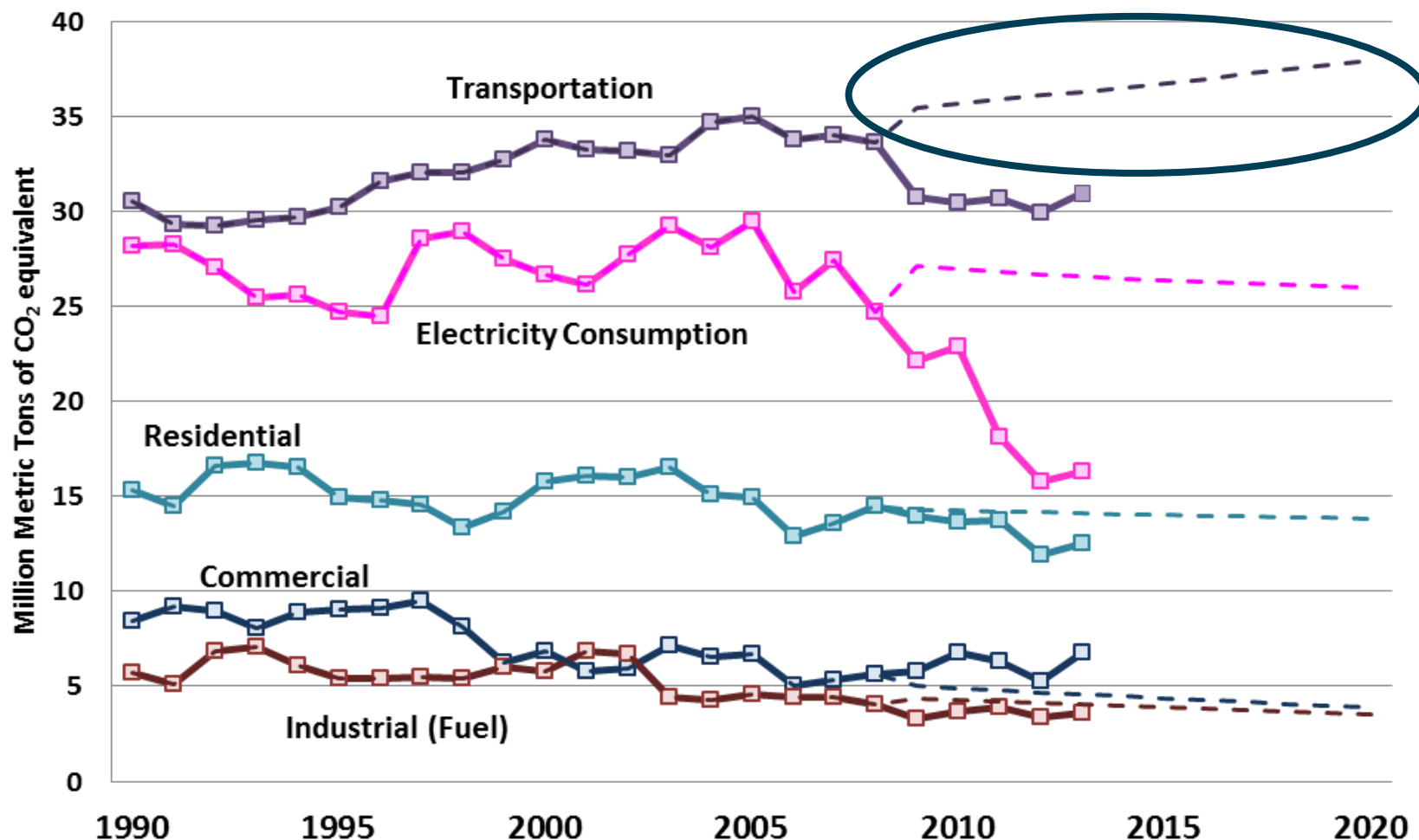




Decarbonizing Transportation: Challenges and Opportunities

New England Electric Restructuring Roundtable
June 15, 2018
Stephanie Pollack, MassDOT Secretary and CEO

We can't tackle climate change in Massachusetts without addressing transportation



Source: MassDEP's Statewide GHG Emissions Baseline and Projection



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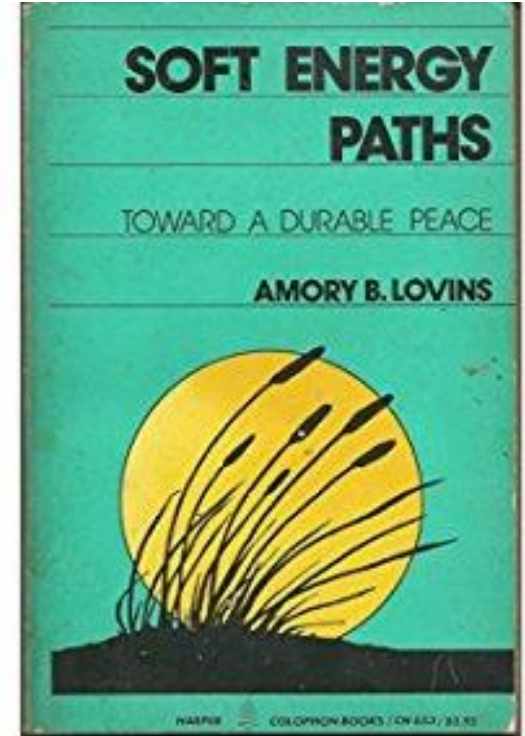
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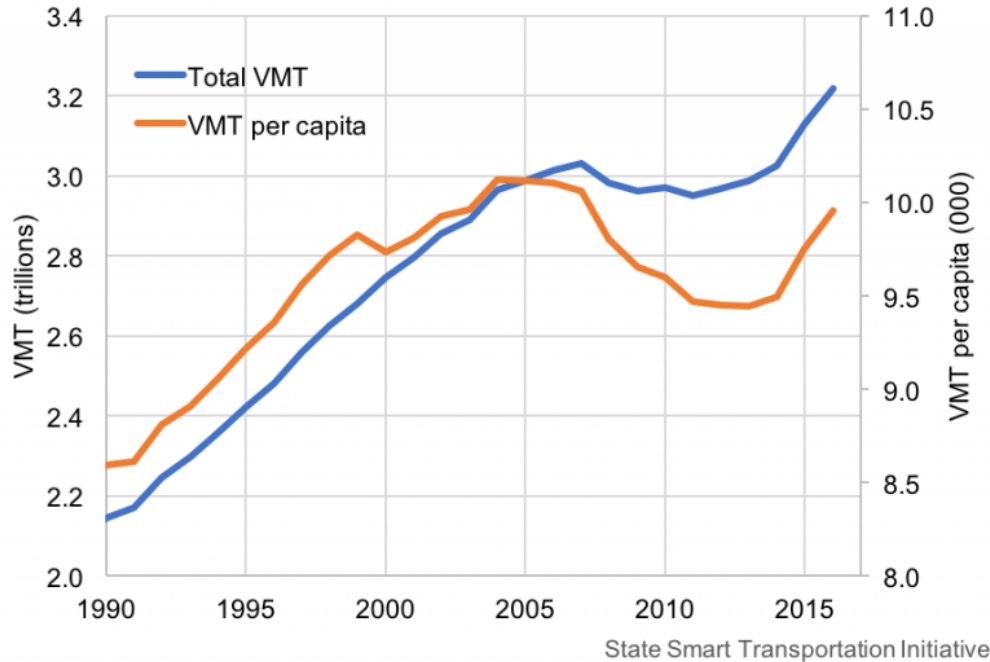
When it comes to GHGs, transportation is not the same as the electricity sector

“How much energy we use to accomplish our social goals could instead be considered a measure less of our success than of our failure - just as the amount of traffic we must endure to get where we want to go is a measure not of well-being but rather of our failure to establish a rational settlement pattern. ... [M]uch of our prized personal mobility is really involuntary traffic made necessary by the settlement patterns that cars create. Is that traffic a cost or a benefit?”

