Lead or Follow?
Keeping Massachusetts Competitive in Mobility Innovation

Ensuring Massachusetts leads as autonomy and new mobility technologies advance

MASS MOBILITY HUB

MACP COMPETITIVENESS CONVERSATION SERIES
CONVENE COLLABORATE CATALYZE

MA Secretary Eric Paley	Karl Iagnemma	Sidney McLaurin	Jane Lappin	John Moavenzadeh
Economic Development	Vecna Robotics	Fleet Robotics	Blue Door Strategy & Research	MIT Mobility Initiative

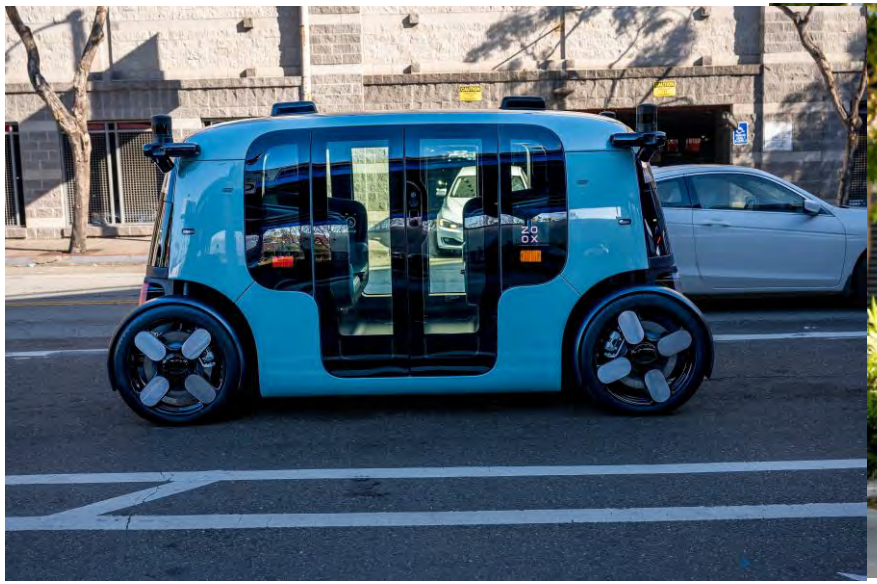
Thursday, February 5, 2026 | Networking: 9:30 —10 AM

Program: 10 —11:30 AM | UMass Club, Boston

RoboTaxi Reboot:
Costs and Benefits of Autonomous Mobility Systems

John Moavenzadeh
Executive Director, MIT Mobility Initiative

Lead or Follow: Keeping Massachusetts Competitive in Mobility Innovation
Feb 5, 2026 Boston




Autonomous Mobility Has Passed Through (Waves) of the Gartner Hype Cycle

Mobility Initiative

Amara's Law: ***We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.***

- Roy Amara, former President of the Institute for the Future

Oct 2022: Business Week Cover: Even After $100B, Self Driving Cars Are Going Nowhere

Oct 2023: Cruise drags pedestrian

AVs 2015-2017

2016: City Interested, Tech not Ready

AVs 2012

AVs 2022-2023

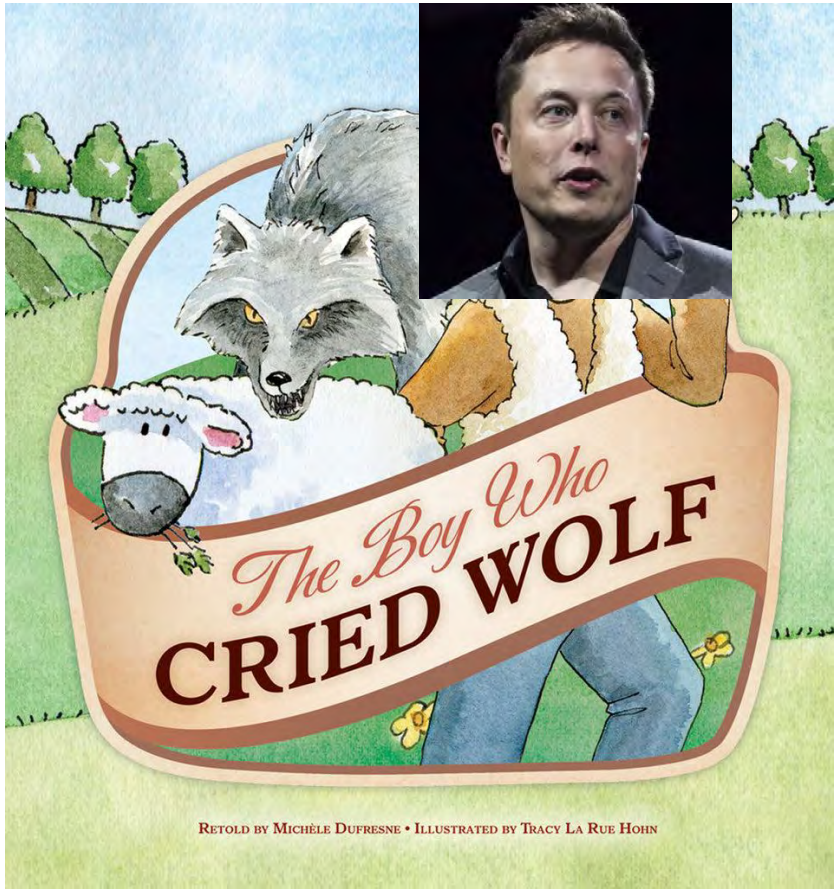
AVs 2025: City Interested Tech Mature

Expectations

Innovation Trigger | **Peak of Inflated Expectations** | **Trough of Disillusionment** | **Slope of Enlightenment** | **Plateau of Productivity**

Time

Elon Musk: “The Boy Who Cried FSD”



2015: Predicts Tesla cars would achieve "full autonomy" by 2018.

2016: States all Teslas would become robotaxis by 2020.

2019: States Tesla's Full Self-Driving (FSD) would be in an early access program by the end of that year, with full unsupervised driving the following year.

2021: Claims "over 1 million robo-taxis" by the end of the year.

July 2025: States that half of US population will have access to robotaxis by the end of the year.

https://mashable.com/article/elon-musk-failed-to-deliver-on-2025-promises and https://electrek.co/2025/07/23/elon-musk-with-straight-face-tesla-robotaxi-will-cover-half-us-population-end-year/ , https://electrek.co/2022/05/17/tesla-1-million-robotaxis-fsd-beta/

AV Policy: No Coherent Federal Policy, State by State Regulation

Mobility Initiative

"The U.S. Department of Transportation (USDOT) must assert its responsibility over the design, construction, and performance of autonomous vehicles and increase its efforts in key areas. AVIA also encourages Congress to act in critical areas and conduct oversight over USDOT's efforts"

- **Autonomous Vehicle Industry Association, Securing American Leadership in Autonomous Vehicles report, 2025**

The absence of a federal policy has led to a patchwork of state policies. As of 2025, half of US states have an AV policy and half do not. According to AVIA, the states with best regulatory environment for AVs are: Arizona, California, Florida, Georgia, Mississippi, Nevada, New Mexico, Oklahoma, Tennessee, Texas, Utah and Virginia.

Massachusetts, while an early leader in passing an Executive Order 572 to form an AV Working Group and to enable AV testing in October 2016, **does not have a policy** to allow autonomous vehicles on public roads without a safety operator.

Autonomous Vehicle Industry Association (AVIA) Securing American Leadership report, AVIA State of AV 2025 report, MA Executive Order 572 Oct 2016

Cities/States Are Haunted by RideHail and Shared Micromobility Chaos: Sore Issues are Control, Deadheading and Data

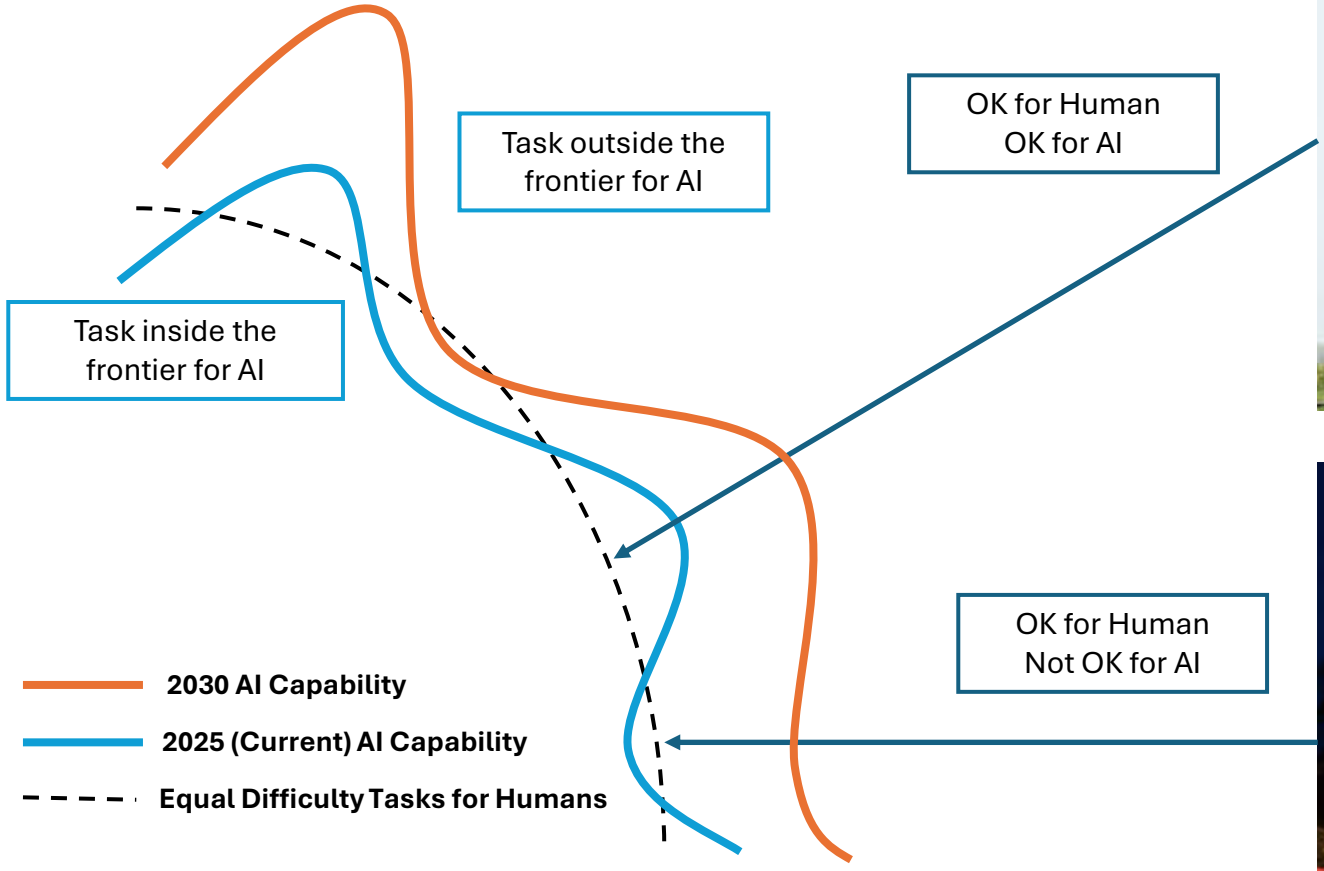
- Diffuse regulatory authority: In California, DMV handles AV permitting while CPUC handles commercial operations.
- Lack of local authority: City of San Francisco has little leverage to influence AV deployment.
- Increasing popular support for this new mobility option: As more people experience Waymo, public support grows.

