

THE MAYOR'S OFFICE OF
**NEW URBAN
MECHANICS**

BOSTON



*Kris Carter, Co-Chair
Mayor's Office of New Urban Mechanics*



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

Motivation: Safety

Boston

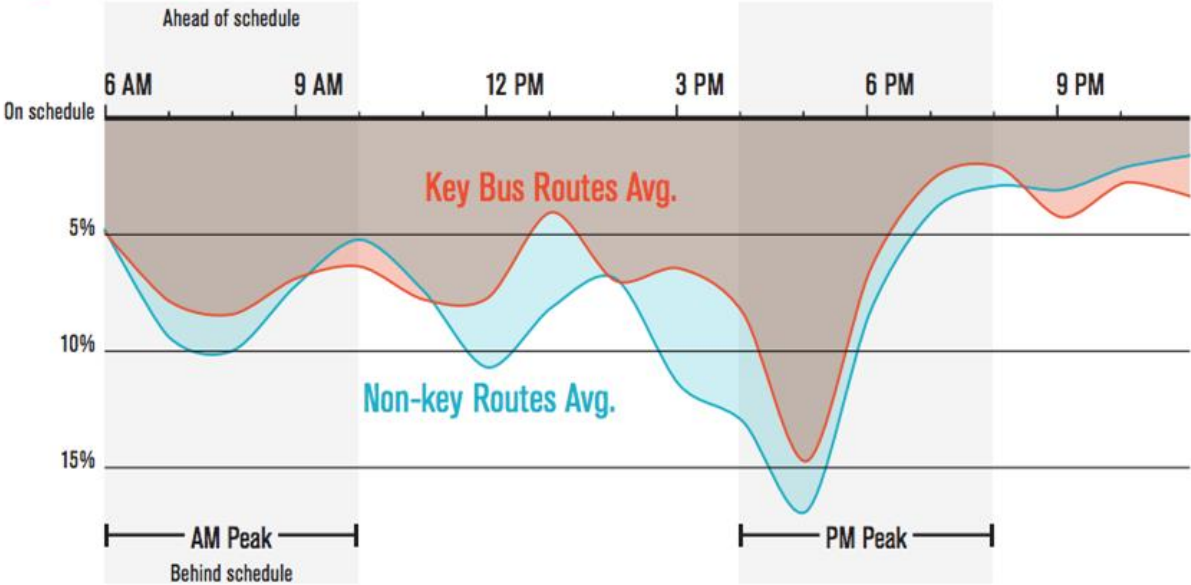
n
22 | 4,548

Source: 2016 Boston Vision Zero

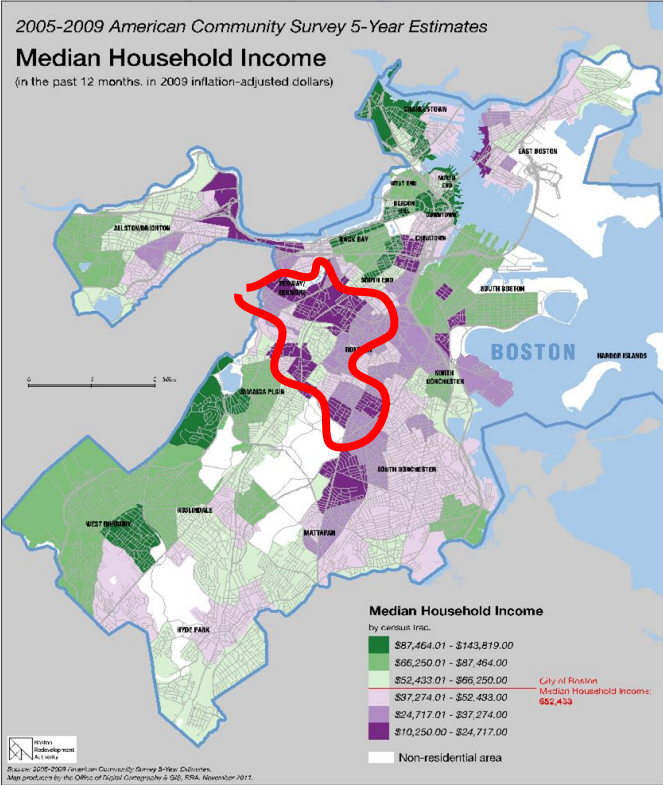
Motivation: More Reliable Trips

24% of Mattapan residents have a commute over 60 minutes