Amory Lovins

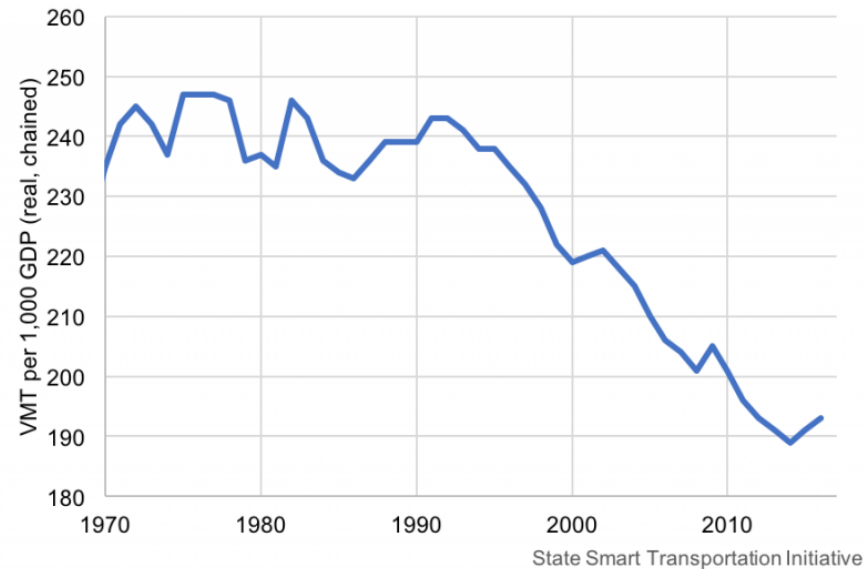


Vehicle Miles Travelled remains a measure of utility – although decoupling is well underway



**Vehicle Miles Travelled (VMT)
and VMT Per Capita Trends**

Vehicle Miles Travelled Per Unit of Gross Domestic Product



Some important context for addressing transportation GHG

- Transportation disruption – with regard to both technology and business models – is underway and will accelerate
- Electrified vehicles that can meet operational needs are not yet available for a wide range of important types of transportation vehicles
- Strategies that increase the cost of transportation for people living in places with no real option but to drive simply punish people and will not change travel behavior or reduce GHGs
- Reliable transit services can reduce GHG emissions both by providing alternatives to driving and by influencing land use through transit-oriented development
- The easiest trips to de-carbonize are short trips that can be made by walking or bicycling



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Transportation Disruption



Revolution?

“We are on the cusp of one of the fastest, deepest, most consequential disruptions of transportation in history.”



Change is here now

MOBILITY AS A SERVICE

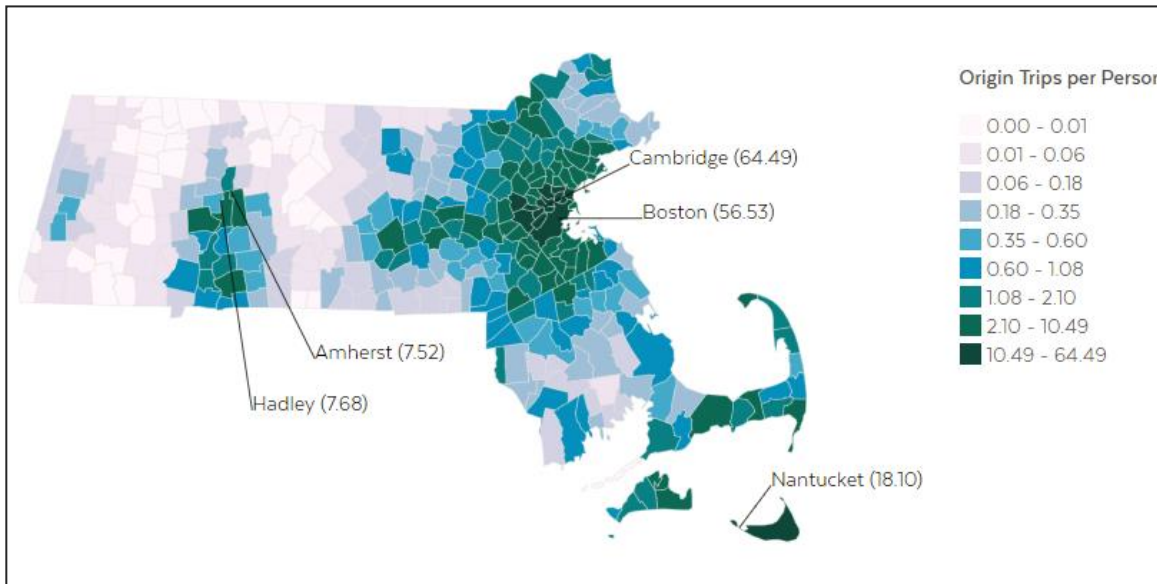
AUTONOMY



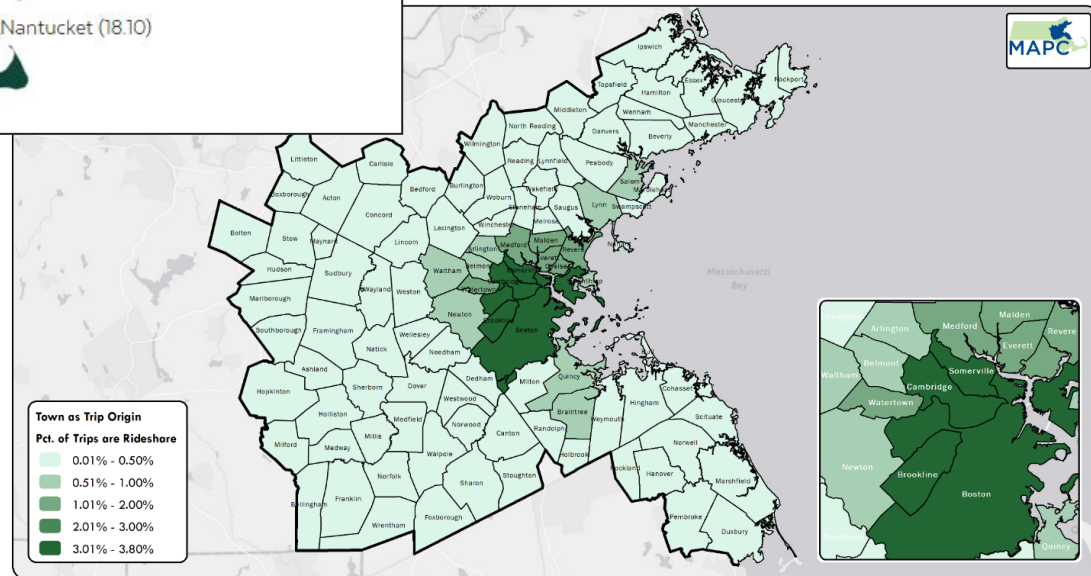
ELECTRIFICATION



Two challenges: Geography and scale



Will fleets of autonomous, electrified rideshare vehicles be able to serve the needs of less urbanized parts of Massachusetts?



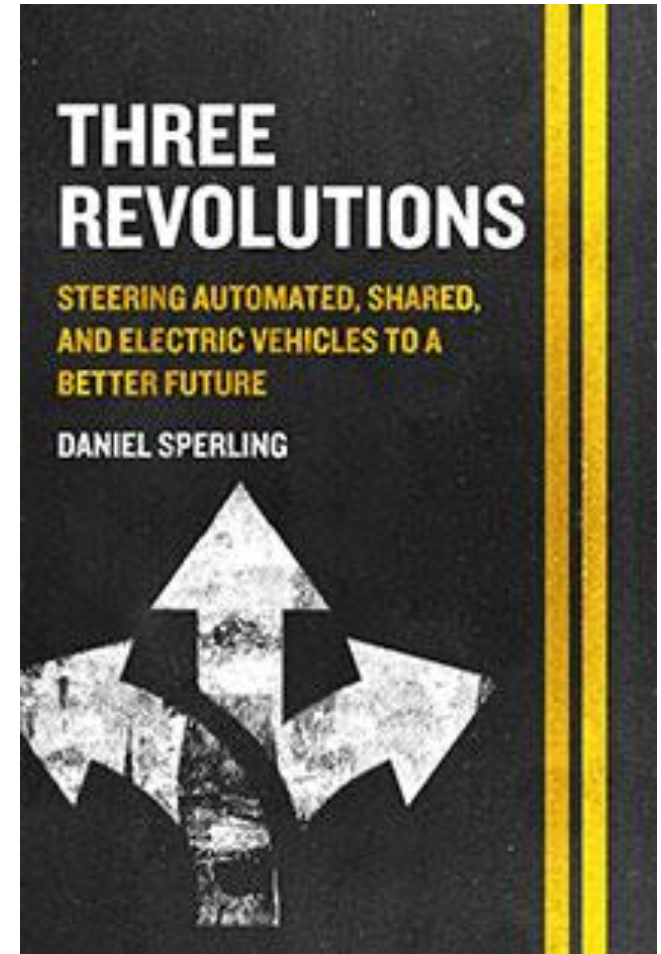
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We have to shape our future

“Over the past half century, transportation has barely changed. ... But change is afoot, finally. ...

