

# Fast Forward 2017:

## Self Driving Cars in Our Communities

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Monday, December 4<sup>th</sup>, 2017  
Westborough, MA

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**Alison Felix** – Metropolitan Area Planning Council  
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# *Fast Forward: The Technology Revolution in Transportation & What it Means for Massachusetts*



**Paul Matthews**  
495/MetroWest Partnership



# Special Thanks to Report Contributors:



# Why the Technology Revolution Matters



**fasten**



# Why the Technology Revolution Matters

SAE Level 0 (e.g., Toyota Camry with conventional cruise control, all classic cars)

- human driver does everything

SAE Level 1 (e.g., Honda Civic with adaptive cruise control, most modern cars)

- automated system can sometimes assist the human driver conduct some parts of the driving task

SAE Level 2 (e.g., Subaru Eyesight with lane keep assist, active braking, etc.)

- automated system can actually conduct some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task



SAE Level 3 (Tesla Model S)

- automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be ready to take back control when the automated system requests



SAE Level 4 (Ford Fusion Hybrid Autonomous Research Vehicle)

- automated system can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions



SAE Level 5 (Waymo)

- automated system can perform all driving tasks, under all conditions that a human driver could perform them





# Why the Technology Revolution Matters



**2000 – 2010**

Advanced Safety Features

- Electronic Stability Control
- Blind Spot Detection
- Forward Collision Warning
- Lane Departure Warning



**2016 - 2025**

Partially Automated Safety Features

- Lane keeping assist
- Adaptive cruise control
- Traffic jam assist
- Self-park

**2010 – 2016**



Advanced Driver Assistance Features

- Rearview Video Systems
- Automatic Emergency Braking
- Pedestrian Automatic Emergency Braking
- Rear Automatic Emergency Braking
- Rear Cross Traffic Alert
- Lane Centering Assist

**2025+**



Fully Automated Safety Features

Highway autopilot



# Source of Policy Principles & Recommendations

- Developed over yearlong input process
  - Survey of key constituencies
  - Practitioner interviews from across country
  - Four policy roundtables
  - Diverse constituencies participating in interviews, roundtables, and survey
  - Vetted with key policy makers
- Released in 2016 with recommendations for state, municipalities, private sector, and other key constituencies

## Fast Forward

The Technology Revolution in Transportation and What it Means for Massachusetts

## Policy Recommendations

### A Public Policy Framework for Innovative Mobility

Transportation for Massachusetts recognizes the transformative benefits that advances in information technology, shared mobility, and autonomous vehicles can have for Massachusetts' economy, environment and quality of life – as well as the challenges that could result from disruption to existing forms of mobility. Emerging innovative mobility options will affect not only our transportation system, but also our economy, our safety, our workforce, our environment, our land use, and our energy use.

Federal, state, regional and local governments must play an important role in shaping our transportation future by setting overall goals for mobility based on the following policy principles, and by integrating information technology, shared mobility and autonomous vehicles into our transportation system in ways that help to meet those goals.

### Policy Principles

**Protect people and the environment.** Innovative mobility should improve community quality of life and bring us closer to the safety objectives of the Vision Zero initiative. Innovative mobility must prioritize the safety of all transportation users, advance social equity, ensure that the benefits and burdens of new advancements are fairly distributed, and protect the environment.

**Serve everyone.** The evolution of services should directly benefit people of low-income and of color, people whose primary language is not English, seniors, people with disabilities, and suburban and rural residents across the Commonwealth.

**Encourage innovation.** To address long-standing transportation problems, challenges, and barriers, local and state governments should support public-serving innovative pilot projects and adoption of new technologies and services.

**Share data.** Data sharing is essential for the Commonwealth, municipal governments, and public agencies (such as Regional Transit Authorities) to have access to the information they need to plan, operate,

# Policy Principles

- Protect people and the environment
- Serve everyone
- Encourage innovation
- Share data
- Modernize oversight and address gaps in regulatory coverage for emerging services
- Plan for our future infrastructure needs
- Improve and expand our public transportation, walking, & biking network



# Policy Recommendations

1. Set Goals
2. Maintain core infrastructure and enhance the network with innovative mobility
3. Encourage electric, shared, autonomous fleets that serve everyone

# Policy Recommendations

4. Support pilots & demonstrations
5. Provide regulatory & indirect support for AV testing in Massachusetts
6. Require selected, standardized, open data

# Policy Recommendations

7. Update modeling
8. Encourage regional efforts to regulate taxis and coordinate policy around innovative mobility
9. Limit zero-occupancy and single-occupancy use of AVs in congested areas

# Policy Recommendations

- 10.** Empower municipalities to maximize local benefits of innovative mobility
- 11.** Anticipate innovative mobility in the design and maintenance of public infrastructure
- 12.** Update minimum parking requirements and fee structures





**13.** Support innovative bike programs

**14.** Adopt pricing policies

**15.** Create virtual pop-up “mobility hubs”



# Thank you

- More at <http://www.t4ma.org/fastforward>
- T4MA and members are continuing to lead on these issues

*Transportation for Massachusetts is a diverse coalition of organizations working together to create safe, convenient, and affordable transportation for everyone. We advocate for transportation funds to be spent fairly and responsibly, for transportation decisions that are transparent and accountable, and to ensure that our transportation network has sufficient resources to meet tomorrow's needs all throughout the Commonwealth.*



# Self-Driving Cars in Our Communities

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Alison Felix, Senior Transportation Planner &  
Emerging Technologies Specialist

- Legislative & Policy Considerations
  - Critical Areas for Municipal Planning
  - Testing in Massachusetts
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# Legislative and Policy Considerations for Autonomous Vehicles

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In May 2017, the MAPC Executive Committee adopted legislative and policy considerations to encourage the **safe, sustainable, and equitable** accommodation of autonomous vehicles.

