

Q1 2019

# PROGRESS REPORT

AUTONOMOUS VEHICLE TESTING  
CITY OF BOSTON





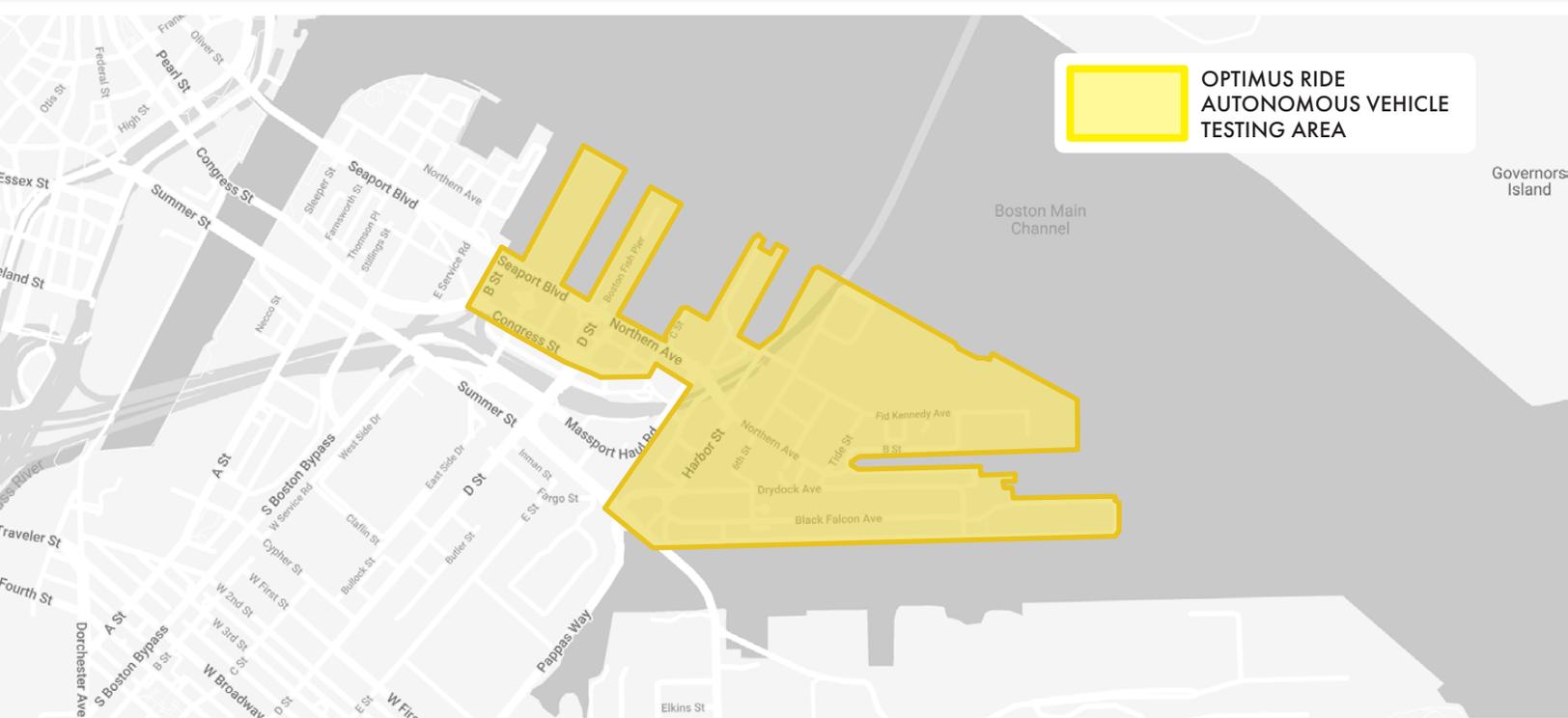
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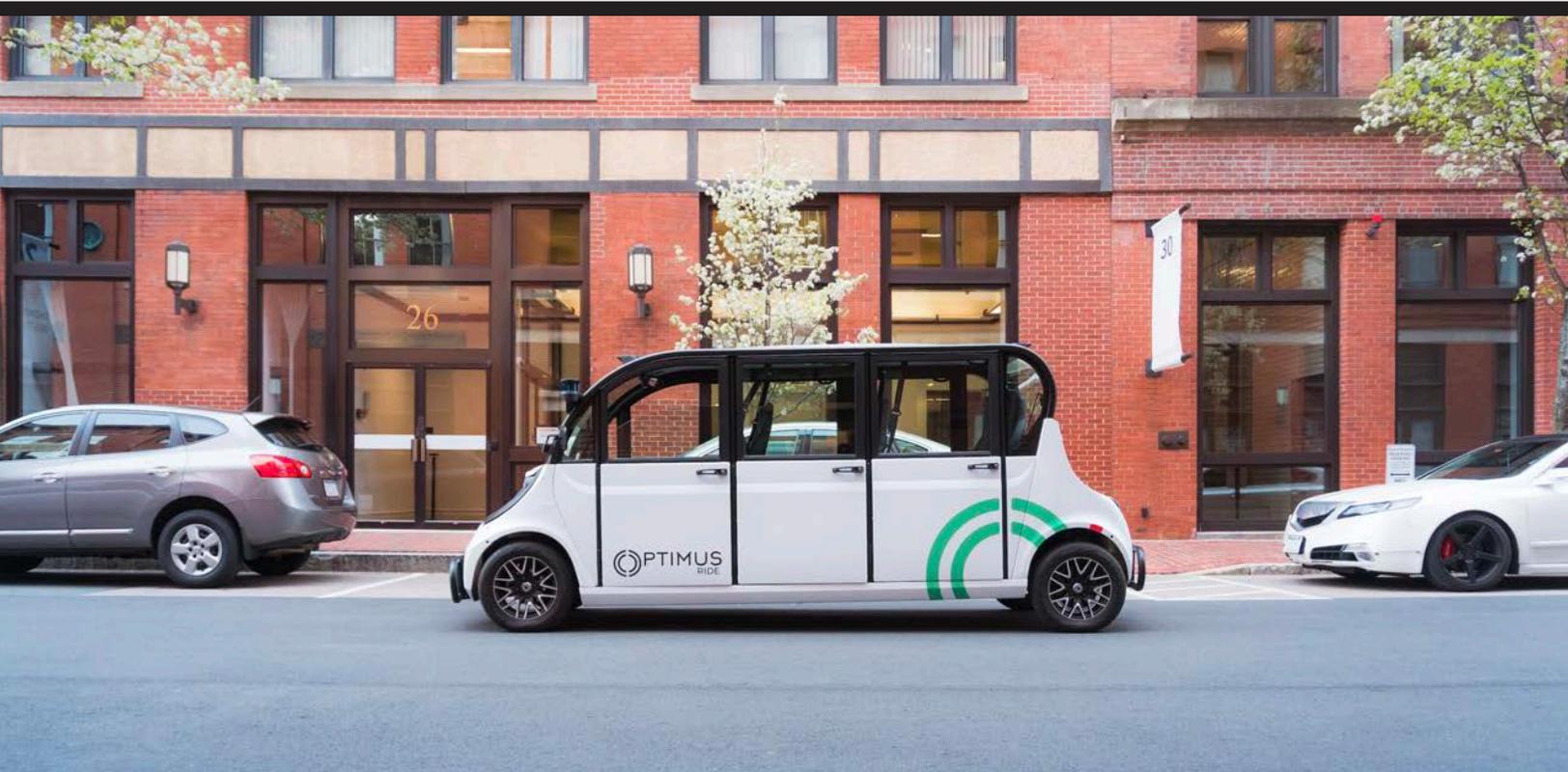
Optimus Ride Inc. is a self-driving vehicle technology company. Emerging from Boston's vibrant robotics ecosystem, we bring together the promise of self-driving technologies with real-world considerations. We design our software to enable efficient, sustainable, and equitable mobility solutions.