We now have the potential to transform how we get around—to create a dream transportation system of shared, electric, automated vehicles that provides access for everyone and eliminates traffic congestion at far less cost than our current system. Or not. It could go awry. It could turn out to be a nightmare.”



Disruption: What We are Doing

- Electrification (more on that next)
- Autonomous Vehicles:
 - Executive Order 572 enables testing and creates Working Group
- Mobility as a Service: Enacted and implementing statewide transportation network company legislation
- Commission on the Future of Transportation in the Commonwealth

Commission on the Future of Transportation in the Commonwealth

- Executive Order 529 signed by Governor Charlie Baker on January 23, 2018
 - Final work product due on December 1, 2018
- Three part framework established by Commission
 - Focus on facts and trends
 - Develop plausible scenarios for 20+ years from now
 - Provide guidelines and recommendations to the Governor, Lt. Governor and other decisionmakers



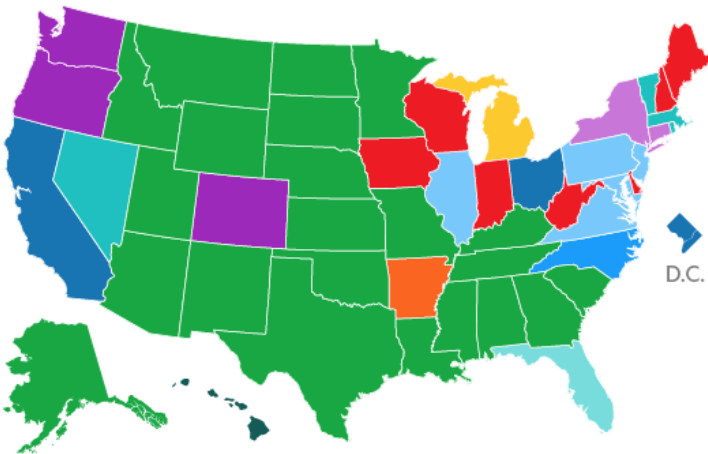
Electrification and Its Limits



Electrifying light duty passenger vehicles will not be enough given consumer demand

MOST POPULAR VEHICLES

Top vehicles sold in each state based on new car registrations in 2016.



SOURCE Kelley Blue Book



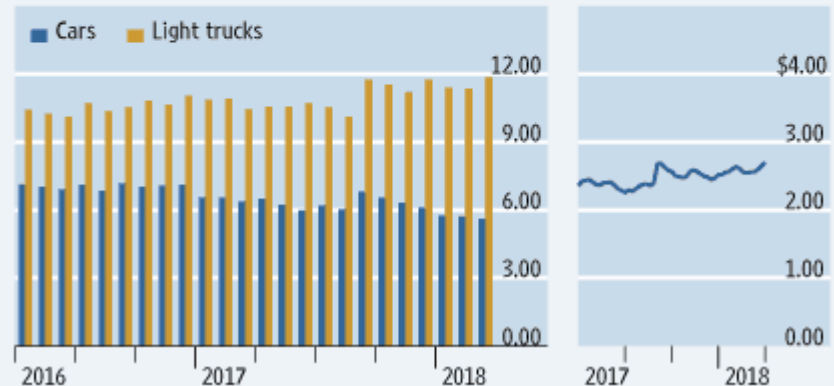
What's Moving: U.S. Auto Sales

Kicking the tires

Sales of cars and light trucks in the U.S. retail market; in millions of units at seasonally adjusted annual rate.

At the pump

Unleaded gasoline, average weekly retail price per gallon



Source: Wall Street Journal

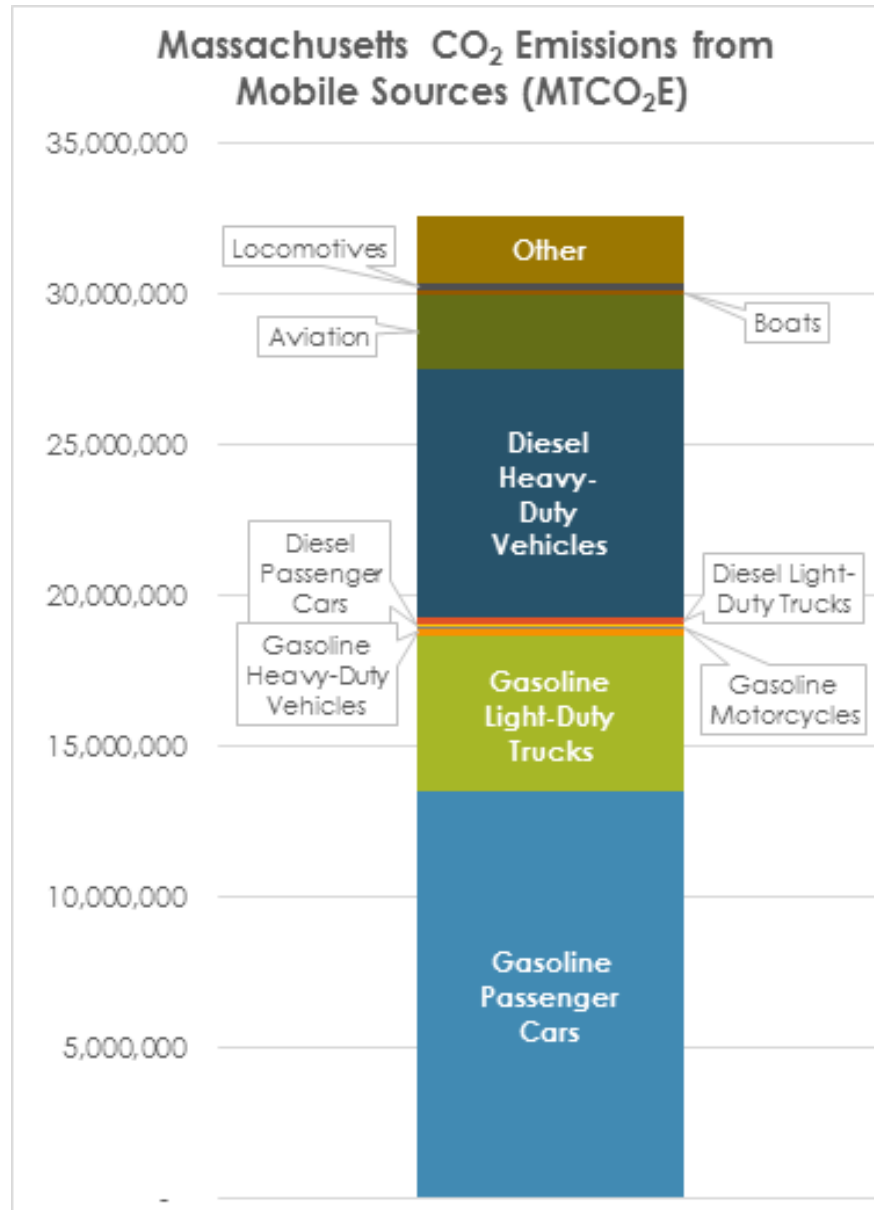


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Transportation is much more than gasoline passenger cars



- Less than half of transportation GHG emissions in Massachusetts are from gasoline passenger cars
- Many vehicle categories currently do not have cost, performance and range comparable battery electric versions available and it is not clear that production will be available at scale any time soon



