

# Three Transportation Revolutions ... and What It Means for Health

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5 May 2019

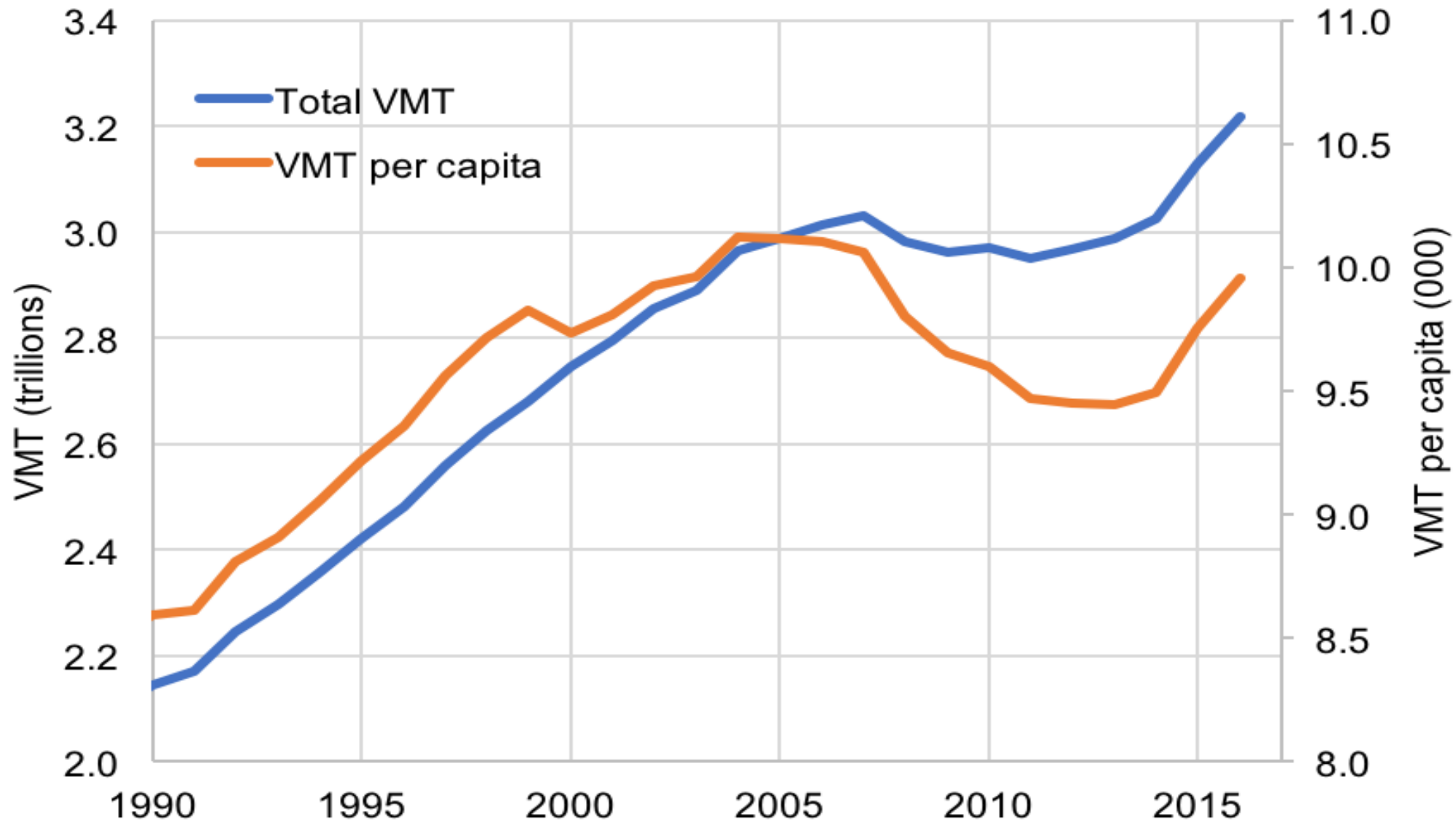


# Transportation Heading in Wrong Direction

- Transit <2% of passenger miles (and shrinking)  
... and 80% subsidized
- Carpool lanes failed (less carpooling now)
- Single-occupant vehicle use increasing (and vehicles getting larger)
- Greenhouse gases (GHG) increasing
- Congestion worsening