Maximize benefits, minimize risks





# LEGISLATIVE CONSIDERATIONS

1

Data Collection and  
Data Sharing

2

Potential Changes to  
Municipal and State Revenue

3

Public Infrastructure

4

Safety and Consistency

5

Shared-Use Mobility Model

6

Speed Limits

7

Testing Activities

8

Vehicle Miles Traveled (VMT)

9

Zero Emissions Vehicles (ZEV)

# POLICY CONSIDERATIONS

1

Autonomous Delivery  
of Goods

2

Education

3

Equity

4

Land Use

5

Long Range Goals

6

Long Range Planning and  
Modeling

7

Parking

8

Public Transportation

9

Track & Monitor  
Federal & State  
Developments

10

Transition Period

11

Truck Freight and Delivery  
Systems

12

Workforce Impacts



# LEGISLATIVE AND POLICY CONSIDERATIONS

Data Collection and  
Data Sharing

Zero Emissions Vehicles (ZEV)

Land Use

# **OPPORTUNITY: More & better information about travel needs and transportation system**

**Traffic management and operations**

**Integrated trip planning applications**

**Improved travel models and forecasts**

**Performance measurement (equity, sustainability)**

## **Data Collection and Data Sharing**

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Standardized system for **data collection, storage, analysis, & dissemination** of info about vehicle occupancy, travel times, and shared vs non-shared service.



Robust policies to ensure **data privacy and security** for owners and passengers.



## **OPPORTUNITY: Faster transition to more sustainable technology**

New class of vehicles

Trip types and conditions  
amenable to electric vehicles

### **Zero Emissions Vehicles (ZEV)**



Develop policies that **maximize the number of zero-emission autonomous vehicles** incentivize their use.

## **POTENTIAL RISK:** Ease of travel triggers “Sprawl 2.0”

Reduced disincentive for long commutes

Increased development pressure in remote areas

Infrastructure and public service demands

Increased VMT, congestion, GHG emissions

### **Shared-Use Mobility Model**

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Promote & incentivize shared-use mobility models, **incentives for shared rides or shared ownership** of autonomous vehicles, and **integration with public transportation** (e.g., first mile/last mile); discourage private car ownership as well as vehicles operating without passengers.





# Self-Driving Cars in Our Communities

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- Legislative & Policy Considerations
- **Critical Areas for Municipal Planning**
- Testing in Massachusetts