Electric buses? The MBTA has working toward a lower emission bus fleet BUT

2000: First Compressed Natural Gas Bus

2004: Electric Trolley Bus (ETB) Fleet

2004: Dual Mode Articulated (DMA)- Silver Line Fleet

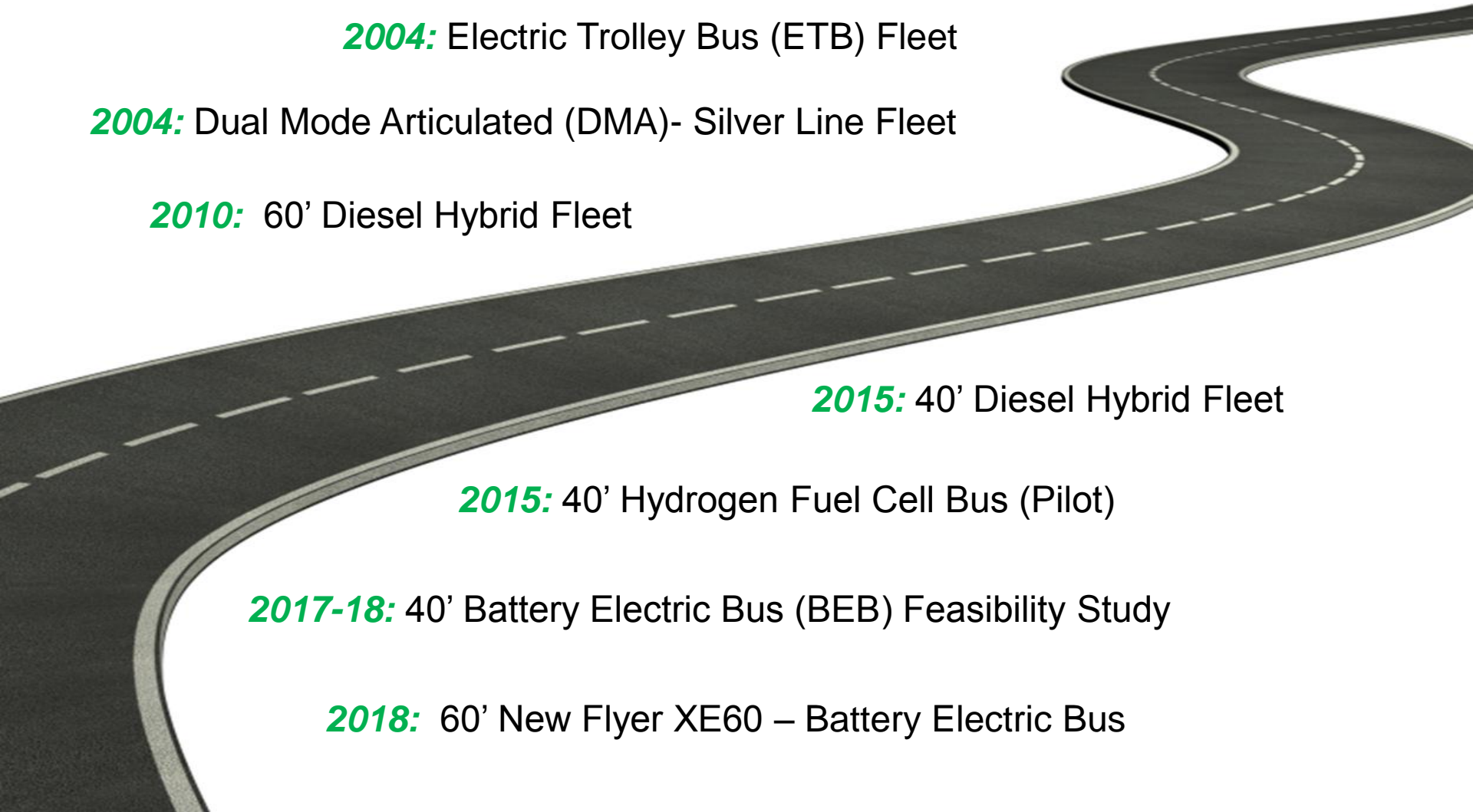
2010: 60' Diesel Hybrid Fleet

2015: 40' Diesel Hybrid Fleet

2015: 40' Hydrogen Fuel Cell Bus (Pilot)

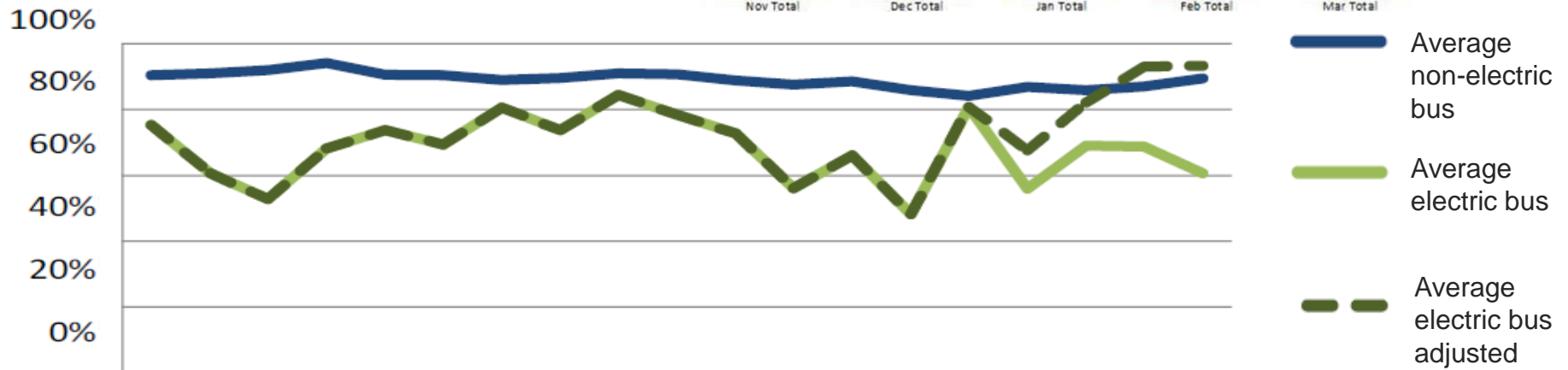
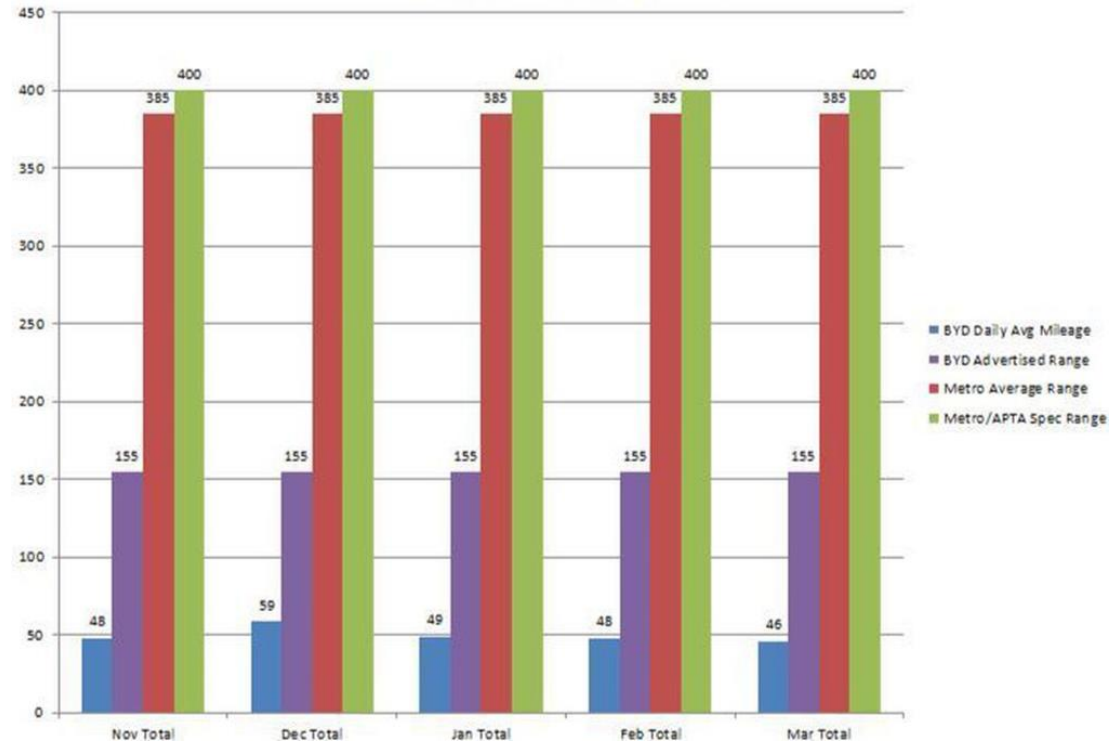
2017-18: 40' Battery Electric Bus (BEB) Feasibility Study