Average % Delay in Bus Schedule



Motivation: Ensuring Equity & Access



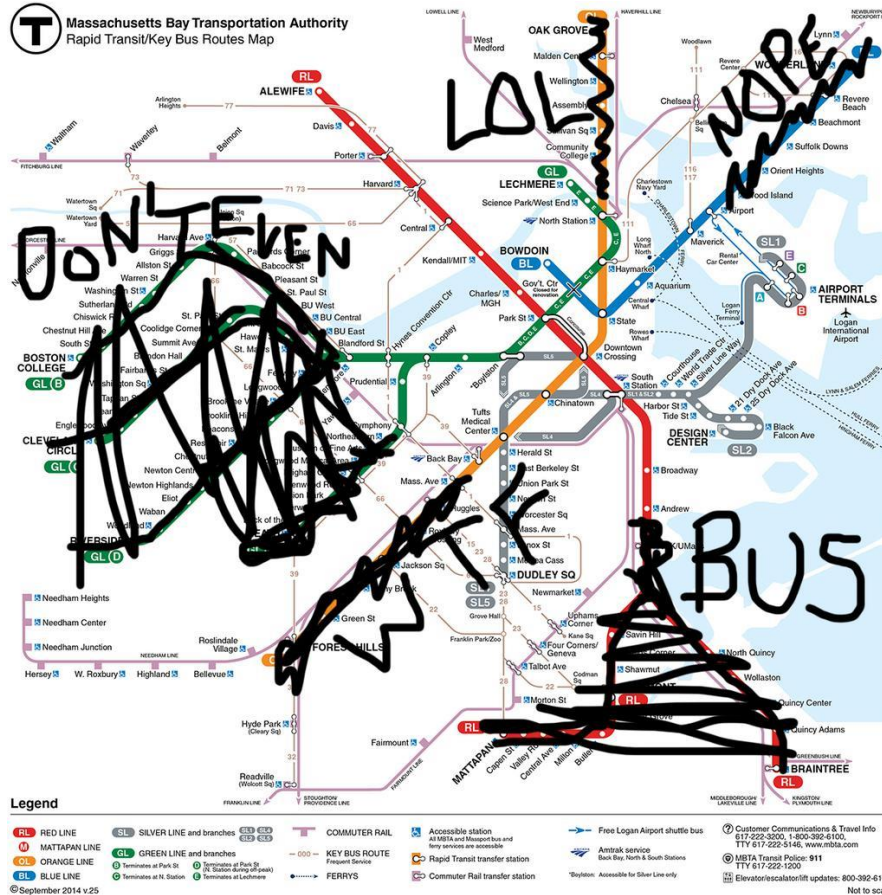
Sub-prime service

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



Source: Boston Globe

Motivation: Systems that can work in Boston's climate



Source: MBTA Snow Map,
Sara Morrison

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

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.”