Technology: Driving is Easy When It's Easy, and Hard When It's Hard

Source: Raquel Urtasun, Waabi

The Jagged Frontier Advances:
AI Has Driven Progress in Autonomous Mobility Systems

Mobility Initiative



OK for Human
OK for AI

OK for Human
Not OK for AI

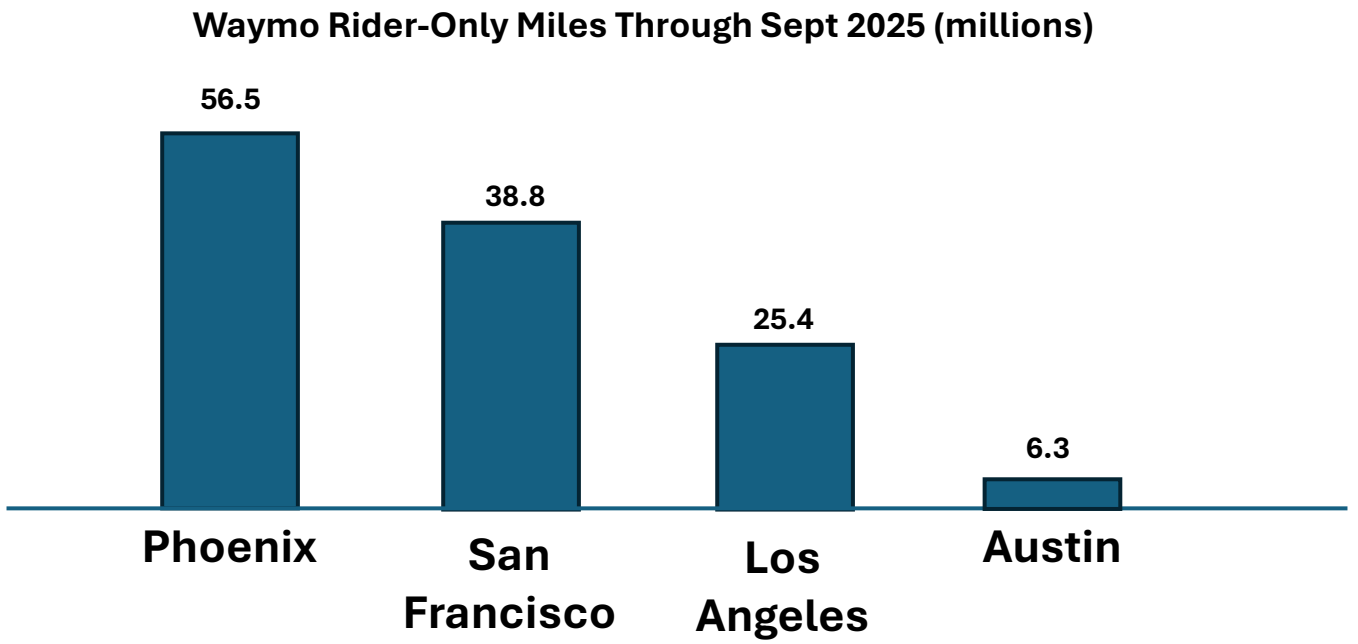
Source: MIT, Kearney, HBS, Epoch AI,

An Update on Waymo: Feb 2, 2026

Additional $16B in funding bringing valuation to $126B (GM = $80B, Ford = $55B)

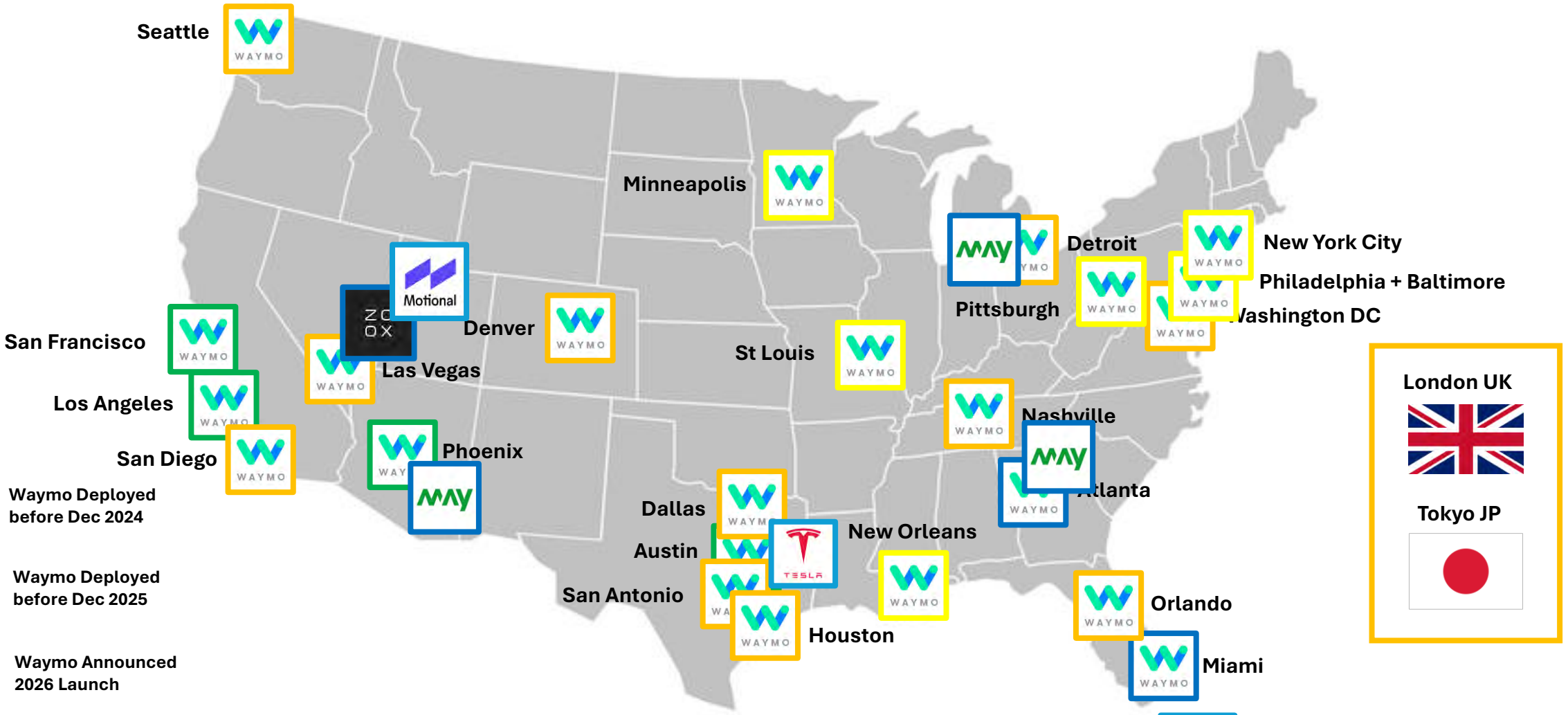
2025 data: 15 million rides (3x 2024) accounting for 127 million miles of fully driverless service across Phoenix, SF, LA, Austin, Atlanta, Miami

2026 expansion to 20+ cities with goal to increase from current 400k rides per week to 1M rides per week



