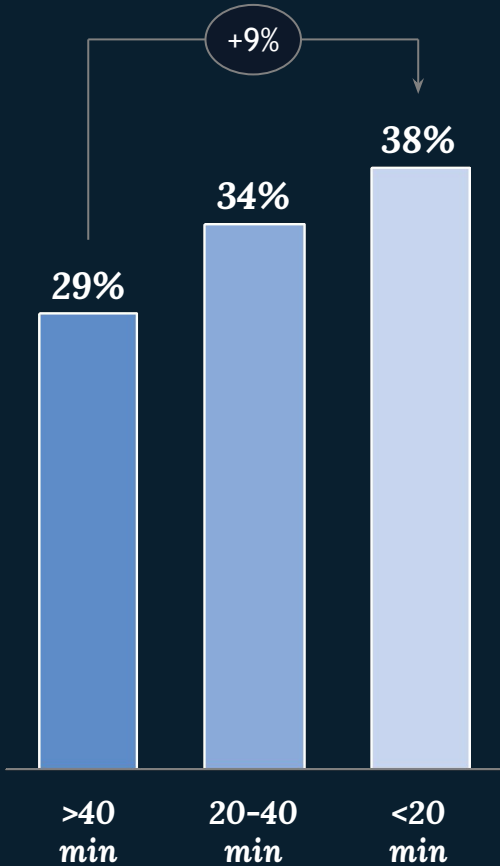


source: World Economic Forum & BCG analysis, 2018



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The shorter the trip, the higher the AV adoption

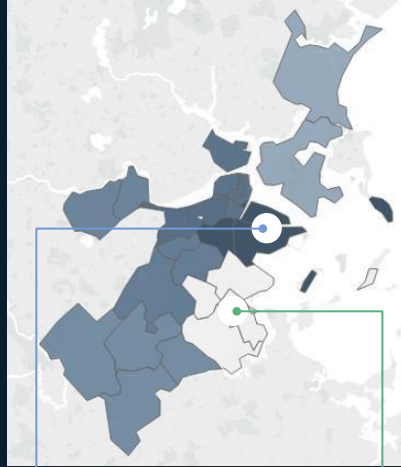


source: World Economic Forum & BCG analysis, 2018



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AV adoption is correlated to income levels.



**% AV
adoption**

53

26

**Median
income**

\$100-\$149K

\$50-\$74K

**Seaport and
South Boston**

Dorchester

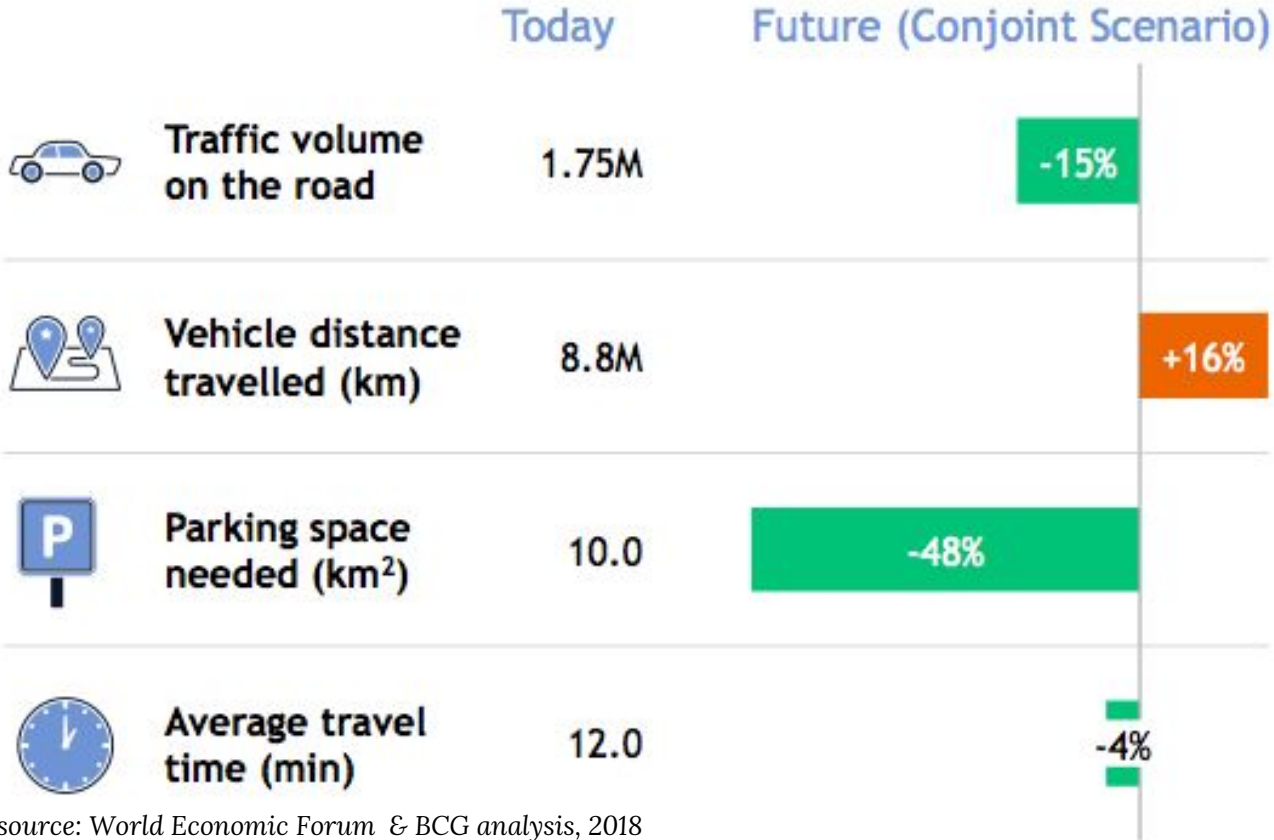


source: World Economic
Forum & BCG analysis, 2018



City of Boston
Mayor Martin J. Walsh

Results from agent-based trip model for City of Boston



source: World Economic Forum & BCG analysis, 2018



We shape our buildings; thereafter they shape us.

-Winston Churchill



Streets

We shape our ~~buildings~~; thereafter they shape us.

-Me



44% of people said the number one reason for having a self-driving car is to **not have to park.**

source: World Economic Forum; BCG analysis, August 2016



City of Boston
Mayor Martin J. Walsh

shared trips = fewer cars = more space for people



City of Boston
Mayor Martin J. Walsh

Best practices for launching an AV pilot



Develop clear a mobility vision



Balance stakeholder interests in approval process



Create a tiered testing plan with achievement milestones



Build trust between stakeholders



Share updates on testing progress with residents regularly to build awareness





Thank you

@Kris_W_Carter
Kristopher.Carter@Boston.gov

Boston.gov/Boston-av