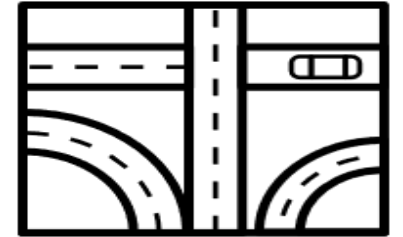


# Critical Areas for Municipal Planning

**Regulatory Framework**



**Infrastructure**



**Data**



**Parking**



**Land Use Impacts**

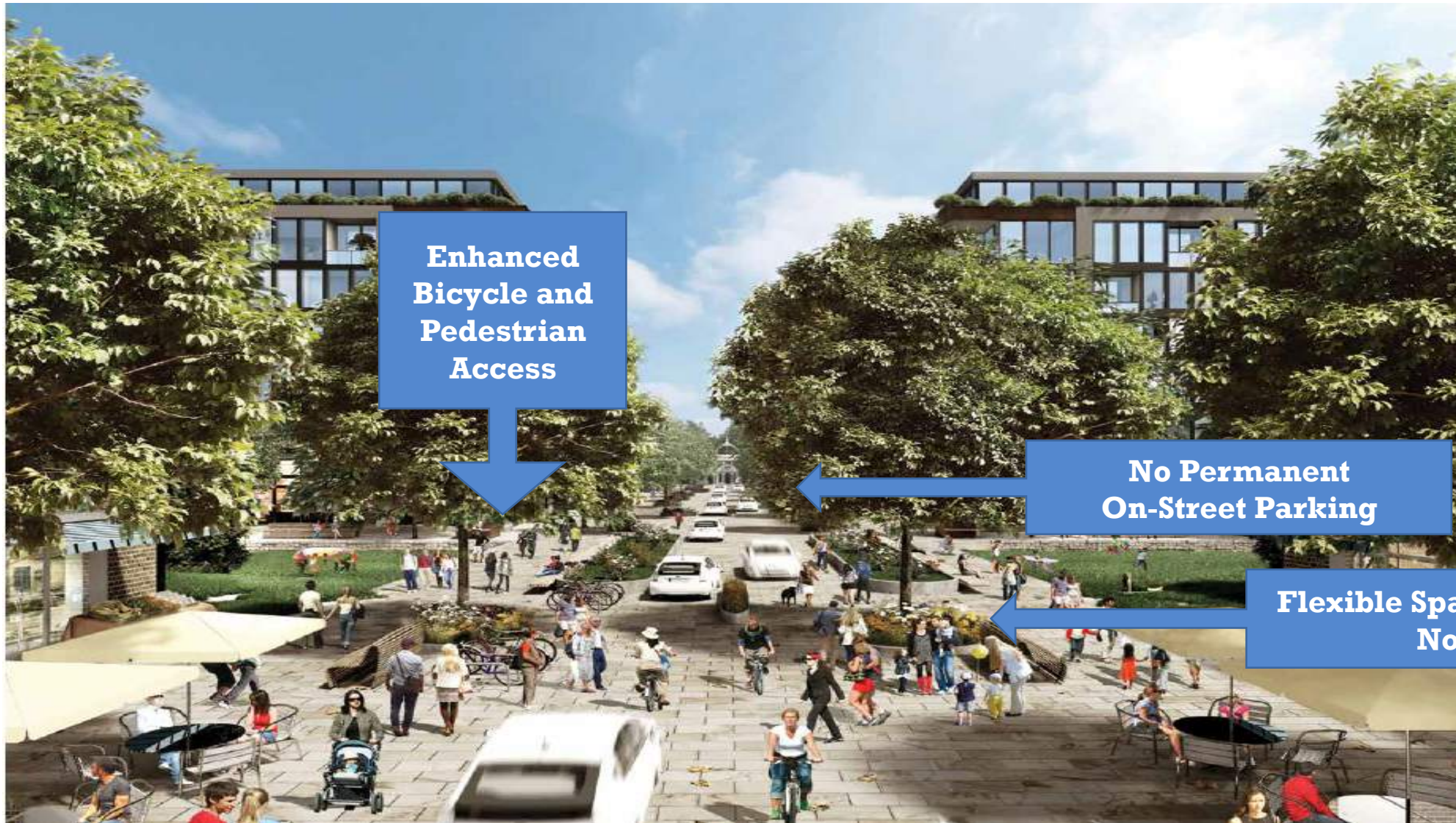


**Coordination**





# Imagining Future Places



Source: Making Better Places: Autonomous Vehicles and Future Opportunities WSP | Parsons Brinckerhoff

# Imagining Future Places



**Redevelop Surface Parking to  
Infill Development and/or Parks  
and Public Space**



Source: Envisioning Florida's Future: Transportation and Land Use in an Automated Vehicle World



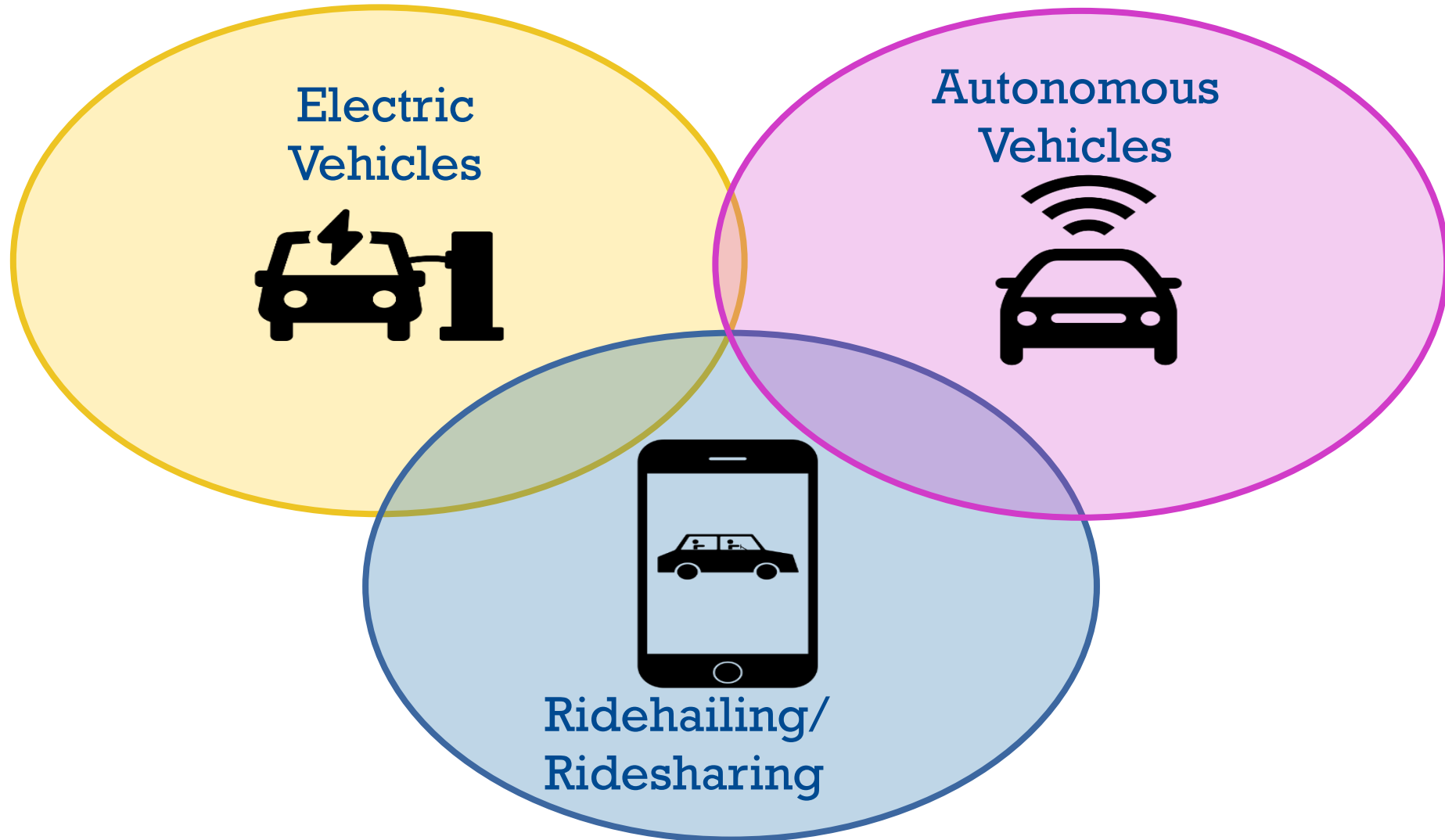
# Transportation as a Service

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- Instead of consumers owning the asset (car, bike, bus) a third party provides it for a small fee.
- New business models dependent on smart-phone technology.
- Standardized and simplified payment methods.
- Can combine public and private transportation providers through a unified system.
- Example Services: ride hailing, car sharing, bike sharing, transit route planning, instant home delivery, parking applications.
- Example Companies: Uber, Lyft, Zipcar, Hubway, Instacart, GrubHub.