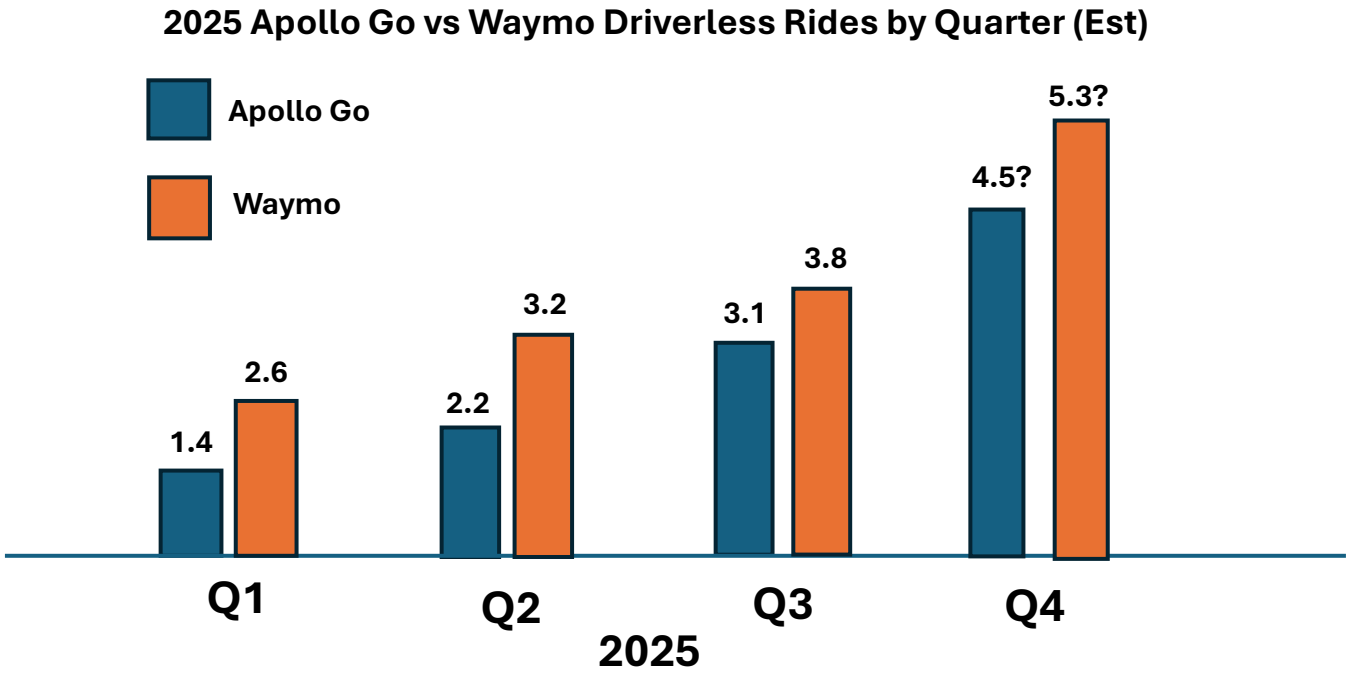
Source: https://waymo.com/blog/2026/02/waymo-raises-usd16-billion-investment-round

Commercial, Driverless Robotaxi Deployments Are Proliferating



China Is Catching Up (Passing?) US Autonomous Deployment

Three Major Players: Baidu (“the Chinese Google”), WeRide and Pony.ai (Toyota investment)



https://www.techbuzz.ai/articles/baidu-matches-waymo-s-250k-weekly-robotaxi-rides-in-china-push, https://www.media-outreach.com/news/china/2025/03/19/368993/apollo-go-and-waymo-lead-the-way-scaling-up-ai-powered-autonomous-ride-hailing-services/

China: Commercial, Driverless Robotaxi Deployments Are Proliferating

Apollo Go Major City

WeRide Major City

Pony.ai Major City

London UK

Dubai UAE
Abu Dhabi UAE

https://cnevpost.com/2026/01/15/baidu-apollo-go-robotaxi-operations-20-cities-china/ https://ir.weride.ai/news-releases/news-release-details/weride-secures-worlds-first-city-level-fully-driverless-robotaxi?mobile=1#:~:text=WeRide%20has%20been%20operating%20Robotaxis,safety%20and%20regulatory%20approval%20process.

RoboTaxi Business Model Has a Long Way to Profitability

Mobility Initiative

The dance among 1) full stack AV providers 2) ride hail platforms and 3) auto OEMs continues

Waymo and Uber expand partnership to bring autonomous ride-hailing to Austin and Atlanta

September 13, 2024

Uber and May Mobility Announce Strategic Partnership to Scale Autonomous Vehicles

By May Mobility • May 1, 2025 • Partnerships

WAYMO | TOYOTA

Waymo and Toyota Outline Strategic Partnership to Advance Autonomous Driving Deployment

Lyft and Waymo Launch Partnership to Expand Autonomous Mobility to Nashville

September 17, 2025 8:55am EDT

Nvidia, Mercedes-Benz advance robotaxi plans with Uber

The companies are expanding autonomous driving collaboration around Mercedes' S-Class and MB.OS platform, intensifying competition with Tesla and Waymo.

China and US compete for Rest of World

Baidu | Uber

Baidu and Uber Join Forces to Accelerate Autonomous Vehicle Deployment

Baidu | lyft

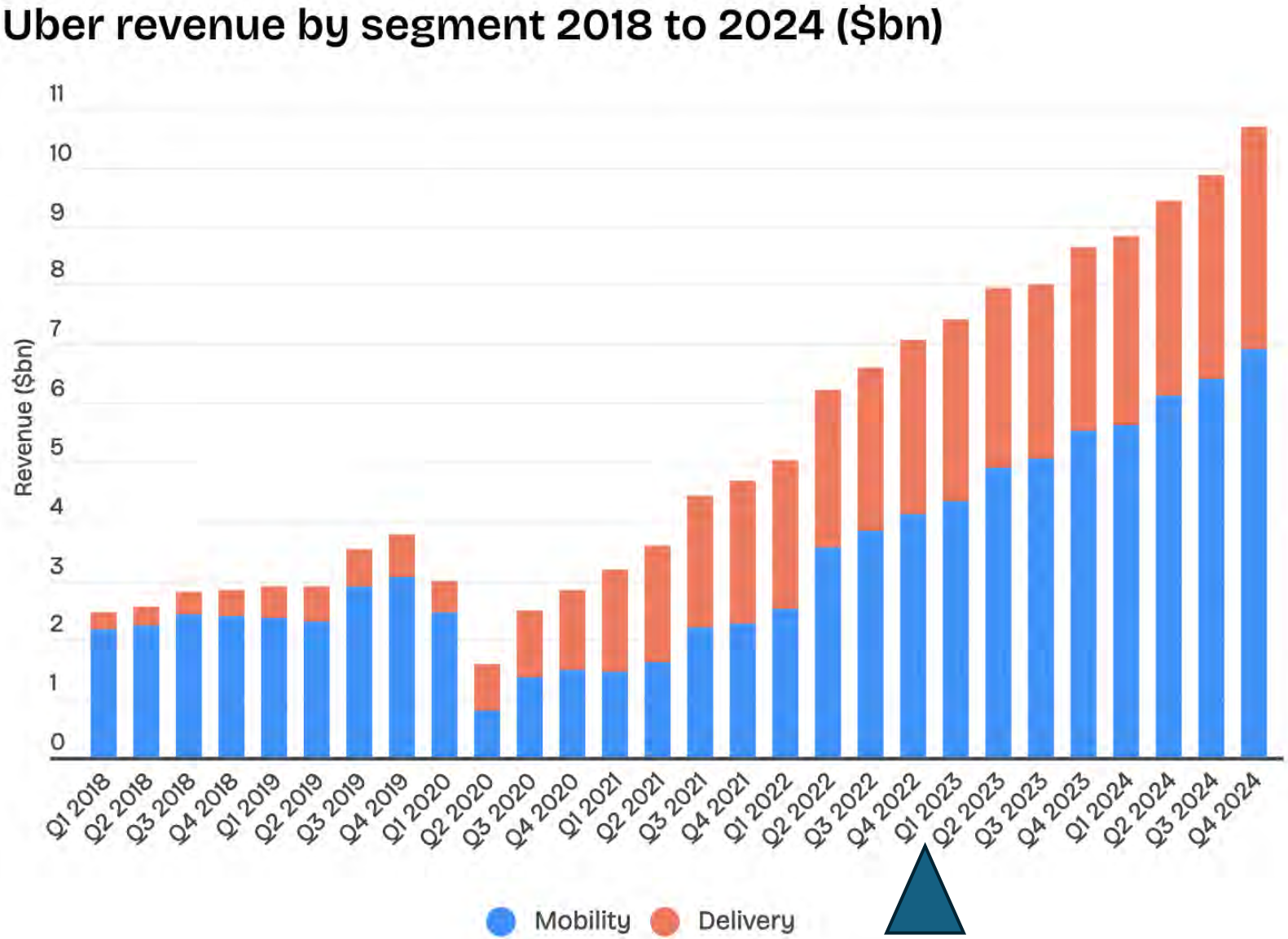
Lyft Partners with Baidu to Deploy Autonomous Rides Across Europe

Baidu to Bring Robotaxis Without Steering Wheels to Switzerland

WeRide and Uber Launch Middle East's First Fully Driverless Robotaxi Commercial Operations in Abu Dhabi, UAE

https://investor.uber.com/news-events/news/press-release-details/2025/Baidu-and-Uber-Join-Forces-to-Accelerate-Autonomous-Vehicle-Deployment-2025-OfJR8lmv7m/default.aspx , https://investor.lyft.com/news-and-events/news/news-details/2025/Lyft-Partners-with-Baidu-to-Deploy-Autonomous-Rides-Across-Europe/default.aspx

RideHail Also Had a Long Journey to Profitability

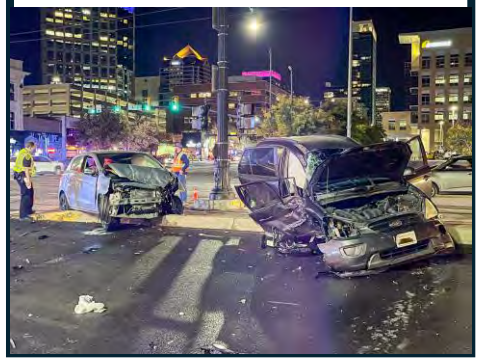


Uber achieves profitability Q2 2023

https://www.businessofapps.com/data/uber-statistics/#:~:text=Note:%20Uber%20stopped%20reporting%20this,Source:%20Company%20data