2018: 60' New Flyer XE60 – Battery Electric Bus



Electric bus in-service performance needs to improve

Monthly average bus mileage (LA Metro)



Bus availability (Worcester Regional Transit Authority)



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Electrification: What We are Doing

- Working with Executive Office of Environmental Affairs on achieving EV target (300,000 by 2025)
 - Installing charging stations at rest areas
- Procuring and comparing in-service performance of electric buses from all 3 current manufacturers
- Studying electrification of the commuter rail system as part of *Commuter Rail Vision* study



Agency	Number of battery electric buses	Details
WRTA	6	WRTA began running Proterra fast charge buses in 2013 with the help of an FTA Clean Fuels grant
PVTA	3	PVTA deployed 3 Proterra Catalyst fast charge buses in 2016, with state and federal funds. They have two fast chargers and one slow charger.
MBTA	5 (delivered 2018)	Won a Low No grant in 2015 to procure five 60' battery electric buses for the Silver Line from New Flyer.
VTA	4 (delivered 2018)	Won a Low No grant in 2017 to procure first electric buses from BYD.

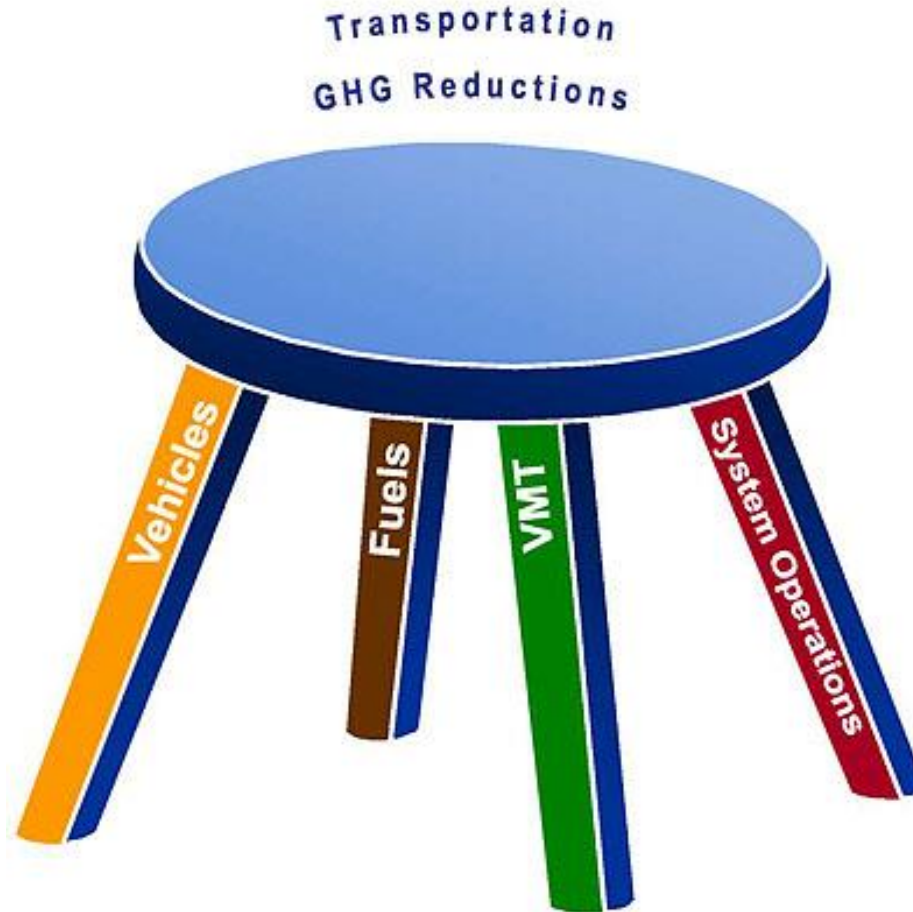


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Better Travel Options



We need a multi-pronged strategy

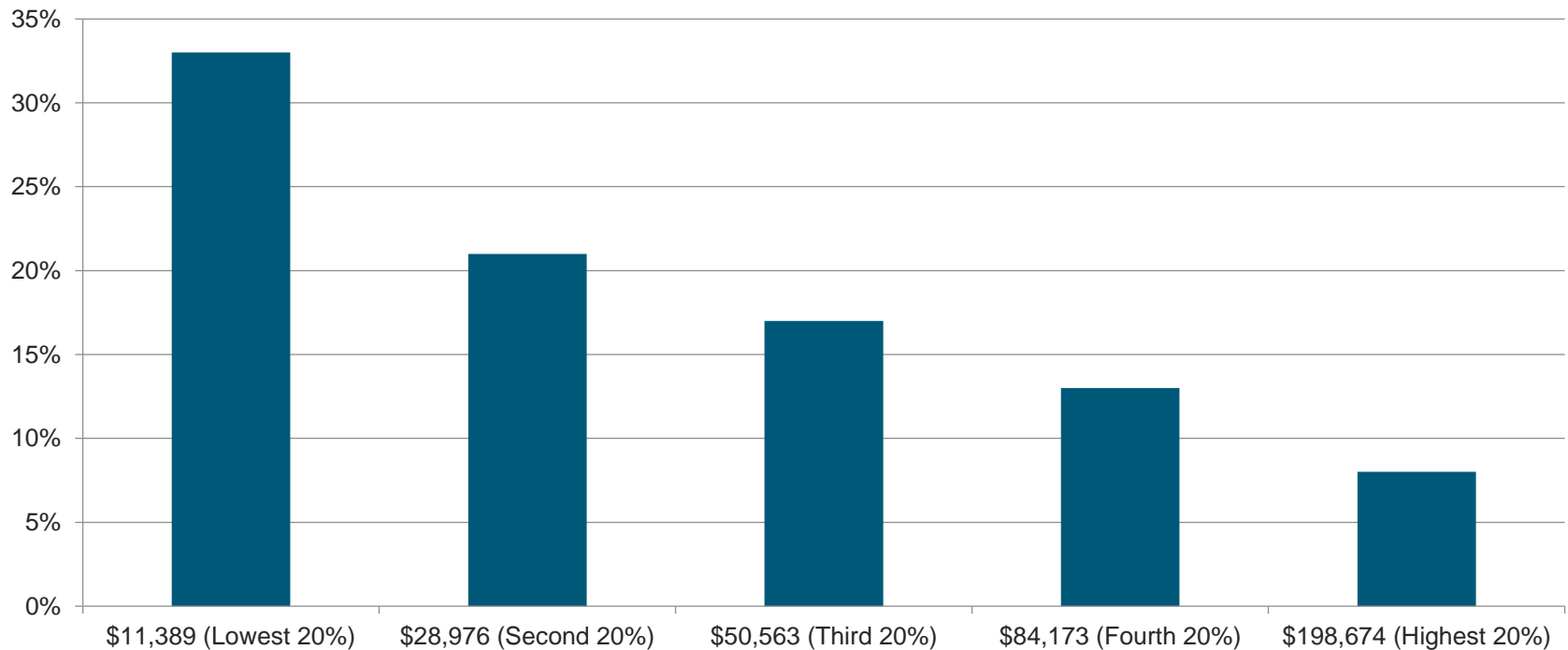


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Policies need to address economic equity

Percentage of annual household income spent on transportation by quintile (US households 2016)