# Convergence of Technologies

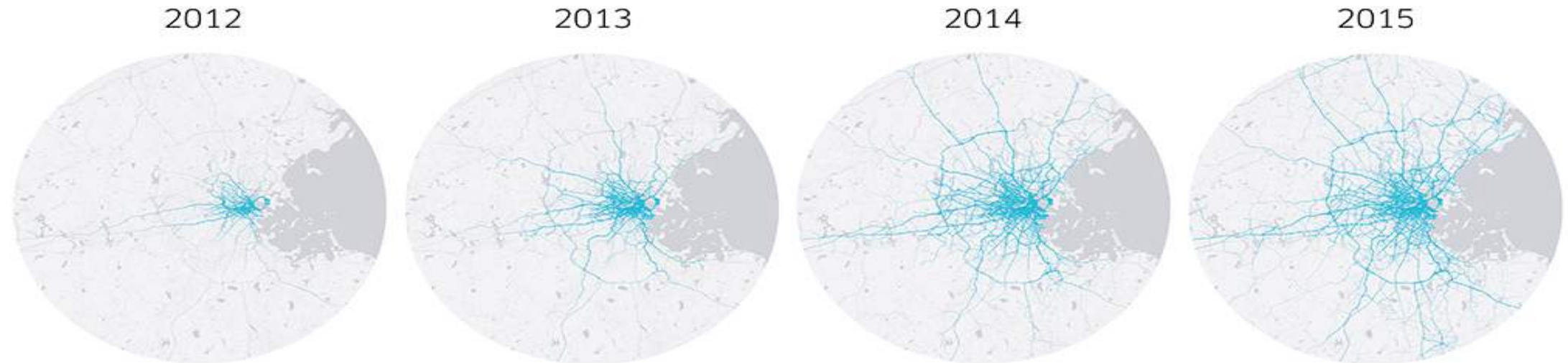
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# Growth in Ridehailing

## Boston Region

- Uber arrived in Boston in 2011, followed by Lyft in 2013.
- Number of trips with Uber exceeded 115 million between 2012 and 2015.
- Approximately 70,000 trips between Friday and Saturday in Boston from 10:00 PM to 4:00 AM.



Source: Uber



# Rate of Ridehailing

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## **New York City**

- Ridehailing tripled between June 2015 and Fall 2016.
- Added 600 million miles of travel between 2013 and 2015.

## **San Francisco**

- On a typical weekday, there are more than 170,00 vehicle trips within San Francisco, representing 15% of all intra-city vehicle trips in 2016.
- At peak periods, ridehailing trips are estimated to comprise 20-26% of vehicle trips in downtown areas in 2016.



# Self-Driving Cars in Our Communities

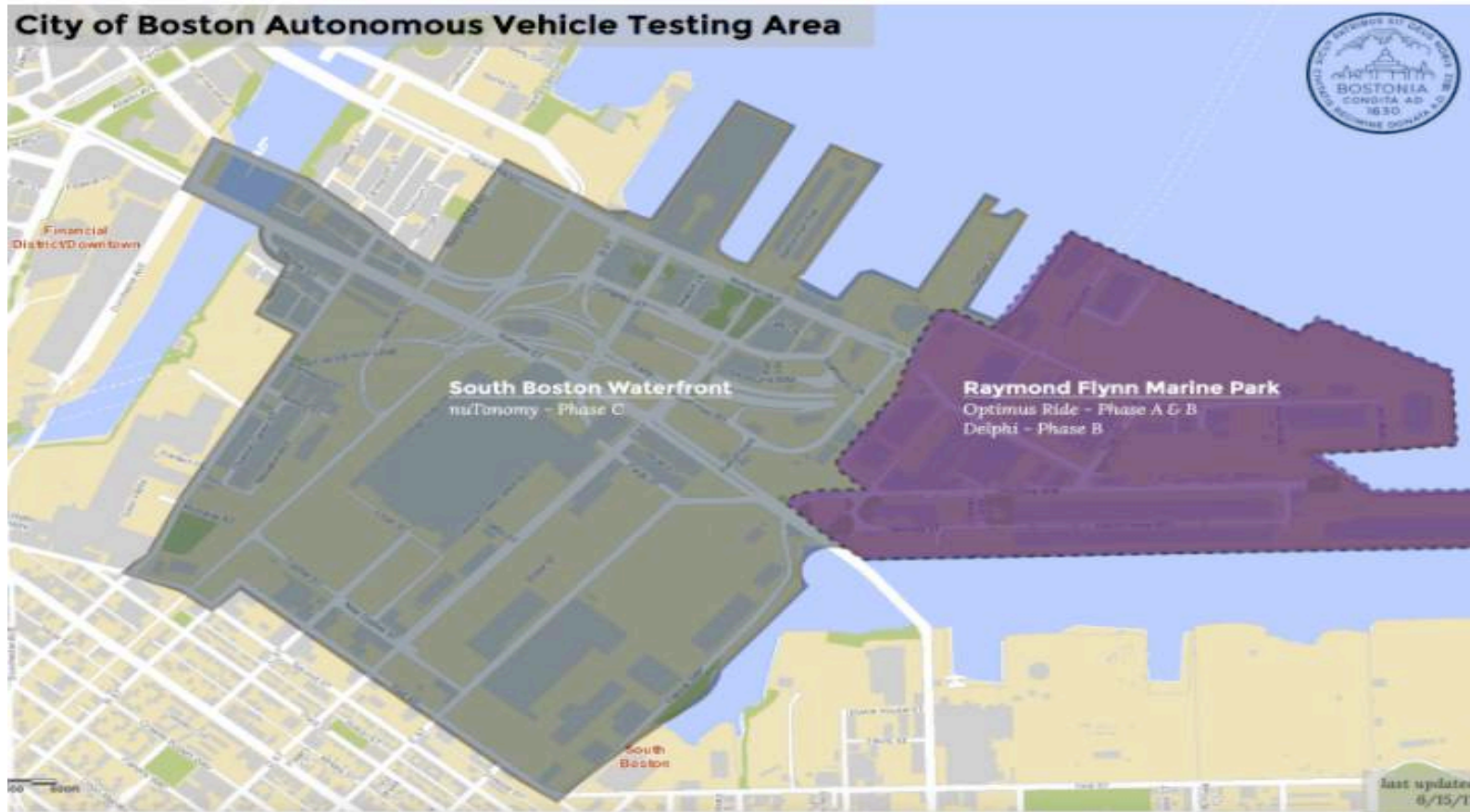
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- Legislative & Policy Considerations
- Critical Areas for Municipal Planning
- **Testing in Massachusetts**