This document provides a quarterly update to the City of Boston and the general public on Optimus Ride's autonomous vehicle testing program.

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## OPTIMUS RIDE TESTING OPERATIONAL DOMAIN





## INTRODUCTION

Participating in the Autonomous Vehicle Testing Program established by the City of Boston and MassDOT enables Optimus Ride to explore the promise of autonomous vehicles to improve road safety, expand access to public transit, enhance sustainability, and promote economic growth. To date, Optimus Ride has driven over 2,500 miles autonomously on public roads in Boston and logged many more thousands of autonomous miles in the state of Massachusetts.

This quarter, we announced and launched commercial programs with three communities across the United States: Halley Rise by Brookfield Properties in Reston, VA, the Brooklyn Navy Yard in Brooklyn, New York, and Paradise Valley Estates in Fairfield, CA. We are grateful to the State of Massachusetts and the City of Boston for enabling the development of the autonomous vehicle industry and supporting Optimus Ride.

Thank you,  
**The Optimus Ride Team**



# RESEARCH & DEVELOPMENT

## Research Achievements

Given the launch of our new commercial partnerships, the Optimus Ride team has been focused on expanding our operations safely, efficiently, and robustly. As a result of our research and development efforts during the quarter, our passengers have noticed more sophisticated vehicle handling at intersections, during right-of-way events, and road circumstances involving yielding vehicles.

To accomplish this, we have been studying a range of traffic behaviors and devising solutions to improve ride fluency. A behavior many human drivers are familiar with, for example, is hidden or obscured objects. These objects are referred to as “traffic occlusions” in the autonomous vehicle industry and are considered a major environmental risk factor for all drivers. Common and extremely dangerous traffic occlusions include both static and dynamic objects, such as traffic signs obscured by trees or oncoming vehicles obscured at a T-intersection when a vehicle is positioned to make a left turn. As a means of improving vehicular safety, autonomous vehicles are programmed to detect and track obstacles past occlusions. Optimus Ride is committed to advancing the development of operational, algorithmic, and sensor-based solutions to reduce the impact of occlusion on road interactions.

## Safety

Optimus Ride continues to foster a Safety Culture by maintaining and continuously improving the safety of our daily activities and overall operations record. We maintain an excellent safety record and have no accidents, failures, or disruptions of our vehicles to report.

The driver takeover methods used in the Optimus Ride vehicles have been designed to ensure the Human Machine Interface (HMI) is clear, consistent, gives context, and provides the necessary feedback about the system.

The system is designed to disengage autonomous control and enable manual control by the safety driver when a takeover is initiated. The safety driver can safely and quickly take control using the brakes, throttle or steering wheel. Takeover events occur largely due to environmental factors, such as road interactions with other drivers who disregard right-of-way traffic rules.



# MOBILITY SERVICE & COMMUNITY ENGAGEMENT

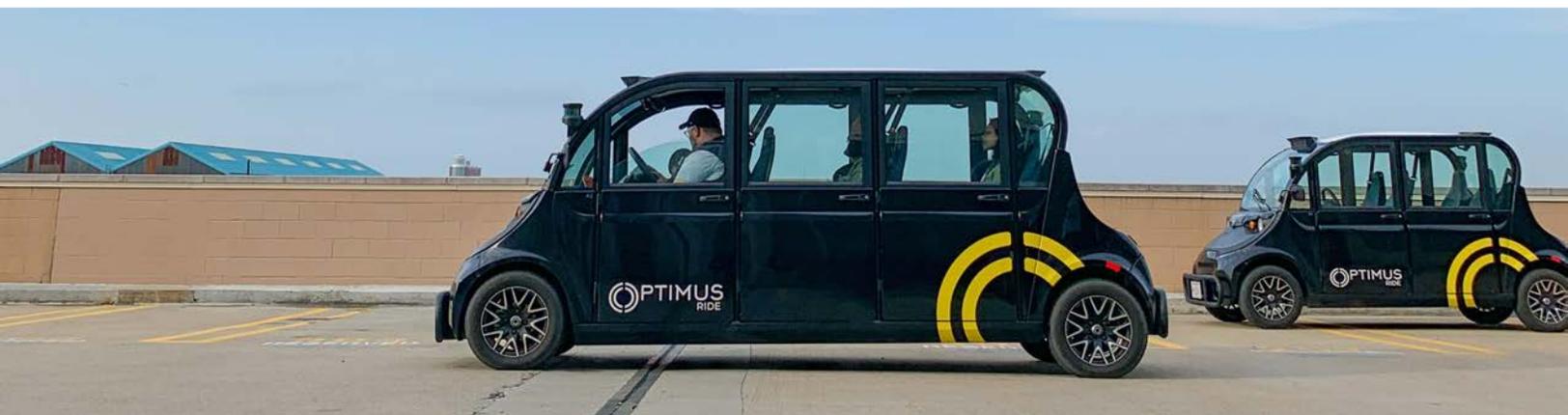
## Passenger Satisfaction

The safety and satisfaction of our passengers is our utmost priority. Key satisfaction metrics tracked by our team during the first quarter continue to indicate that our users gain value from our service and experience high levels of satisfaction, advancing our mission to increase access to public transit and improve overall mobility. To augment passenger access to our fleet, Optimus Ride launched a new booking system this quarter to simplify the process of requesting a ride. The system is available to our users at Union Point in South Weymouth and Boston's Seaport District.