5 Buckets of Value (or Cost) for AVs

Safety



Labor

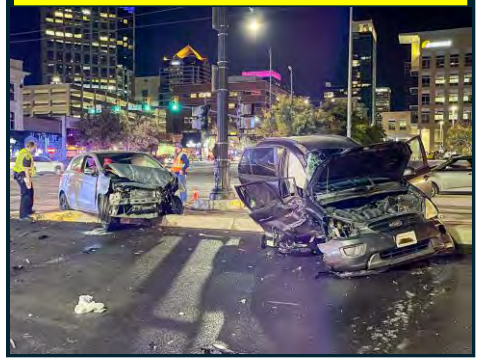
Innovation

Access

Mobility

5 Buckets of Value (or Cost) for AVs

Safety



Labor

Innovation

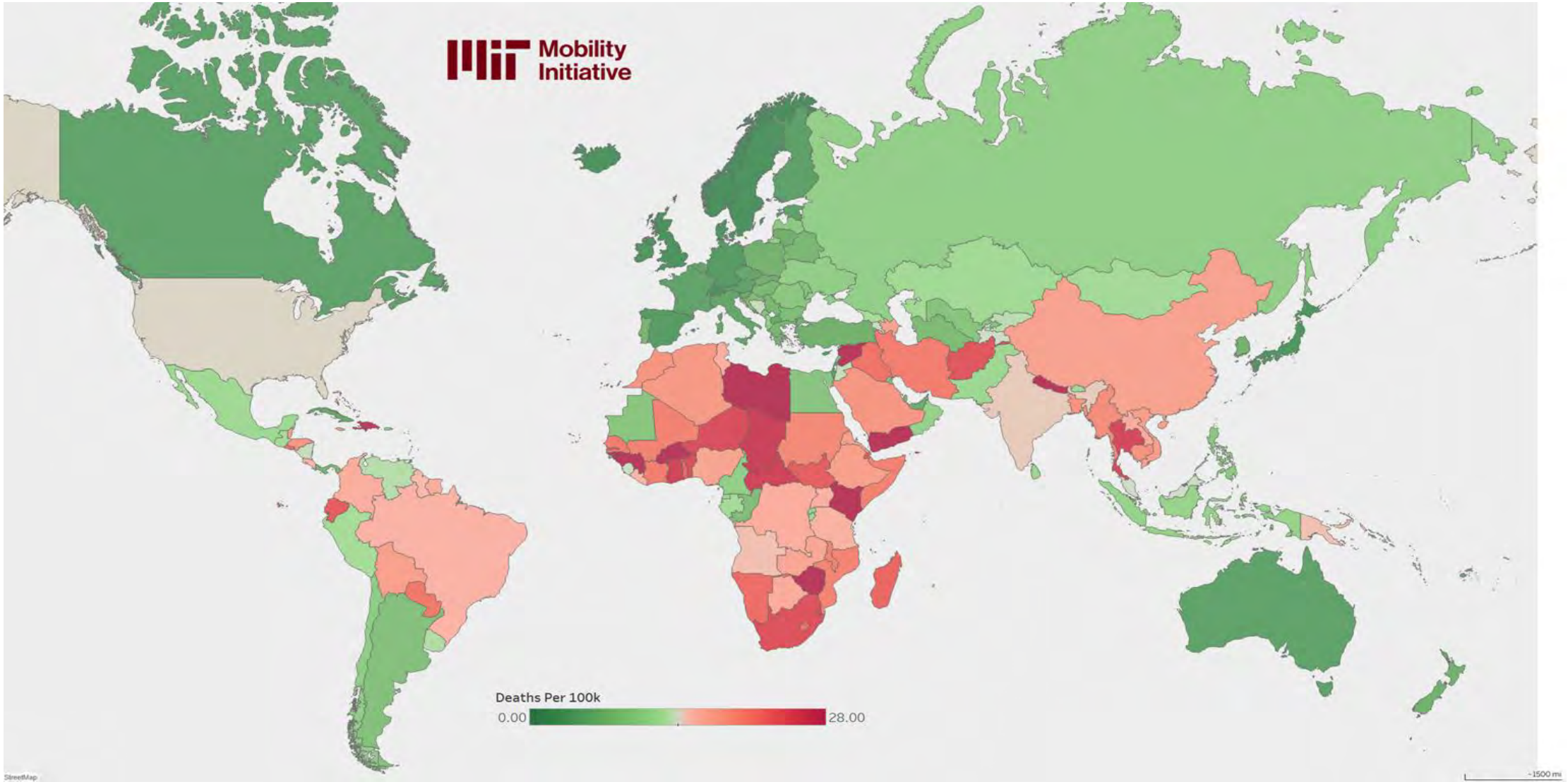
Access

Mobility

The USA Is Middle-of-the-Road for Road Safety

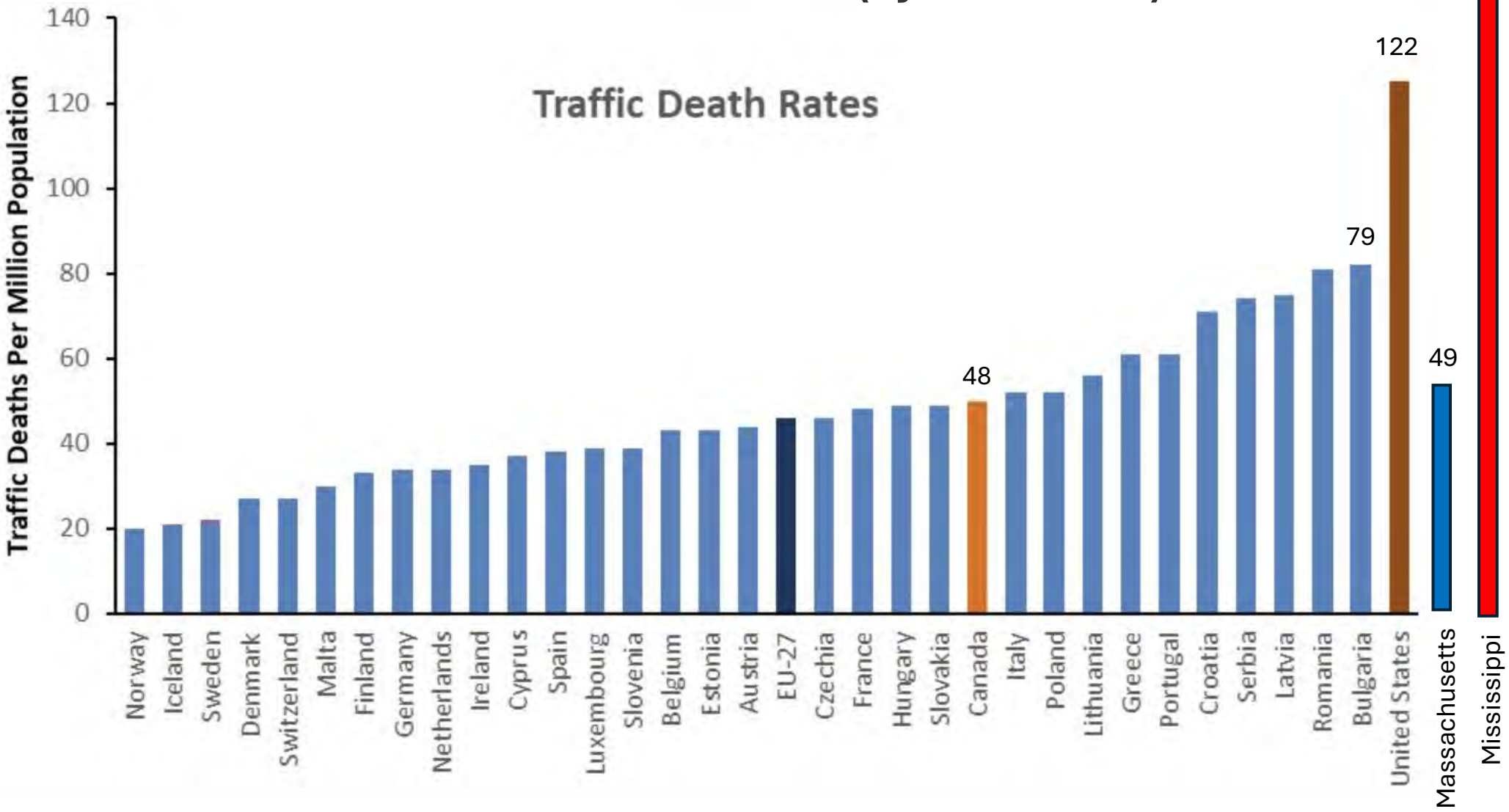
Mobility Initiative

2021 WHO Estimated Road Traffic Deaths (per 100k population)



US Road Death Rate 2.5x Canada, +4x Nordic Countries …
But Massachusetts Is Safest State (by this metric)

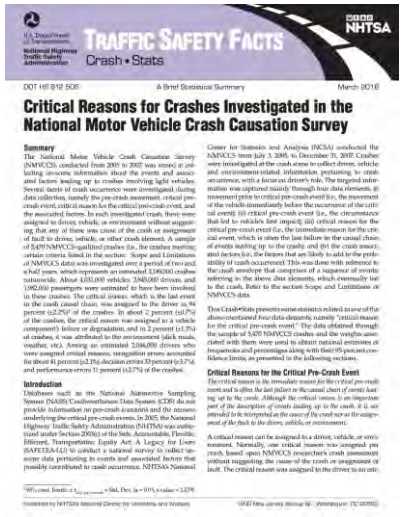
Mobility Initiative



Source: Analysis by Todd Lipman, Victoria Transport Policy Institute using EU, Transport Canada and NHTSA data. https://transport.ec.europa.eu/news-events/news/20400-lives-lost-eu-road-crashes-last-year-2024-10-10_en, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813561. MA and MI data based on 20223 NHTSA FARS database as reported by IIHS

Why do car crashes happen? Because of people?