# Autonomous Vehicle Testing in Boston

## Testing Sites



Source: Kris Carter, Mayor's Office of New Urban Mechanics, City of Boston

## Testing Phases



# Autonomous Vehicle Testing in Boston



Renault Zoe

**C3** 200 miles in South Boston Waterfront, day and night, mixed weather, with passengers



Polaris GEM e4 and e6

**B** 100 miles, Marine Industrial Park, day time only, good weather



Audi Q5

**B2** 100 Miles, Marine Industrial Park, night-time and light rain

merger occurring

# Regional Memorandum of Understanding to Facilitate Testing of Autonomous Vehicles

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Coordinating with Governor's Office,  
Metro Mayors Coalition and Massachusetts DOT







FAST FORWARD:  
SELF-DRIVING CARS IN OUR COMMUNITIES

***Will self-driving cars also  
drive your budget?***

*The Fiscal and Economic Impacts of Autonomous Vehicles*

December 4, 2017

Rafael Mares

Vice President & Program Director  
Healthy Communities and Environmental Justice





# TODAY'S ROAD MAP

## Municipal Budgets

Current Motor Vehicle Revenue Sources.



## State Budgets

Current Motor Vehicle Revenue Sources.



Trends  
AV Budget Drivers.



## Projected Fiscal Impacts

AVs and Municipal Revenue Sources.  
AVs and State Revenue Sources.



## Projected Economic Impacts

The costs and benefits of AVs.



## Lessons Learned

What we have learned along the way.



## Recommendations

Policies that can help us benefit from AVs.





# CURRENT MUNICIPAL MOTOR VEHICLE REVENUE SOURCES

## Excise Tax:

\$25 per thousand is assessed annually upon the value of the vehicle by the community where the motor vehicle is customarily garaged.



## Fines:

Moving Violations

MASSACHUSETTS UNIFORM CITATION

1. CITATION NUMBER

2. TYPE OF OFFENSE

3. OFFENSE DESCRIPTION




4. NOTICE TO VIOLATOR

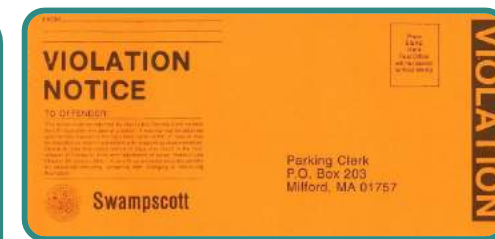
5. VIOLATOR'S SIGNATURE

6. OFFICER'S SIGNATURE

7. DATE AND TIME

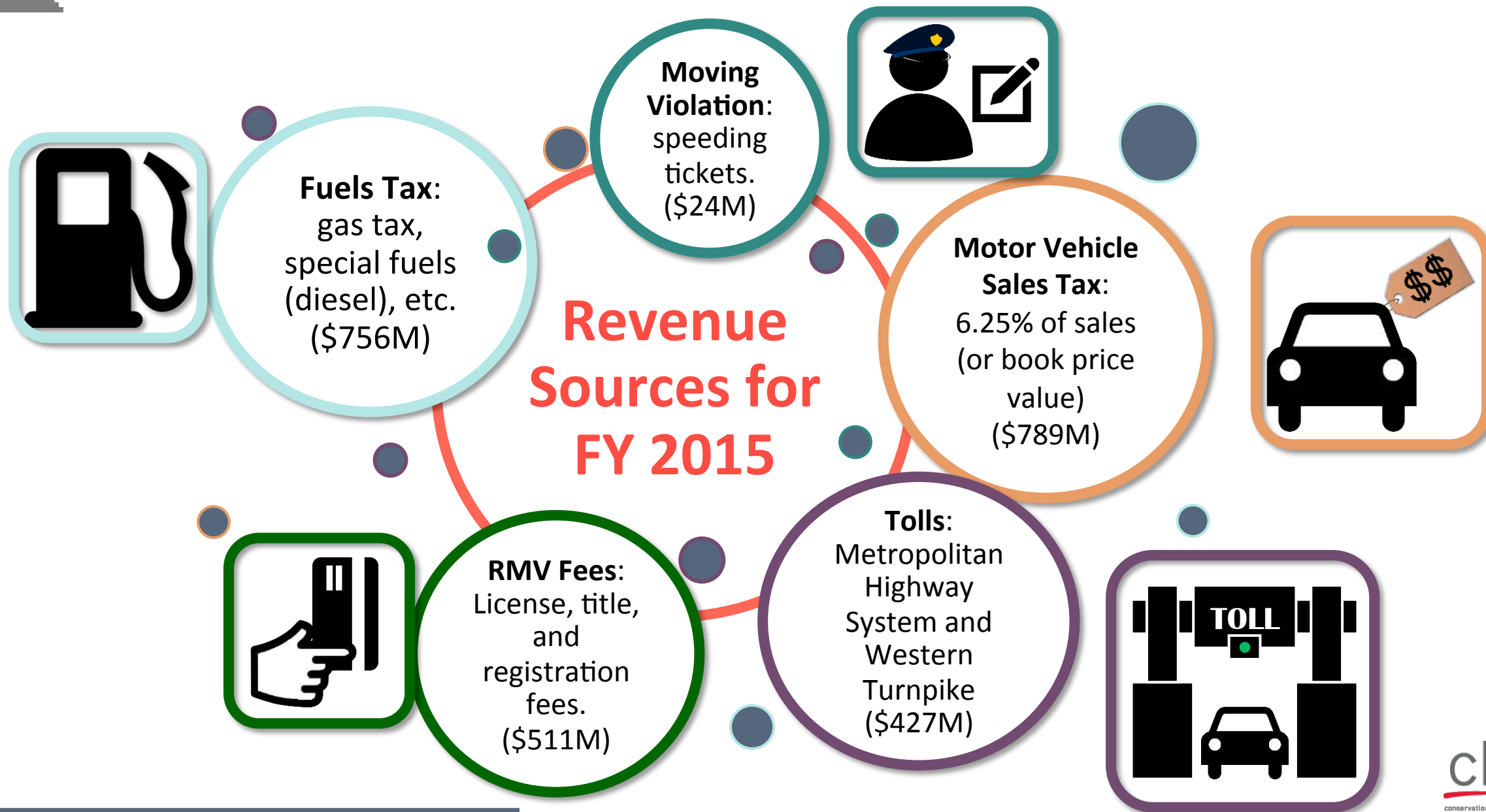
## Parking:

-  Street Parking
-  Parking Permits
-  Parking Violations









# CURRENT STATE OF REVENUE SOURCES







## TRENDS: AV BUDGET DRIVERS



**Traffic:** studies estimate VMT increase of 37% to 90%.

-  Accessibility to non-drivers
-  Increased willingness to travel longer distance
-  Diversion from the MBTA
-  Zero-Occupancy vehicles

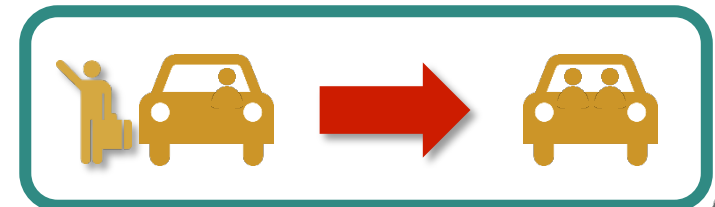
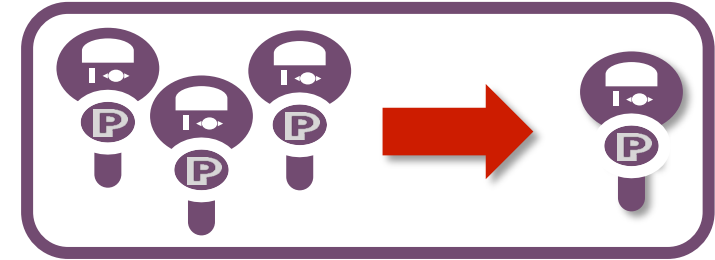
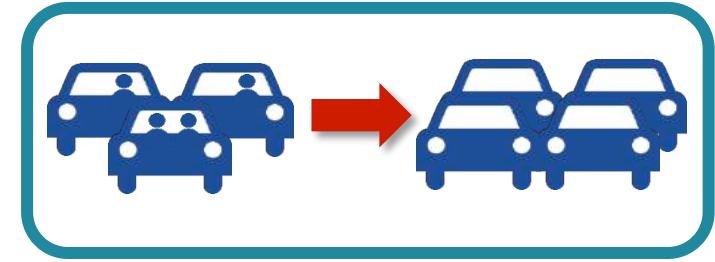
**Parking:** reduced need for parking.

-  AVs can park closer together and let each other out.
-  AVs can circle the block or drive home.

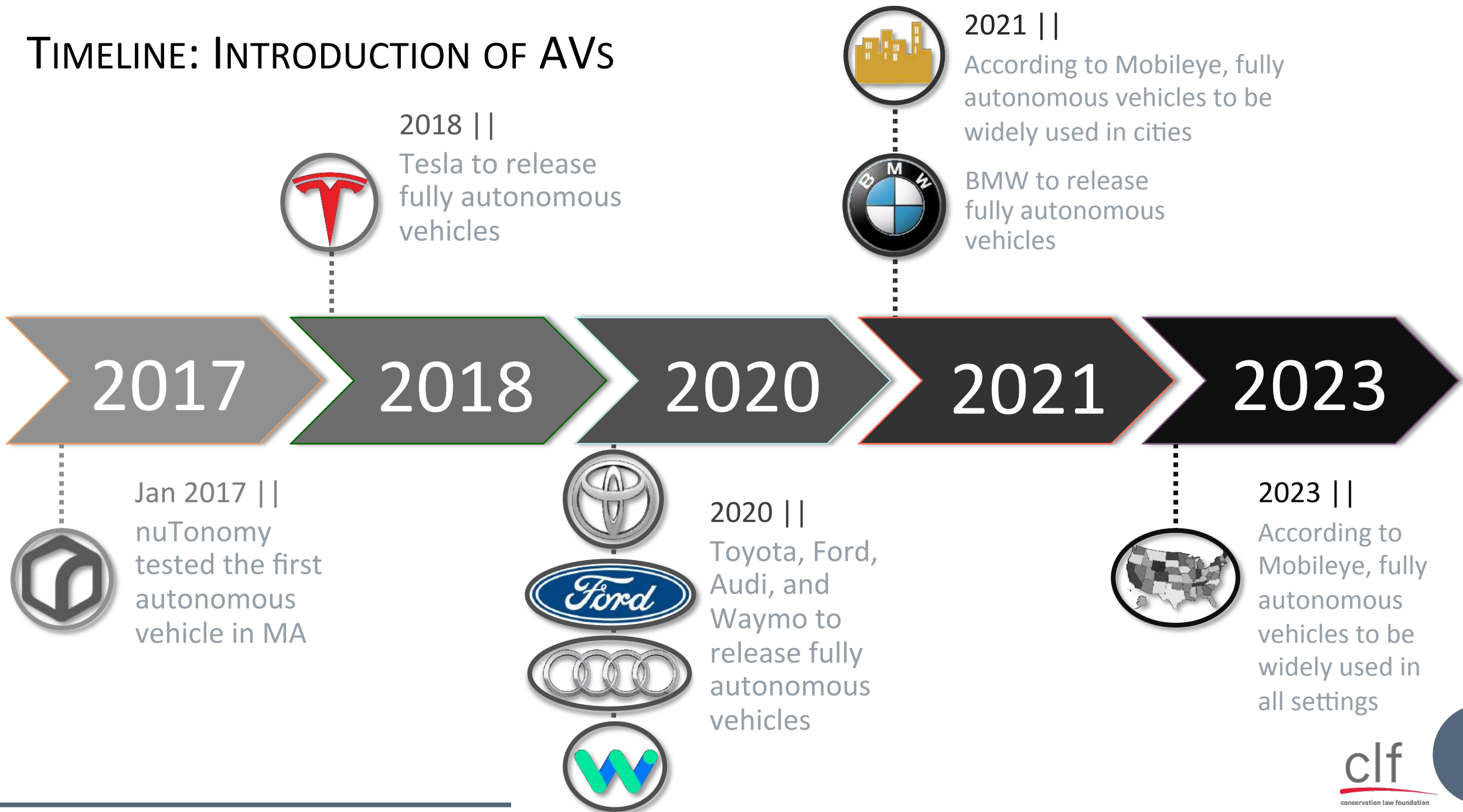
**Zero-Emissions Vehicles:** introduction of electric AVs.