U.S. Bureau of Labor Statistics

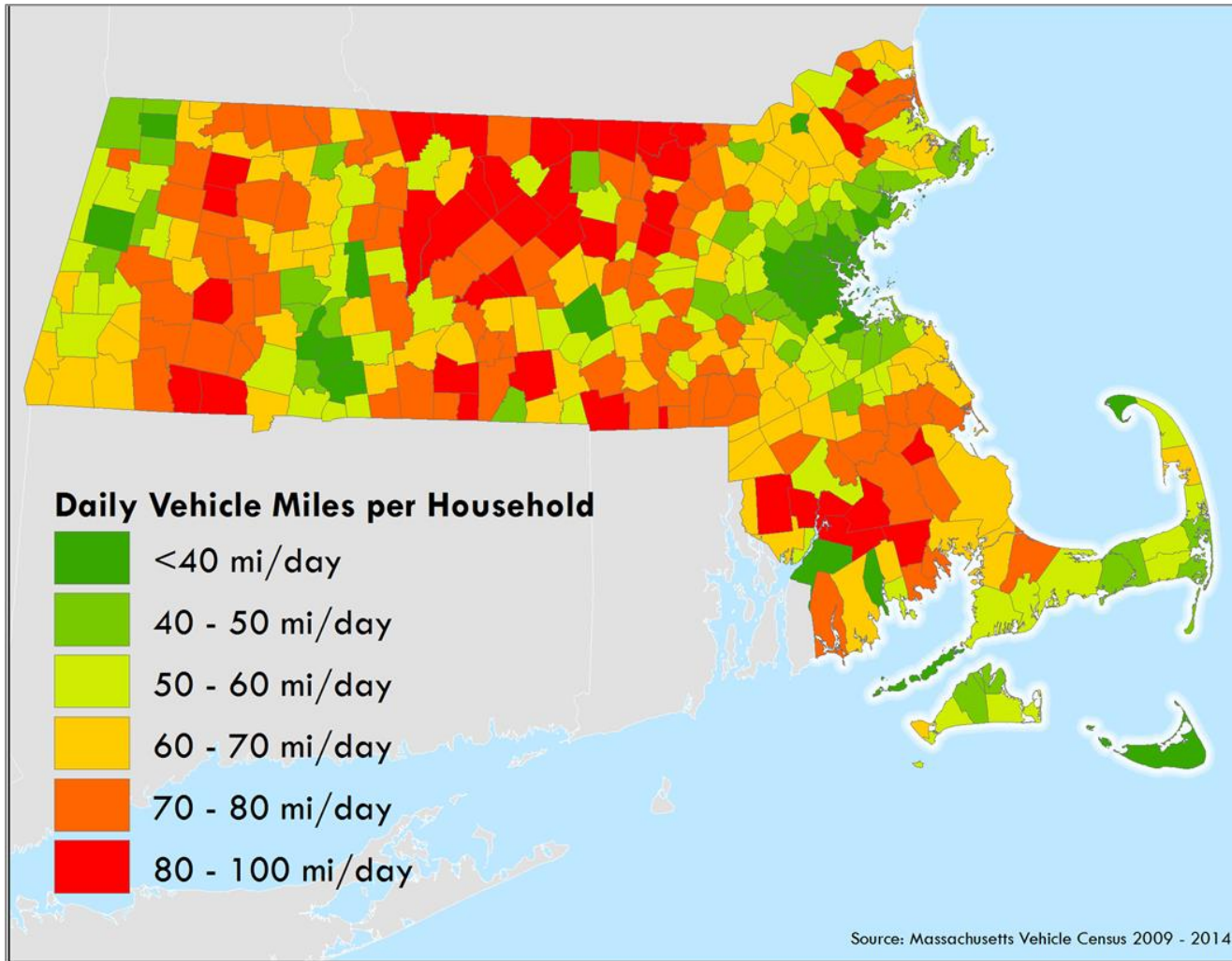


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Policies need to address geographic equity

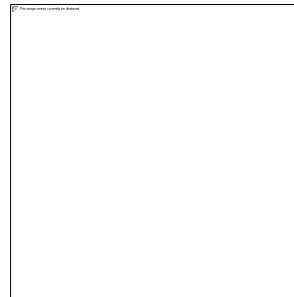


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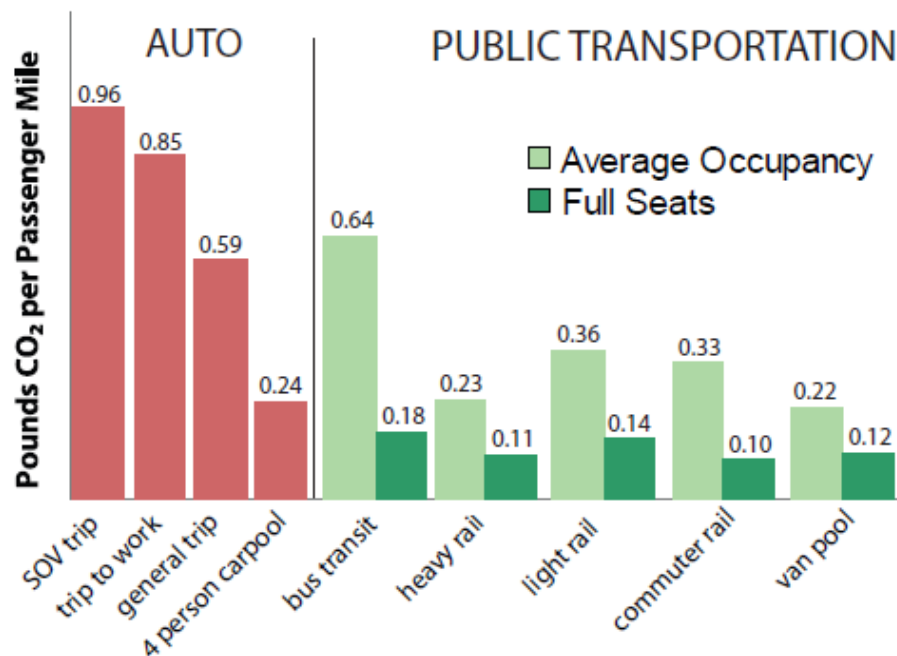
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Transit and Transit Oriented Development

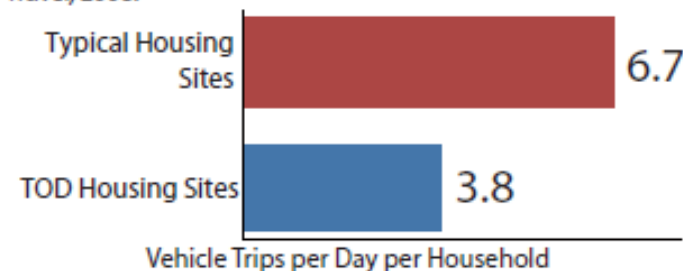


Transit and Transit-Oriented Development are important strategies for reducing GHGs



Vehicle Trips per Day of Transit Oriented Development (TOD) Housing Sites versus Typical Housing Sites

Source: TCRP 128: Effects of TOD on Housing, Parking and Travel, 2008.