What We Are Doing

Set Policy Priorities



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

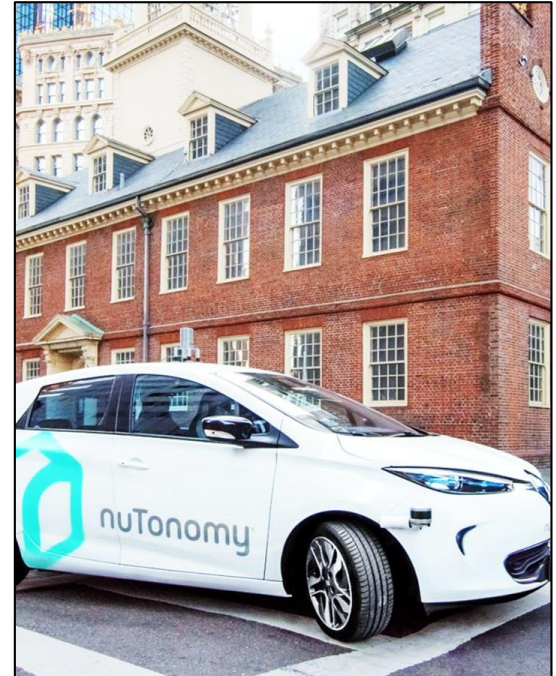
Research Partnership

WORLD
ECONOMIC
FORUM

BCG

THE BOSTON CONSULTING GROUP

Started Testing



Our Five Areas of Research

- 1 AV Testing**
- 2 Business Models**
- 3 Street Design**
- 4 Workforce**
- 5 Governance & Financing**

Governance Work

Executive Order(s)



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

MOU(s)

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 current transportation options our system provides. The aging population, those with visual impairments, those looking to reduce the burden of personal vehicle ownership, and those without access to rapid transit, all stand to greatly benefit from this technology if applied those types of users in mind.

More Reliable: A reduction in the number of vehicles on our roadways can be achieved through the adoption of shared fleets of autonomous vehicles, freeing up space for other uses and other 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

Testing Plans

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 daylight hours only during weather without precipitation.	Testing can only occur within the Marine Industrial Park.	Vehicle must have a safety driver behind the wheel.	After documenting 100 miles logged in Phase B1, the partner may request to move to Phase B2.

Phase B2 - The Raymond L. Flynn Marine Park			
Time	Place	Manner	Milestone
Testing must occur in both during daytime and nighttime hours.	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.
Testing must include periods during precipitation.			

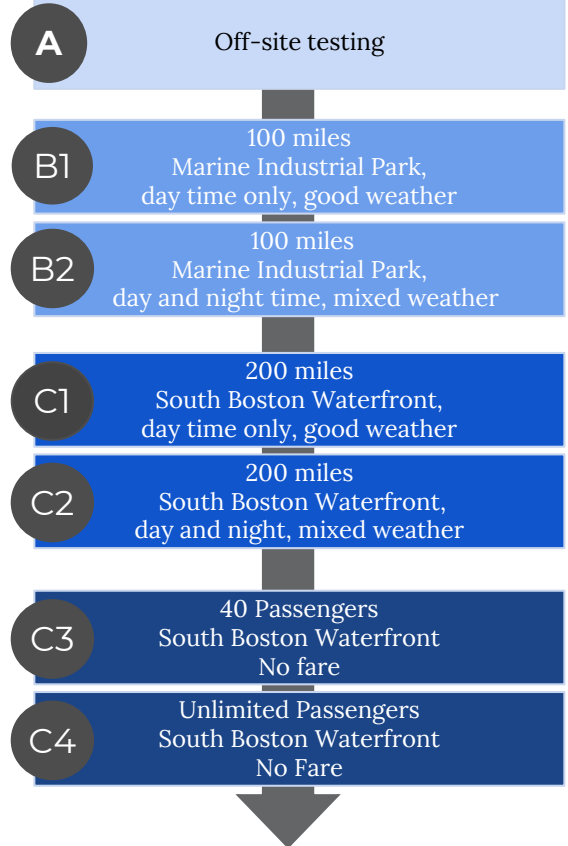
Phase C1 - A Second, Mutually-Agreed Upon Geography			
Time	Place	Manner	Milestone
Testing must occur in daylight hours only during weather without precipitation.	Testing can only occur within the South Boston Waterfront, an area defined in attachment	Vehicle must have a safety driver behind the wheel.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

AV Testing

Current Testing Sites



Testing Phases



Current AV Testing Partners



Renault Zoe (EV)