-  MA Goal: 300,000 vehicles by 2030
-  Currently: 11,000 ZEVs

**Sharing:** introduction of ride-sharing (v. ride-hailing).



# TIMELINE: INTRODUCTION OF AVs





# PROJECTED IMPACT: AVs AND MUNICIPAL REVENUE SOURCES

**Overall:** Parking revenue will decline.

**Urban:** Short-term loss; long-term balance

- 🚗 Major sources of motor vehicle-related revenue are street parking and parking fines (52 to 60%).
- 🚗 Boston and nearby cities will see significant decline (e.g., \$35M or 27% of motor vehicle-related revenue in Boston at 20% market penetration).
- 🚗 After high penetration of AVs, opportunities for increase in property taxes because fewer parking garages will be needed.

**Rural/Suburban:** Less impact expected, because parking revenue is small (3% to 15%) compared to urban municipalities.





# PROJECTED IMPACT: AVs AND MUNICIPAL REVENUE SOURCES

**Overall:** Excise tax largely dependent on private ownership rate.

- ↑ AVs will be more expensive in the beginning (but this impact will largely disappear as additional costs of technology decline).
- ↓ If more AVs are used in ride-sharing (but would be balanced out partially due to larger turnover of vehicles).
- ↑ If more AVs are owned privately or used for ride-hailing (could impact different municipalities differently).

**Urban:** Excise tax is smaller source of motor vehicle-related revenue (40% to 48%), but greater expectation that AVs will be used in ride-sharing.

**Rural/Suburban:** Excise tax is larger source of motor vehicle funding (84% to 97%), but may not see large decline in excise tax, because private ownership of AVs more likely.










# PROJECTED IMPACT: AVs AND STATE REVENUE SOURCES




## Fuels Tax:

-  Will be slightly higher as a result of increase in VMT (at 20% market penetration).
-  Significantly increased (at 100%), unless there is significant ride-sharing.
-  If fleet is electric, fuels tax will decrease (at 20%) and plummet (at 100%).



## MV Sales Tax:

-  Pulled up due to higher cost (private ownership)
-  Pulled down due to reduction in vehicles (ride-sharing), but larger turn over mitigates or makes up for it.



## Tolls:

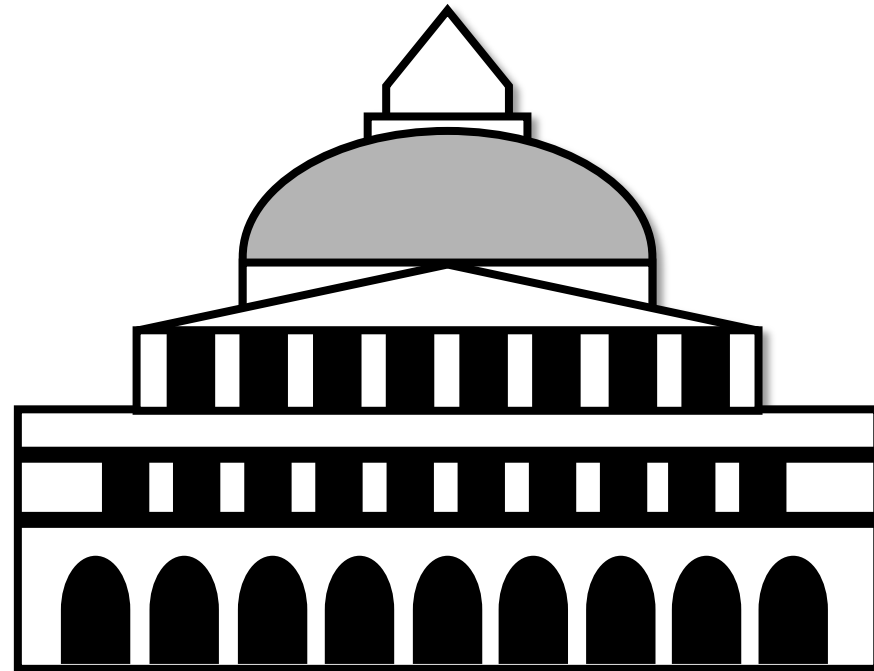
-  Increase due to higher VMT (at 20%).
-  Large increase (at 100%).
-  Small increase for ride-sharing.