Mobility Initiative



TRAFFIC SAFETY FACTS
Crash • Stats
NHTSA

DOT HS 812 506 — A Brief Statistical Summary — March 2018

Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey

Summary

The National Motor Vehicle Crash Causation Survey (NMVCCS) conducted from 2005 to 2007 was aimed at collecting in-scene information about the events and associated factors leading up to crashes involving light vehicles. Several facets of crash occurrence were investigated during data collection, namely the pre-crash assessment, critical pre-crash event, critical reason for the critical pre-crash event, and the associated factors. In each investigated crash, three were assigned to drivers, vehicle, or environment without suggesting that any of these was cause of the crash or assignment of fault to driver, vehicle, or other crash element. A sample of 5,470 NMVCCS-qualified crashes (i.e., the crashes meeting certain criteria listed in the section: Scope and Limitations of NMVCCS data) was investigated over a period of two and a half years, which represents an estimated 2,189,000 crashes nationwide. About 4,031,000 vehicles, 3,945,000 drivers, and 1,982,000 passengers were estimated to have been involved in these crashes. The critical reason, which is the last event in the crash causal chain, was assigned to the driver in 94 percent (±2.2%) of the crashes. In about 2 percent (±0.7%) of the crashes, the critical reason was assigned to a vehicle component's failure or degradation, and in 2 percent (±1.3%) of crashes, it was attributed to the environment (slick roads, weather, etc). Among an estimated 2,046,000 drivers who were assigned critical reasons, recognition errors accounted for about 41 percent (±2.1%), decision errors 33 percent (±3.7%), and performance errors 11 percent (±2.7%) of the crashes.

Introduction

Databases such as the National Automotive Sampling System (NASS) Crashworthiness Data System (CDS) do not provide information on pre-crash scenarios and the reasons underlying the critical pre-crash events. In 2005, the National Highway Traffic Safety Administration (NHTSA) was authorized under Section 2008(a) of the Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to conduct a national survey to collect in-scene data pertaining to events and associated factors that possibly contributed to crash occurrence. NHTSA's National Center for Statistics and Analysis (NCSA) conducted the NMVCCS from July 3, 2005, to December 31, 2007. Crashes were investigated at the crash scene to collect driver, vehicle, and environment related information pertaining to crash occurrence, with a focus on driver's role. The targeted information was captured mainly through four data elements, (i) movement prior to critical pre-crash event (i.e., the movement of the vehicle immediately before the occurrence of the critical event); (ii) critical pre-crash event (i.e., the circumstance that led to vehicles first impact); (iii) critical reason for the critical pre-crash event (i.e., the immediate reason for the critical event, which is often the last failure in the causal chain of events leading up to the crash); and (iv) the crash avoidance factors (i.e., the factors that are likely to aid in the probability of crash occurrence). This was done with reference to the crash envelope that comprises of a sequence of events referring to the above data elements, which eventually led to the crash. Refer to the section Scope and Limitations of NMVCCS data.

This CrashStats presents some statistics related to one of the above-mentioned four data elements, namely "critical reason for the critical pre-crash event." The data obtained through the sample of 5,470 NMVCCS crashes and the weights associated with them were used to obtain national estimates of frequencies and percentages along with their 95 percent confidence limits, as presented in the following sections.

Critical Reasons for the Critical Pre-Crash Event

The critical reason is the immediate reason for the critical pre-crash event and is often the last failure in the causal chain of events leading up to the crash. Although the critical reason is an important part of the description of events leading up to the crash, it is not intended to be interpreted as the cause of the crash nor as the assignment of the fault to the driver, vehicle, or environment.

A critical reason can be assigned to a driver, vehicle, or environment. Normally, one critical reason was assigned per crash, based upon NMVCCS researcher's crash assessment without suggesting the cause of the crash or assignment of fault. The critical reason was assigned to the driver to an esti-

NHTSA Report: "The critical reason, which is the last event in the crash causal chain, was assigned to the driver in 94 percent (±2.2%) of the crashes."

AV Industry: 94% of all crashes are caused by human error.

Speeding

Distracted Driving

Drunk Driving

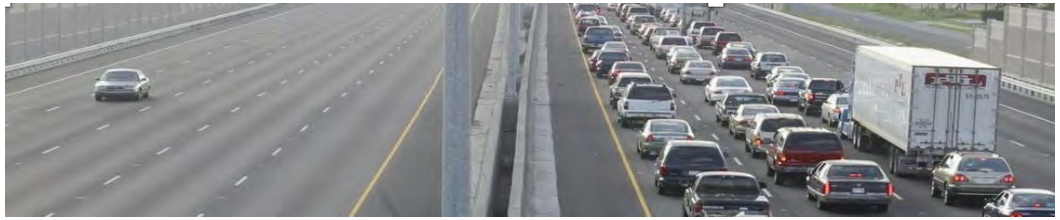
Fatigued Driving

Source: US National Highway Traffic Safety Administration (NHTSA): https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812506

Why do car crashes happen? Because of the system?

Mobility Initiative

LEVELS OF SERVICE



A B C D E F

Free Flow Congestion

Waymo Safety Record Is Impressive …
Some AV Companies Have Been Less Transparent

Mobility Initiative

WAYMO

Compared to an average human driver over the same distance in our operating cities, the Waymo Driver had

Overall crash reduction

90%
Fewer serious injury or worse crashes
↓ 27 FEWER

82%
Fewer airbag deployment in any vehicle crashes
↓ 173 FEWER

81%
Fewer injury-causing crashes
↓ 411 FEWER

Crash reductions involving injuries to Vulnerable Road Users

92%
Fewer pedestrian crashes with injuries
↓ 48 FEWER

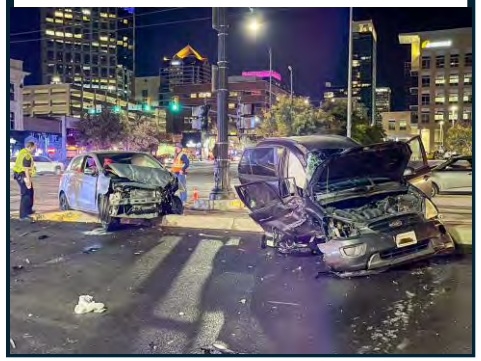
83%
Fewer cyclist crashes with Injuries
↓ 28 FEWER

80%
Fewer motorcycle crashes with injuries
↓ 20 FEWER

Source: https://waymo.com/safety/impact/

5 Buckets of Value (or Cost) for AVs

Safety



Labor

Innovation

Access

Mobility

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Autonomous Mobility Threatens Job Security of Professional Drivers (Trucking, Taxi, RideHail …)

Labor

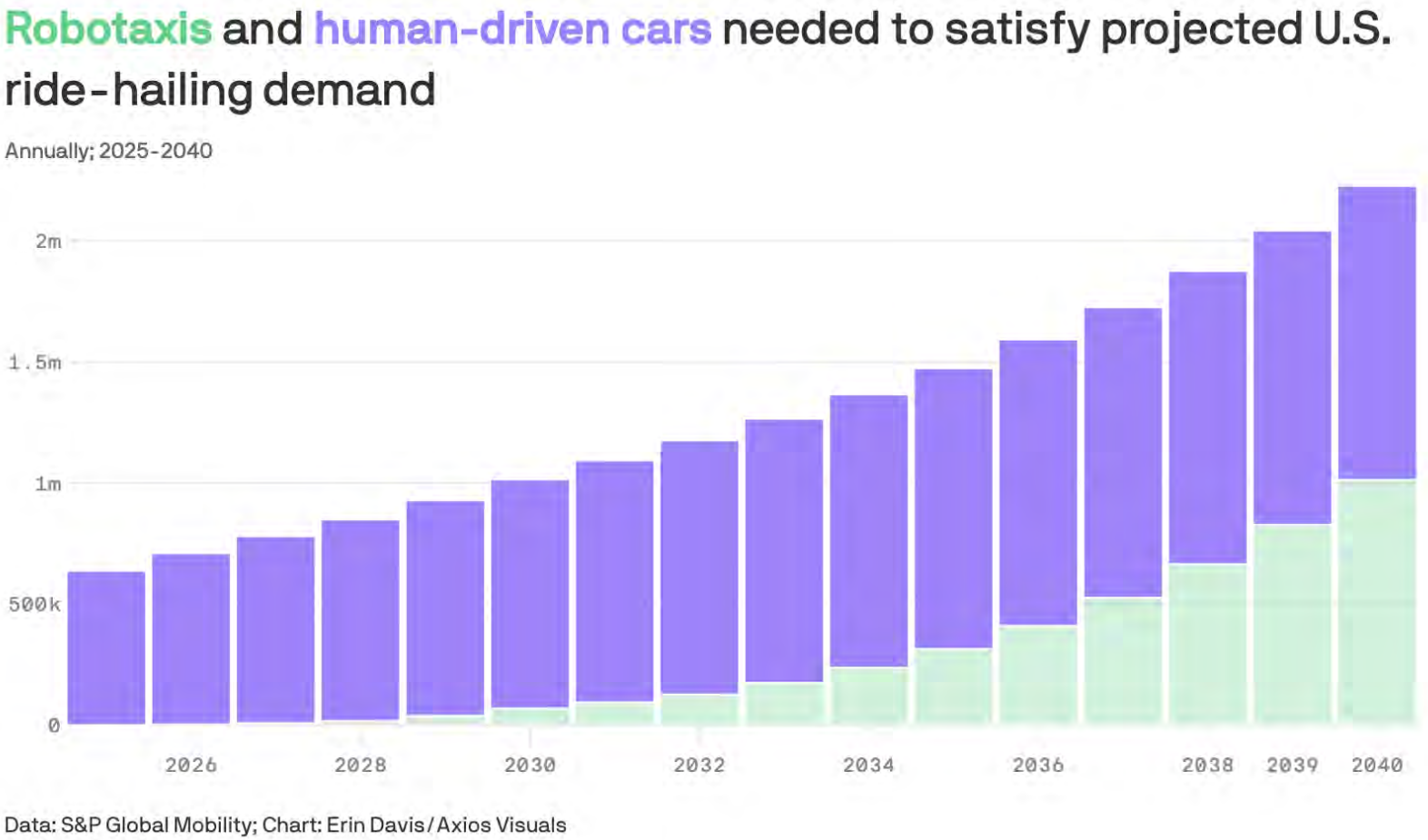
Mobility Initiative

China's drivers worry as robotaxis pick up pace — and passengers

Boston taxi drivers protest against Uber (2016)