## Community Engagement

Optimus Ride welcomed members of the greater Boston community into its headquarters in March for an event titled Robot Block Party: Rides! We invited 20 participants out of nearly 150 who entered our raffle during the Robot Block Party event at Hubweek 2018. These participants represented many constituencies: Back Bay, Dorchester, and Braintree in Boston, as well as Cambridge, Lynn, Lexington, Franklin, and Newton. Like the team at Optimus Ride, many of our participants are enthusiastic about the promise of self-driving vehicles for improving mobility.

In their raffle entry forms, many participants noted that autonomous vehicles primarily interest them for reasons of safety and access, holding lingering questions about how the vehicles operate. Because of this, we enlisted a diverse group of Optimists (employees at Optimus Ride) for our participants to engage with. Participants asked our team members a variety of questions about the technology that enables autonomous driving, such as "How can the cars see their environment?" To answer this, members of our robotics team discussed the most prevalent sensor types that autonomous vehicles utilize and described how modern algorithms immediately transform this information into vehicle behaviors on the road.



# AREAS OF IMPROVEMENTS

## Potential Infrastructure Improvements

The dynamic landscape of the City of Boston-approved C1 & C2 testing area for Optimus Ride presents tremendous research and development opportunities for autonomous vehicles. The rapid development of the Seaport District makes construction and road repair operations prevalent on major arteries along Northern Ave, Summer Street, and Drydock Ave, stimulating dynamic research on perception system design as well as mapping and localization.

For these reasons, Optimus Ride recommends that submitting potential infrastructure improvements move beyond reporting road pavement deterioration. Instead, Optimus Ride believes that focusing on identifying underlying communication and road design opportunities will improve shared road safety goals.