Source: American Public Transportation Association

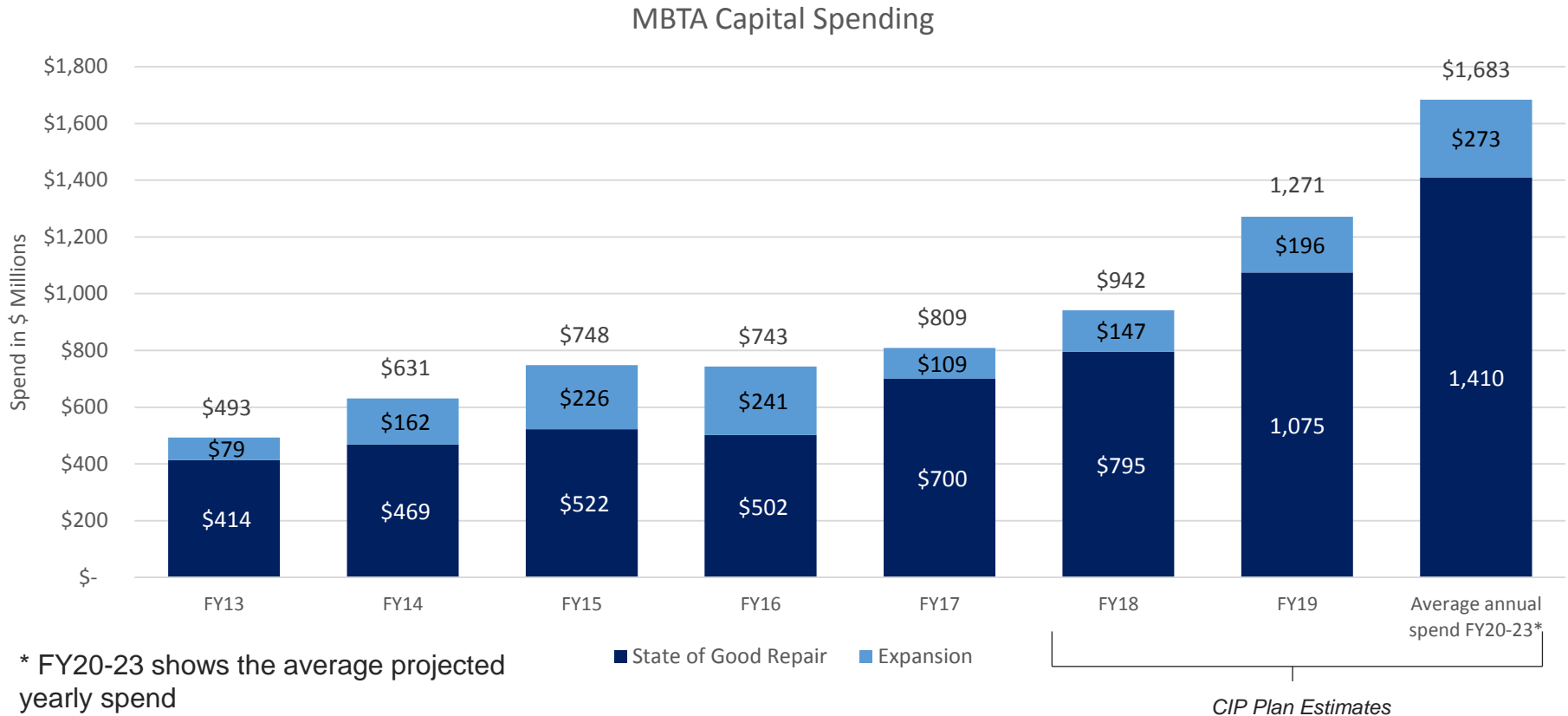


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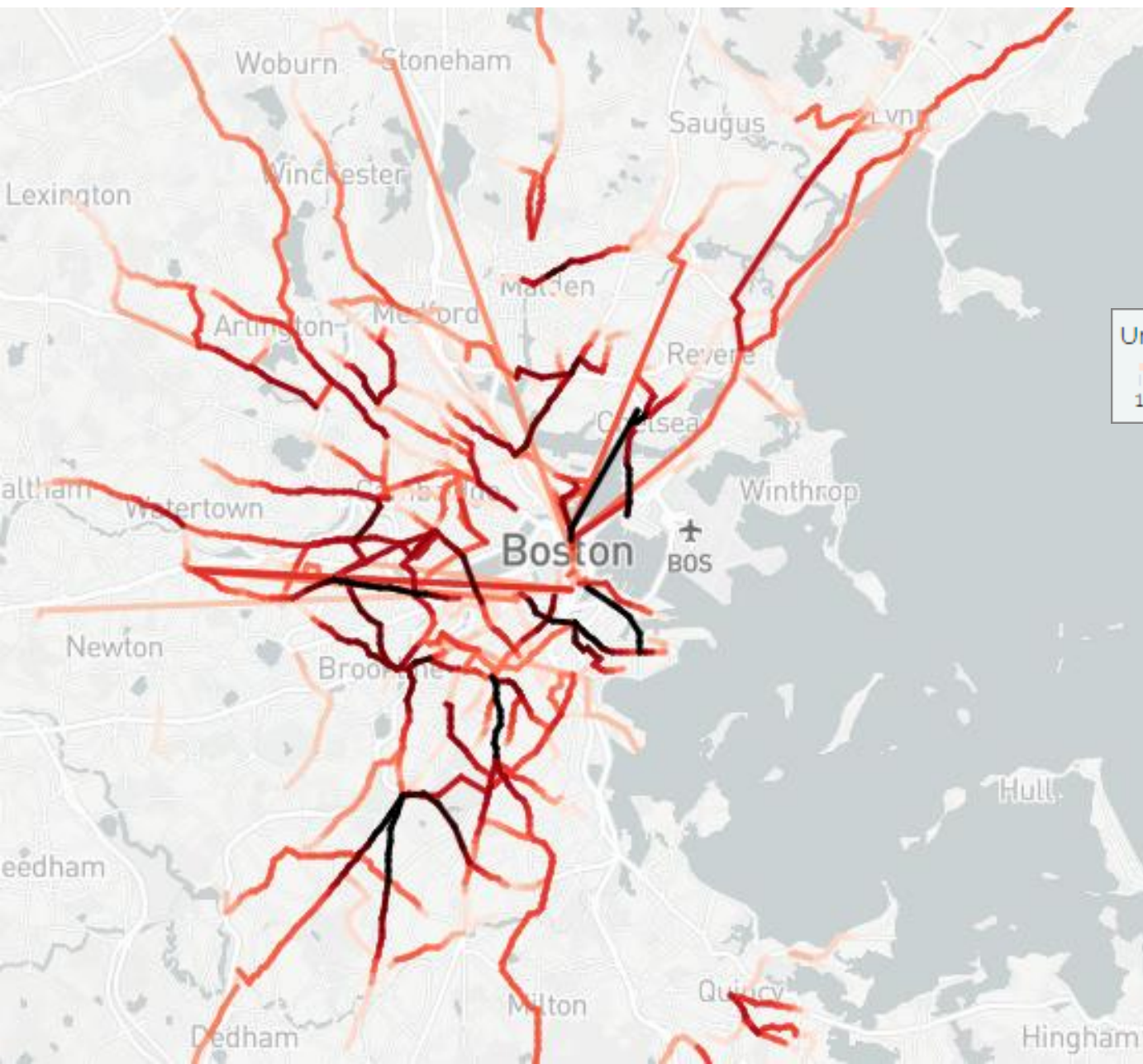
Fixing the MBTA: Investing in State of Good Repair (SGR) and Modernization



	SGR/Modernization Capital Spending	Total Capital Spending
FY13 -17	\$2.6 billion	\$3.4 billion
FY19-23	\$6.7 billion	\$8.0 billion



Fixing the MBTA: Making buses work



This map shows how many passengers experience crowding on inbound trips, totaled across all bus routes that use each street.



Long straight lines represent express buses that use highways without stopping.

Data reflects an average weekday in Fall 2015. Routes SL1, SL2, SLW, 71, and some Limited Service routes are excluded due to insufficient data.

Transit and TOD: What We are Doing

- Fixing the MBTA
 - Fiscal and Management Control Board
 - More than doubling capital spending
 - Comprehensive bus service planning
 - Capacity and ridership goals
 - Service quality standards
- Transit-Oriented Development policies adopted by MassDOT and MBTA boards
- Focus40 plan for 2040



How would you allocate investment among these categories?



Note: Results are the average percentage allocated for each category and may not add up to 100%.