Demand for Ridehail Forecast to Grow – Your Future Uber may be a robot or a human driver

Mobility Initiative



https://www.axios.com/2025/04/09/uber-and-lyft-drivers-aren-t-going-away-future-of-mobility

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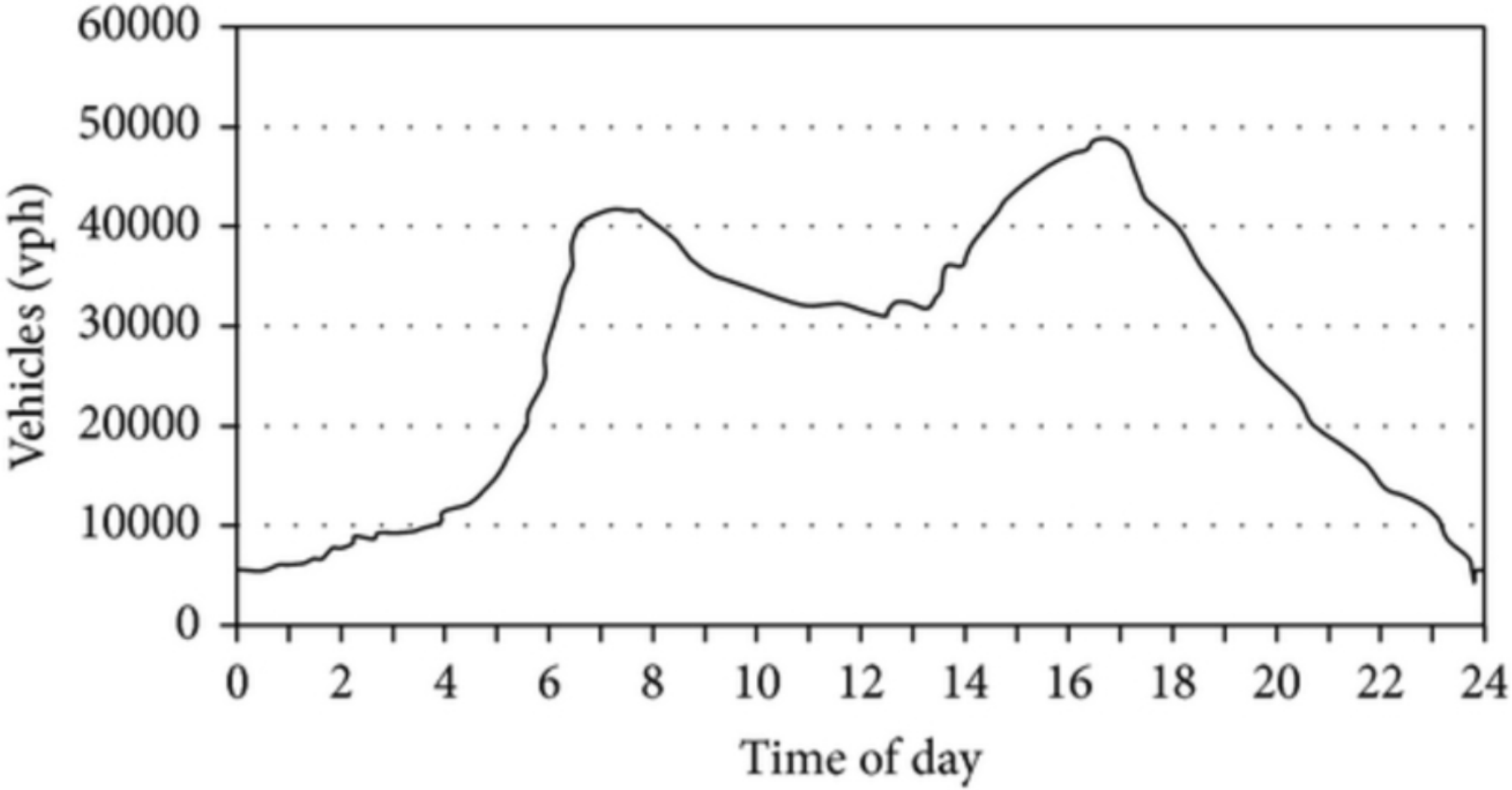
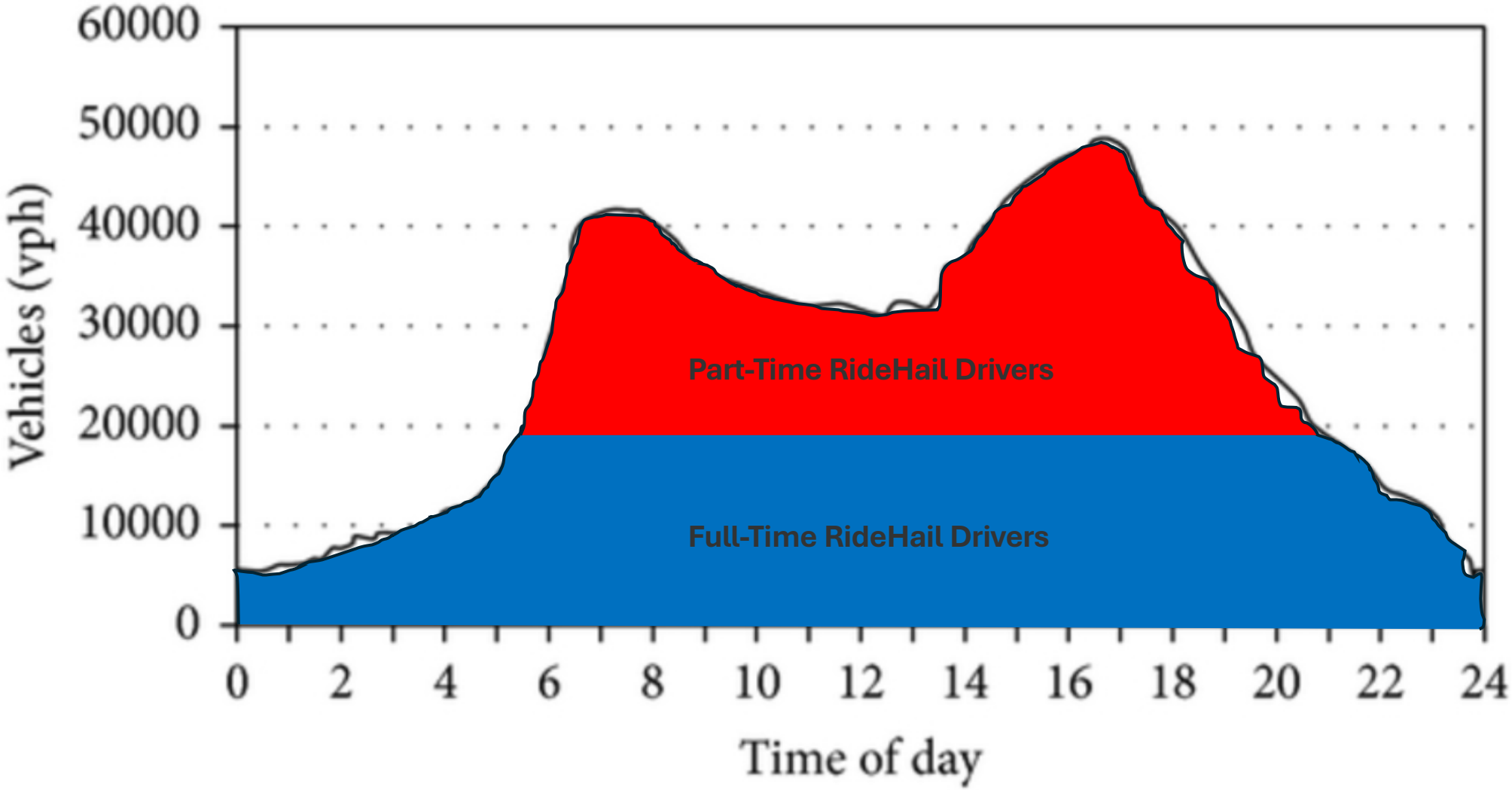
Mobility Demand Peaks During Weekday Morning and Evening Rush