Polaris GEM e6 (EV)



Audi Q5 / BMW 3

C4

Unlimited Passengers
South Boston Waterfront
No Fare

B2

100 miles
Marine Industrial Park,
day and night time, mixed weather

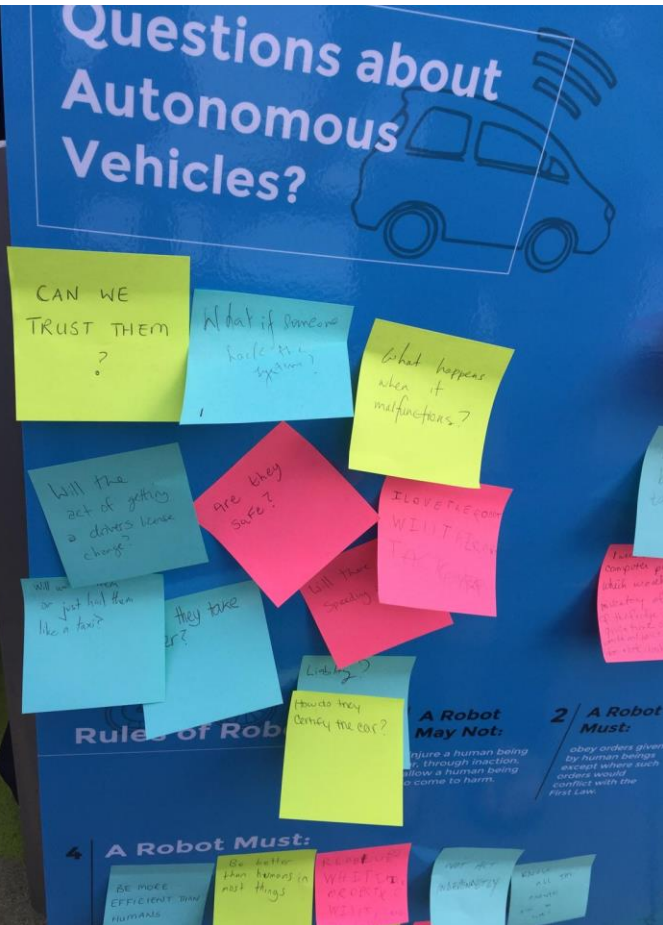
B2

100 miles
Marine Industrial Park,
day and night time, mixed weather

merger occurring

Socialization

Questions about Autonomous Vehicles?



Sticky notes on the board:

- CAN WE TRUST THEM?
- What if someone looks at the system?
- What happens when it malfunctions?
- Will the act of getting a drivers license change?
- Are they safe?
- Will there be any liability?
- How do they control the car?
- A Robot May Not:
violate a human being through inaction, allow a human being to come to harm.
- A Robot Must:
obey orders given by human beings, except where such orders would conflict with the First Law.
- A Robot Must:
be more efficient than humans.
- BE MORE EFFICIENT THAN HUMANS
- BE BETTER THAN HUMANS IN MOST THINGS
- WE'RE NOT READY FOR THIS
- autonomy
- will be...



Boston AV Impact Study

SURVEY

7,000 respondents across 3 cities
(*Berlin, Boston, Shanghai*)

MODEL

54 mi² | 1144 miles of streets | 114 Bus Routes
2M daily Trips | 37% autonomous vehicles

Boston AV Impact Study

	Today	Autonomous Future Scenario	Change
Individual Benefit (Reduction in Travel Time)	12 min	11.5min	-4%
Neighborhood Benefit (Freed Up Street Space)	3.8 mi ²	2 mi ²	-48%
Environmental Benefit (CO2 Emissions - Ton)	1.9K	0.9K	-50%
Environmental Concern (Vehicle Miles Traveled)	5.5M	6.3M	+16%

Paradigm Shifting is Hard

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

Thank you

@Kris_W_Carter

Kristopher.Carter@Boston.gov

Boston.gov/Boston-av