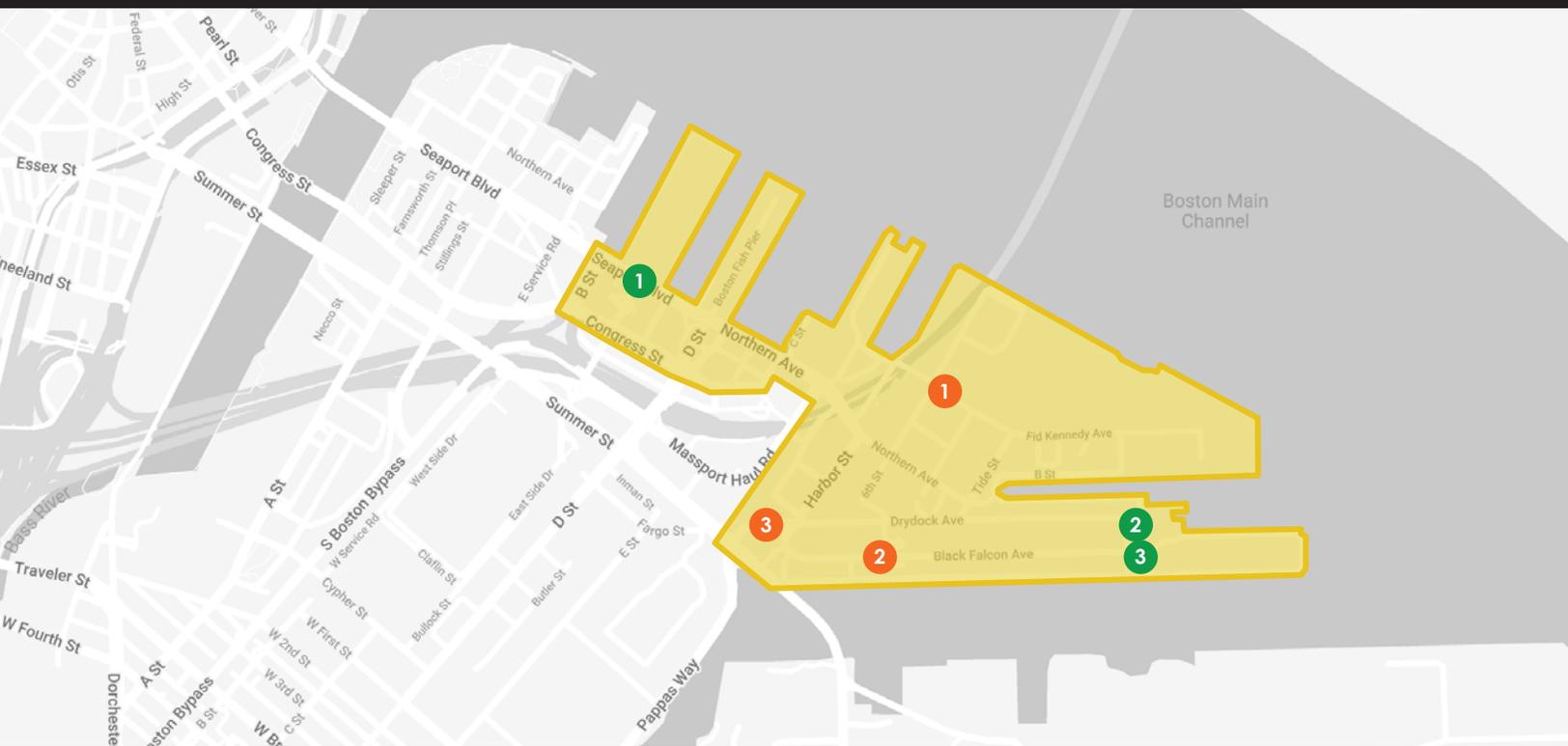
## Communication

Given the aforementioned construction operations on major roadways in the Seaport District, Optimus Ride encourages streamlined communication from construction stakeholders surrounding changing road traffic conditions. An example of a major road system update during Q1 2019 was the installation of two new stop signs at the intersection of Tide St and Drydock, transforming a former 1-way stop into a 3-way stop. Optimus Ride employees noticed the new stop signs and immediately ensured our systems reacted accordingly to respect the 3-way stop. However, during operations, Optimus Ride has noticed that many vehicles do not observe the new 3-way stop, endangering pedestrians and bicyclists. Optimus Ride believes streamlined and visible communication to motorists and AV operators alike would improve shared road safety and encourage adoption of traffic control and calming measures.

## Road Design Opportunities

Through our testing program in the Seaport, we have become intimately familiar with the roadways. In a research study conducted with our operations and research and development teams, we learned of areas of opportunity to increase shared road safety, as well as areas where the City of Boston is excelling in road design.





## Areas of Excellence in Q1

- 1 Bike Lanes on Seaport Boulevard:** Many of our employees ride their bikes to work and appreciate the updated bike lanes on Seaport Boulevard as a means of improving safety during their daily commutes. They are enthusiastic about the expansion of such lane markings for bicyclists in other areas of the Seaport.
- 2 Road Repair:** Near our headquarters on Black Falcon Ave, significant repair efforts are underway to improve road conditions. We appreciate the efficiency at which repairs are being made to areas we have described in our prior reports.
- 3 SL2 Improvements:** We are grateful for the efforts undertaken through the Better Bus Project to improve commuting efficiency for SL2 riders (a critical transportation method for our employees!) and are eager to see the outcome of the SL2 loop improvements including a bus shelter and street crossings from Black Falcon to Drydock.

## Areas of Opportunity in Q1

- 1 Stop Line/Stop Sign Distance Disparity:** At the intersection of Fid Kennedy and Seafood Way, the stop sign and stop lines are positioned too far apart.
- 2 Wrong Way Drivers:** At the intersection of Design Center Place and Black Falcon Ave, more visible Do Not Enter signs are necessary, as drivers occasionally enter Black Falcon Ave through Design Center Place (a 1-way westbound road with entry through Drydock Ave) the wrong way and have difficulty maneuvering out.
- 3 Drydock and Harbor Street:** Construction on the new building leads to dangerous road interactions between vehicles, pedestrians, and cyclists, with a very limited field of vision for right turns.