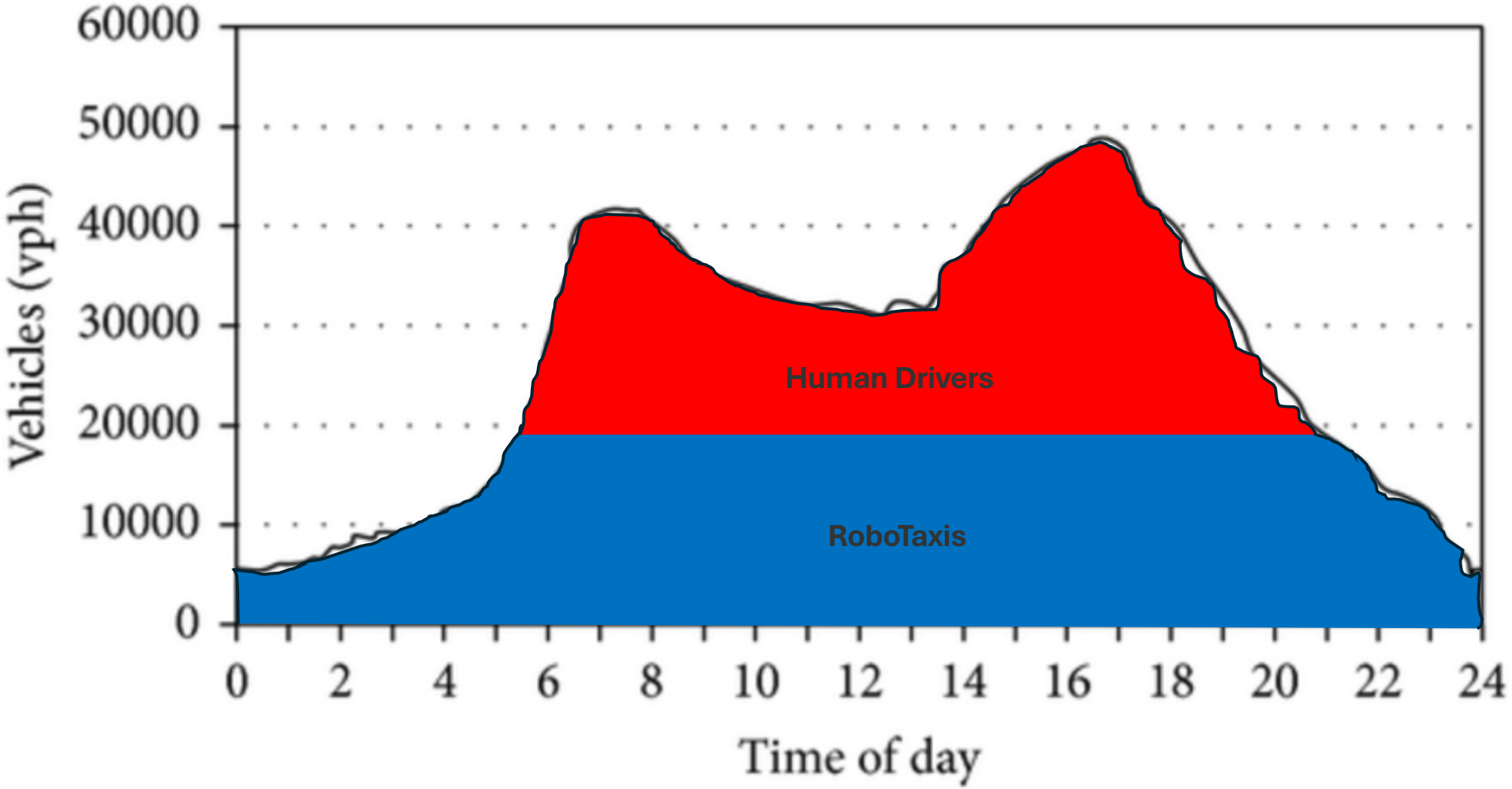
Full-Time Uber Drivers Are on the Road a Full Day, Part-Time Uber Drivers "Skim the Peaks"

Mobility Initiative

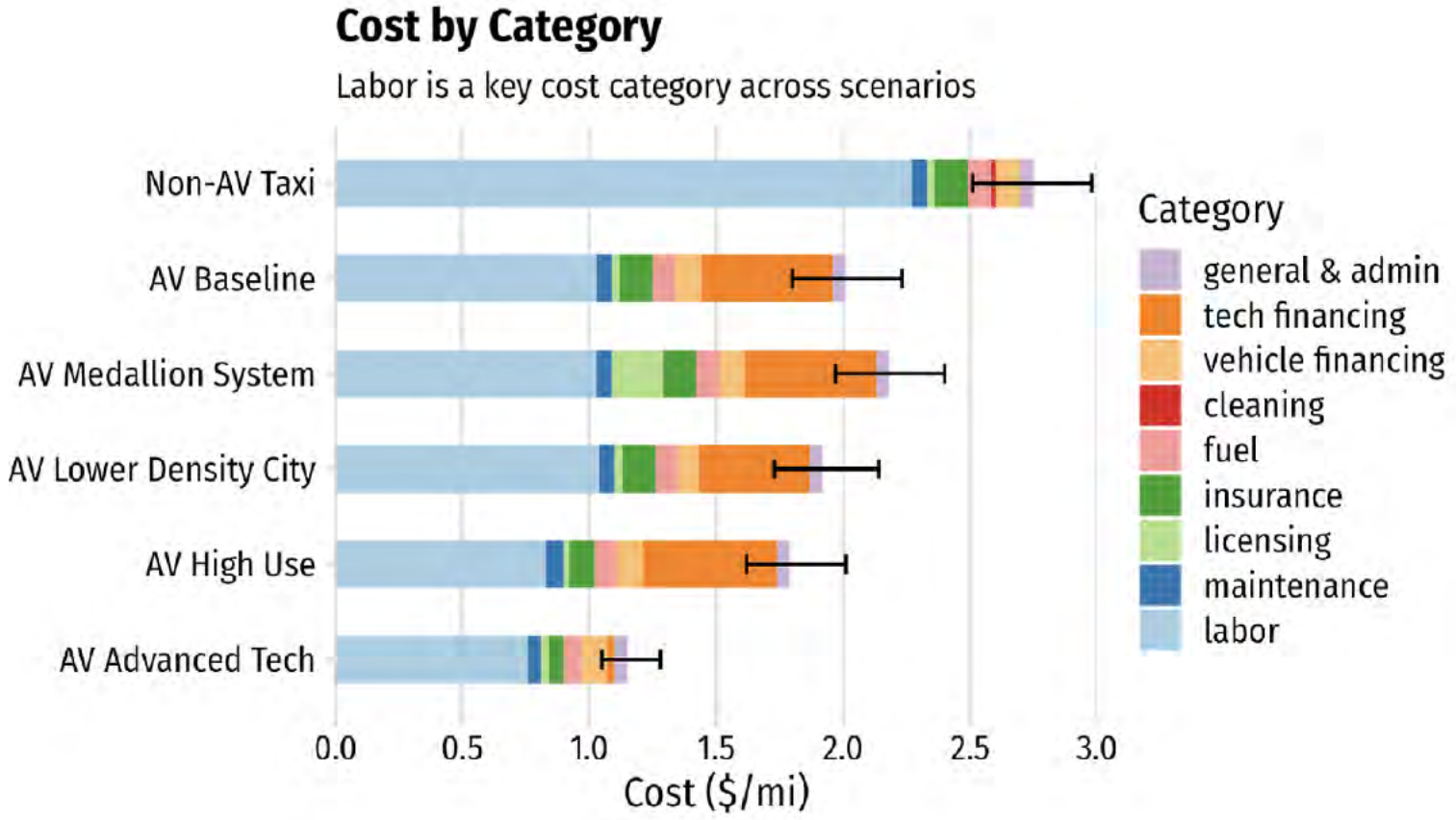


RoboTaxis Are on the Road a Full Day, Human Drivers "Skim the Peaks"

Mobility Initiative



Total Cost / Mile Will Determine Employment Distribution – And Affordability

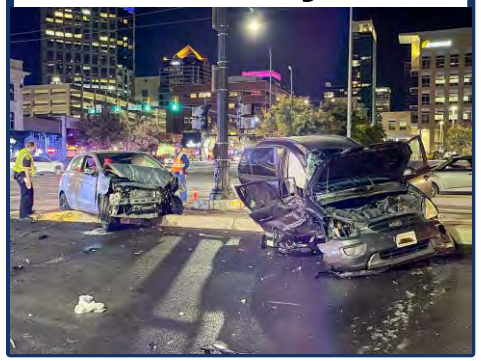


RoboTaxi will also create NEW jobs in fleet mgmt. operations

Modelling the Operational and Labor Costs of Robotaxi Services Leah Kaplan et al, Transport Policy, Dec 2024

5 Buckets of Value (or Cost) for AVs

Safety



Labor

Innovation

Access

Mobility

What Is Massachusetts Good At?

Mobility Initiative

Biotech, Health & Life Sciences

AI & Advanced Computing

Robotics & Adv. Manufacturing

Higher Ed & Research

VC & Fintech

Battery

polarispartners

GENERAL CATALYST

Climate Tech & Clean Energy

MASSACHUSETTS CLEAN ENERGY CENTER®

What Are Autonomous Vehicles?

Robots

Robotics & Adv. Manufacturing

Powered by

AI

AI & Advanced Computing

Supported by an Enabling Ecosystem

Higher Ed & Research

and

Climate Tech & Clean Energy

MASSACHUSETTS CLEAN ENERGY CENTER

and

VC & Fintech

Battery

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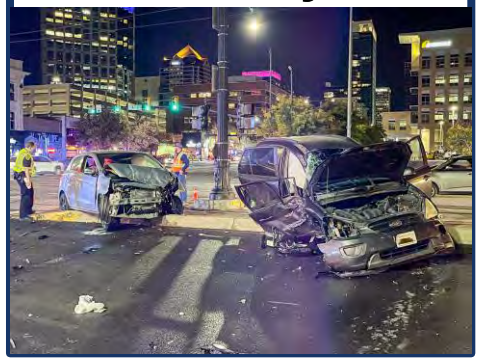
GENERAL CATALYST

5 Buckets of Value (or Cost) for AVs

Safety



Labor

Innovation

Access

Mobility

How Could Autonomous Mobility Increase Access?