## RMV fees:

-  Increase (private ownership).
-  Decrease (ride-sharing).

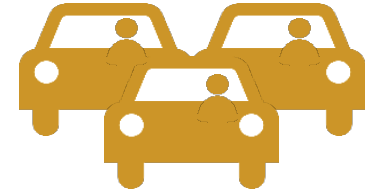
## Moving violations:

-  Significant decrease (at 20%).
-  Elimination (at 100%).



# PROJECTED ECONOMIC IMPACTS: THE COSTS AND BENEFITS OF AVs

**Congestion:** Increased traffic will cost consumers, businesses, and government between \$375M to \$750M (at 20%) annually and \$3.7B/year (at 100%).



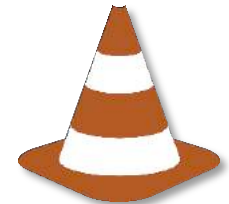
**Greenhouse Gases:** In the short term, GHG will cost an estimated \$28M annually. In the longer term an increase in GHG will cost about \$113M per year.



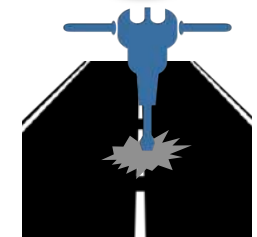
**Air Pollution:** Another \$30M/year can be expected in the short term from air pollution and \$144M/year at 100% market penetration.



**Safety:** \$660M annual (at 20%) and \$3.3B (at 100%)






**Road Maintenance:** \$10 to \$42M at 100%.








## LESSONS LEARNED

-  **No tradeoff necessary** between different economic impacts (e.g., can improve safety, traffic, and GHG at the same time).
-  Tradeoff between **negative fiscal** and **positive economic impacts** can be avoided (e.g., replace gas tax and reap benefits from electric vehicles).
-  AV analyses need to keep benefits of self-driving technology separate from **independent improvements in automobile technology** (e.g., fuel economy, electric vehicles, sharing, and safety).









## MORE LESSONS LEARNED

-  Huge difference in fiscal and economic impacts between **ride-hailing** and **ride sharing**.
-  An increase in VMT, continued use of the ICE and private ownership a **disastrous combination** for air quality and GHG emissions.
-  **MBTA budget could take hit** if low-cost driving pulls riders who can afford it away from the T, leaving behind those who cannot.





## POLICY RECOMMENDATIONS

-  **Limits on Zero-Occupancy Vehicles:** Restrict distance zombie vehicles can travel.
-  **Zero-Emissions Vehicles:** Incentivize electric vehicles.
-  **Real Sharing:** Providing incentives for ride-sharing (over ride-hailing and private ownership).
-  **Replacing the Gas Tax:** introduce mileage-based fees.
-  **Bridge for Parking Revenue:** cities need to replace parking revenue in short term.
-  **Job training:** large-scale programs to retrain drivers.



"SLOW DOWN! STOP TAIL-GATING! @\*!# SELF-DRIVING CAR!"

## Rafael Mares

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For a thriving New England



# Fast Forward 2017:

## Self Driving Cars in Our Communities

*Autonomous Vehicle Policy Implications on the  
Local, Regional, and National Level*

**Monday, December 4<sup>th</sup>, 2017**

**Chris Dempsey**  
Transportation for Massachusetts



# Municipal, Statewide, and Federal



**All three levels of Government play an important role.**



# Municipal Level Policy

- Cities and towns control 89% of road miles in MA
- A handful of municipalities – led by Boston – have begun adopting policies and pilots for Autonomous Vehicles
- AVs will require changes to roads, but also to zoning codes and land use.
- It is important for municipal leaders to begin thinking about these impacts on their communities.



# State Level Policy - Legislation

- Legislators filed six diverse bills regulating AVs. The bills were heard in April by the Joint Committee on Transportation and await further action.
- The bills cover a variety of issues such as:
  - Testing
  - General use
  - Liability/Insurance
  - Compliance with motor vehicle standards and regulations
  - Road usage charges
  - Data
  - Privacy
  - Limits on “zombie” vehicles
  - Electric vehicle incentives
  - Restrictions to legacy motor vehicle manufacturers
  - Requirement of an operator for autonomous trucks and buses



# State Level Policy – AV Working Group

- The Baker Administration created an AV Working Group via Executive Order 572 that meets monthly.
- Charged with convening experts, advising state government on guidance and regulations, and encouraging development of the automation sector in MA.
- Members include representatives of MassDOT, the Executive Office for Housing and Economic Development, the Executive Office for Public Safety and Security, legislators, and others.
- <https://www.mass.gov/orgs/autonomous-vehicles-working-group-massdot>



# Federal Policy on AVs – Voluntary Guidance

- National Highway Traffic Safety Administration (NHTSA) **voluntary** guidelines: *Automated Driving Systems (ADS): A Vision for Safety 2.0* released in September, 2017.
  - Focuses on levels 3 to 5.
  - Generally industry friendly.
  - Includes recommended best practices for state policies.





# Federal Policy on AVs – Pending Legislation

- SELF DRIVE Act passed the House by voice vote on September 6
- AV START bill moving through Senate – next step is full Senate vote
- Bills are generally favorable to the auto industry and reserve regulation to Federal government.
- The process has been criticized by Transportation for America, National Association of City Transportation Officials, etc. Stakeholders have not been adequately involved.
- Two changes advocates want:
  - Pre-emption language on “performance” regulations
  - Data sharing



# Thank You!

## Q & A

**Chris Dempsey**  
Transportation for Massachusetts