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Walking and Biking



Walking and biking are important modes – for shorter trips

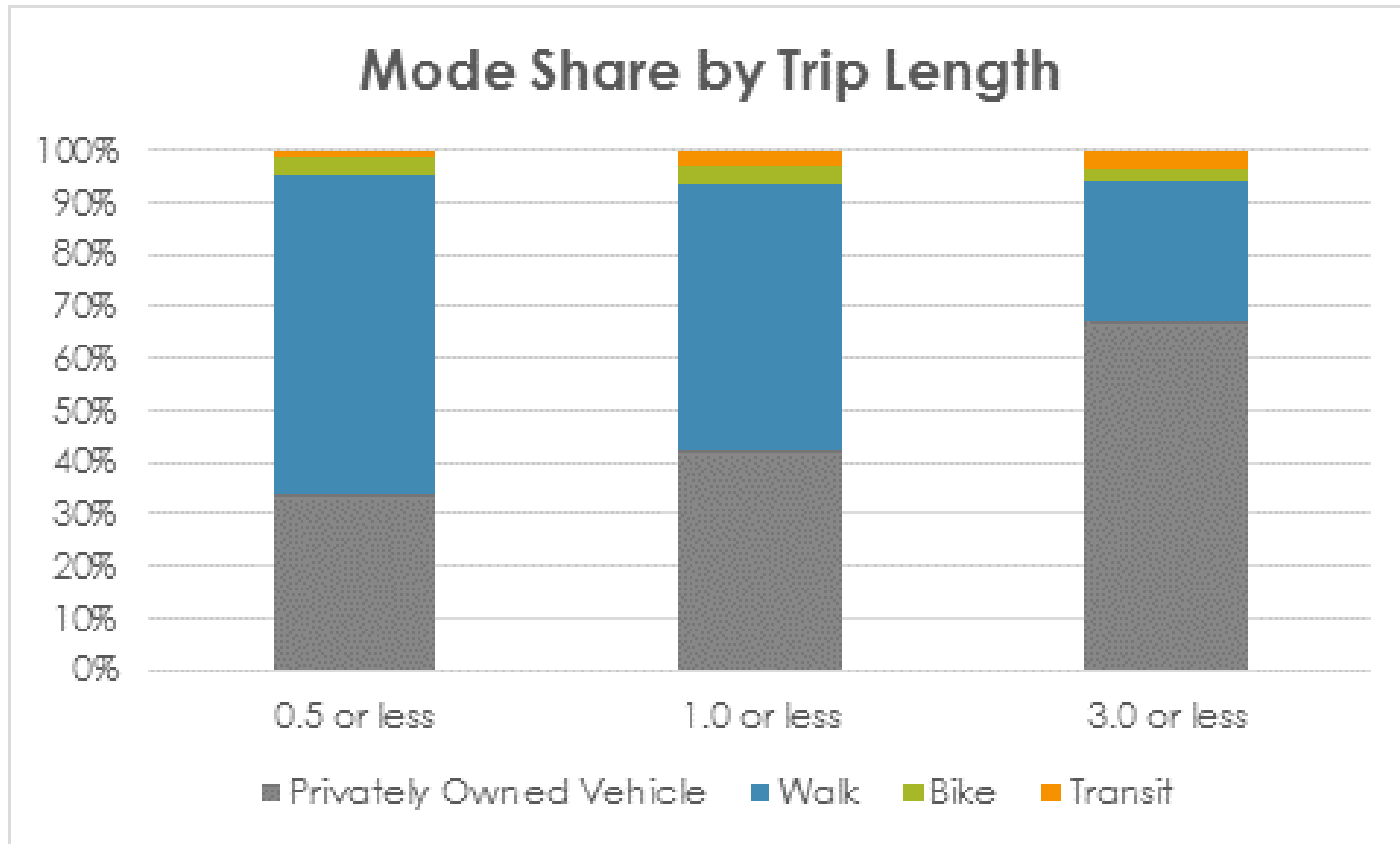
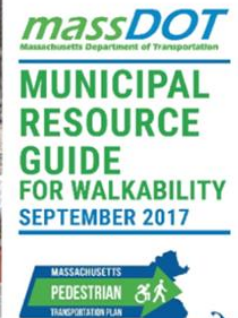
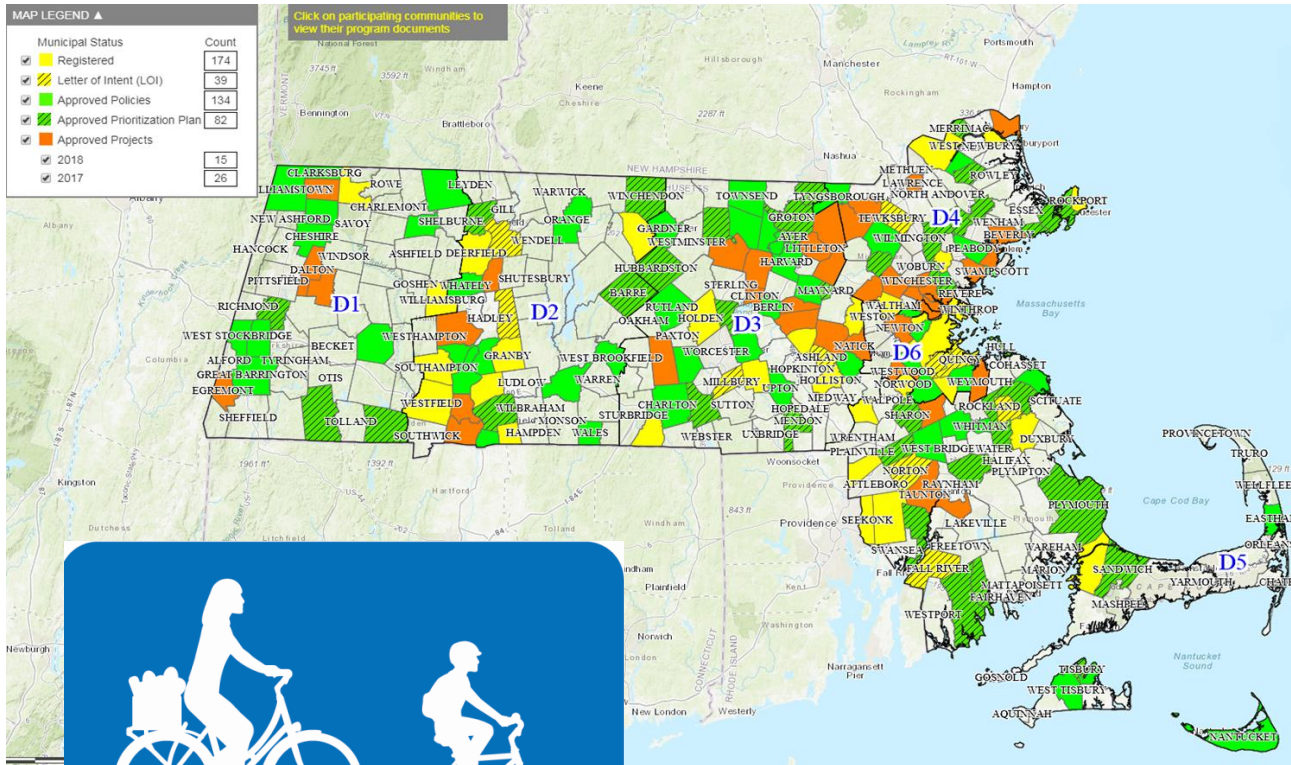


Chart based on data from Short and Sweet: Analysis of Shorter Trips Using National Personal Travel Survey Data
18 July 2017 Todd Litman Victoria Transport Policy Institute



Walking and Biking: What We Are Doing



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In summary...

The current reality is that	Therefore
Transportation disruption – with regard to both technology and business models – is underway and will accelerate	We need to adopt policies to harness and shape the future of autonomous vehicles and mobility as a service
Electrified vehicles that can meet operational needs are not yet available for a wide range of important types of transportation vehicles	While electrification is a critically important strategy, electrification cannot be the sole strategy for addressing near- and mid-term transportation sector greenhouse gas emissions
Strategies that increase the cost of transportation for people living in places with no real option but to drive simply punish people and will not change travel behavior or reduce GHGs	We need to make walking, biking, transit and sustainable mobility realistic options for more Massachusetts residents and communities
Reliable transit services can reduce GHG emissions both by providing alternatives to driving and by influencing land use through transit-oriented development	We need to invest in reliable transit in the places where transit use is practically and financially sustainable and where transit-oriented development will be encouraged
The easiest trips to de-carbonize are short trips that can be made by walking or bicycling	We need to encourage land use that puts homes and jobs closer to each other and to other destinations and make walking and biking safer and more convenient