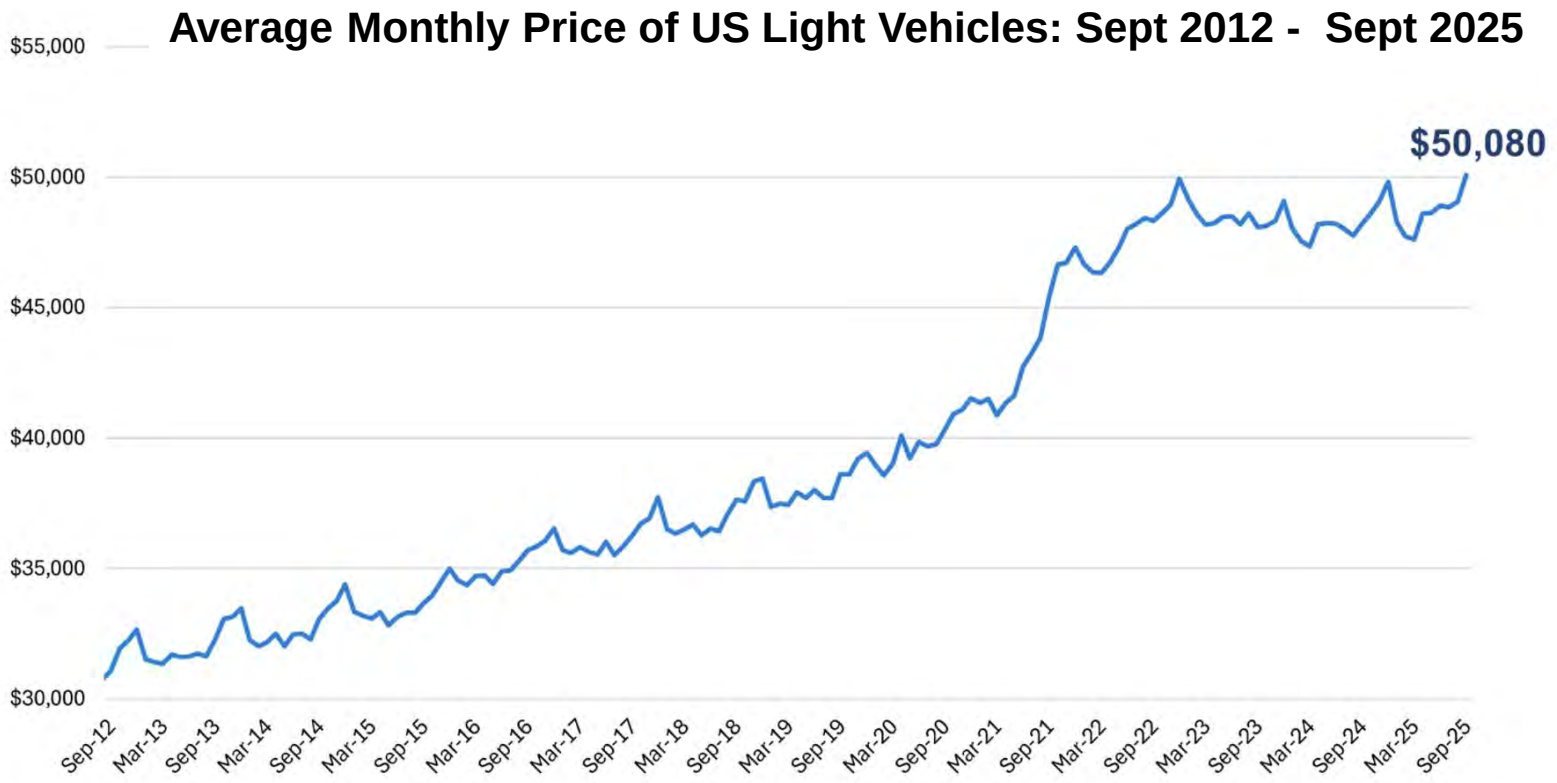
Elderly

Blind

Disabled

Only If It's More Affordable – Both in terms of Money and Time

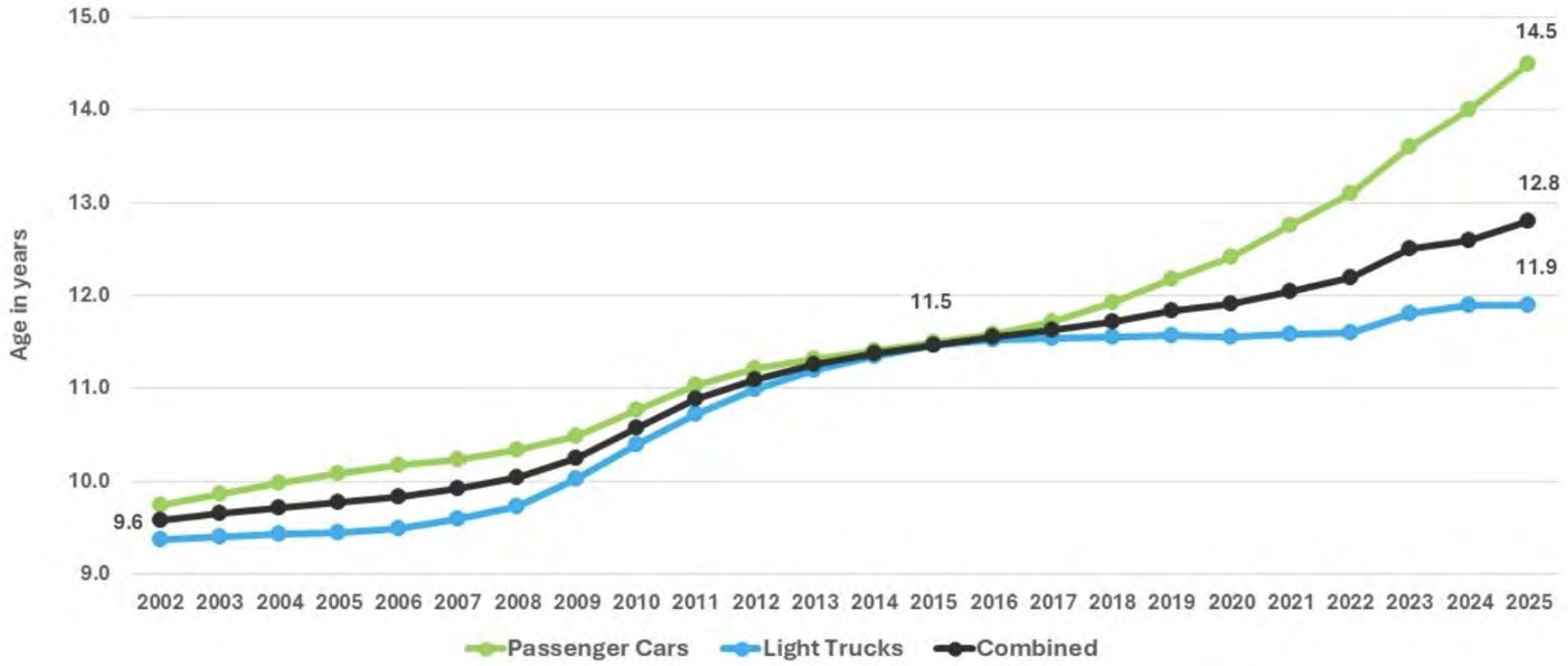
The Crisis of Affordability in the Western Car Industry



Source: KBB data compiled by Cox Automotive, see also US Bureau of Labor Statistics FRED
https://www.kbb.com/car-news/new-record-average-new-car-prices-surpasses-50000/, https://www.coxautoinc.com/insights-hub/sept-2025-new-vehicle-inventory/

Americans Are Keeping Their Cars Longer

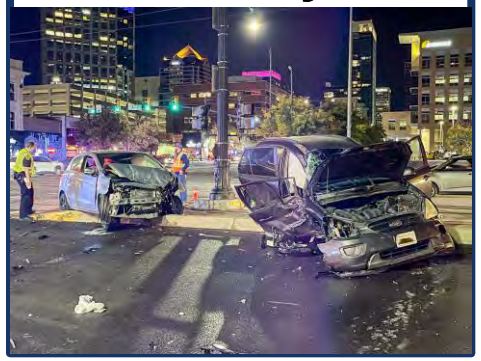
Average Age of US Vehicle: 2002 - 2025



Source: S&P Global Mobility data

5 Buckets of Value (or Cost) for AVs

Safety



Labor

Innovation

Access

Mobility

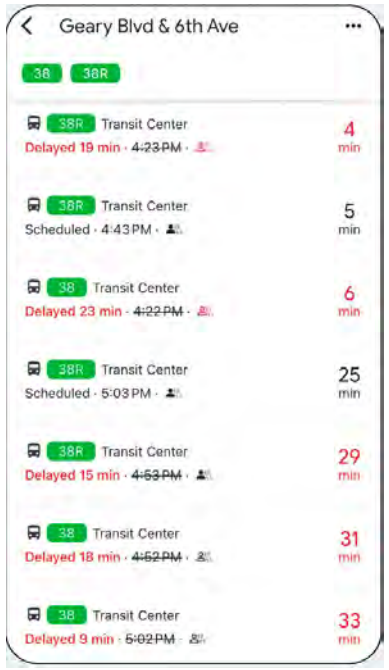
The Shift from (Expensive) Personal Car Ownership in Cities to (Affordable) Fleet Service

- Many models have demonstrated that Mobility-on-Demand fleets -- as opposed to private car ownership -- can reduce the number of cars on the road for a given level of mobility, all things equal
- Another major benefit would be reduced need for urban parking – which typically consumes a significant amount of precious urban land
- BUT … robotaxis are NOT likely to solve congestion due the curse of induced demand
- Long term, robotaxis could enable better cities -- more bike lanes, on-street parking repurposed, less speeding through neighborhoods – or worse cities -- monopolistic price gauging of consumers, cannibalization of public transit, promotion of urban sprawl

Source: S&P Global Mobility data

Public Transit Integration: Will Robotaxis Complement or Cannibalize Public Transportation?

- MIT exploring win-win opportunities for AVs to utilize city priority bus lanes
- Opportunity for City to help Robotaxi service with one of their biggest headaches, curb Pick Up and Drop Off (PUDO)
- Opportunity for Robotaxi to legally gain access to bus lanes
    - Identification of service disruptions
    - Communication to nearby AVs with update to cost function
    - Conditional access to bus lanes, bus stop PUDO and transit hubs



Is the personal-use automobile the best solution for urban mobility?

Mobility Initiative

Heavy therefore energy thirsty: The typical passenger car weighs 10-20 times the weight of the passengers it typically moves

Inefficient Asset Utilization: The typical passenger car is the second largest household expenditure yet sits idle (parked) 95% of the time

Designed for extreme use cases therefore expensive: Vehicle purchase decisions are biased to rare use-cases

Large footprint: the typical passenger car consumes far more street space than its occupants

Technology is not a Panacea:
Typology of Autonomous Vehicles in the Urban Context

Personal-Owned
Low-Occupancy
AV

Fleet-Owned
Low-Occupancy
Robotaxi

Fleet-Owned
High-Occupancy
AV Shuttle

Autonomous Heaven
- Safer mobility (less human error)
- Less congested streets
- Mobility access for elderly, blind, etc.

Autonomous Hell
- Streets clogged with empty AVs
- Greater social isolation
- Increased disparity of access between rich & poor

Questions, comments, feedback

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