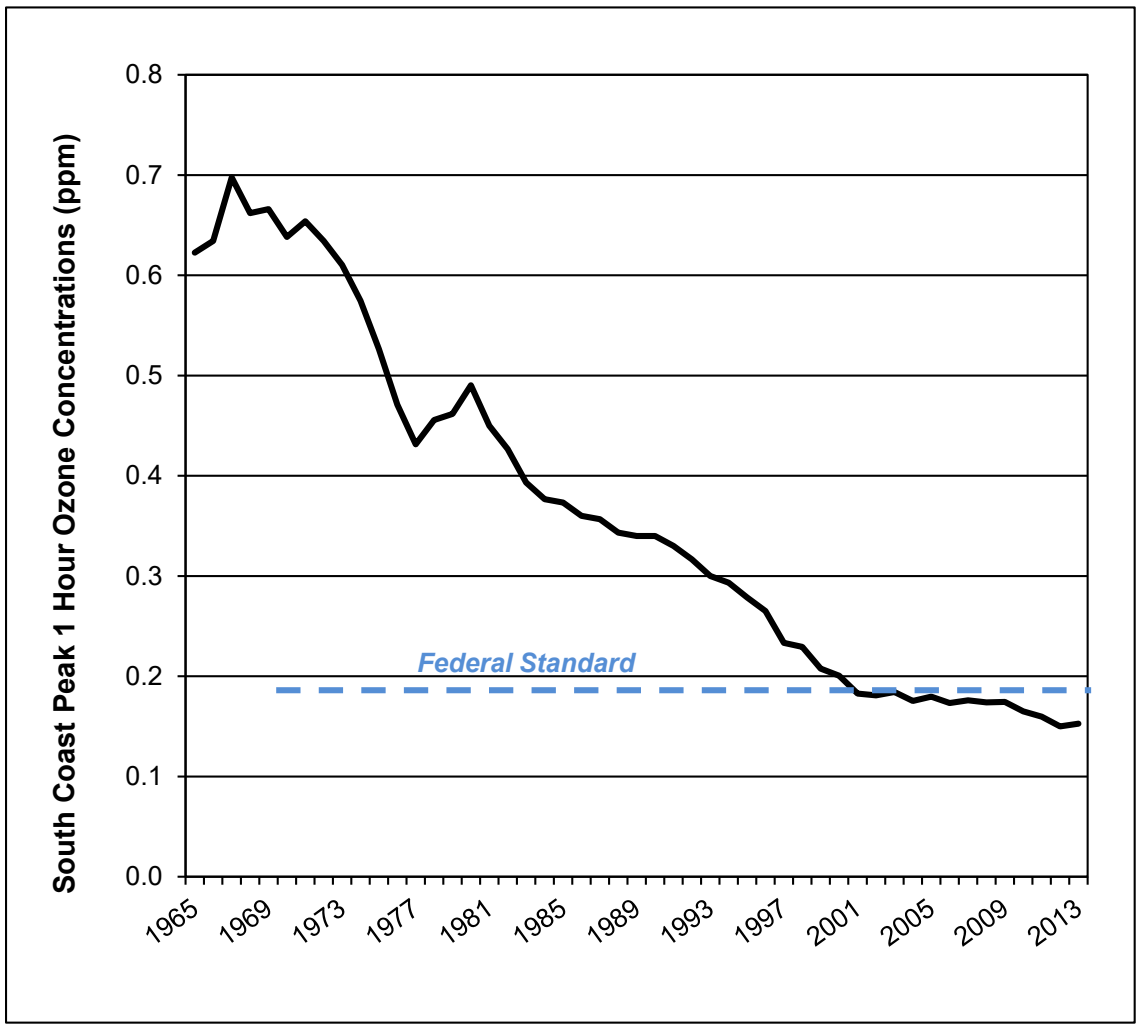
# Vehicle Use Rising in US, Resulting in More GHG Emissions



VMT = vehicle miles traveled

State Smart Transportation Initiative

# Only Major Success ... Large Reduction in Air Pollutant Emissions

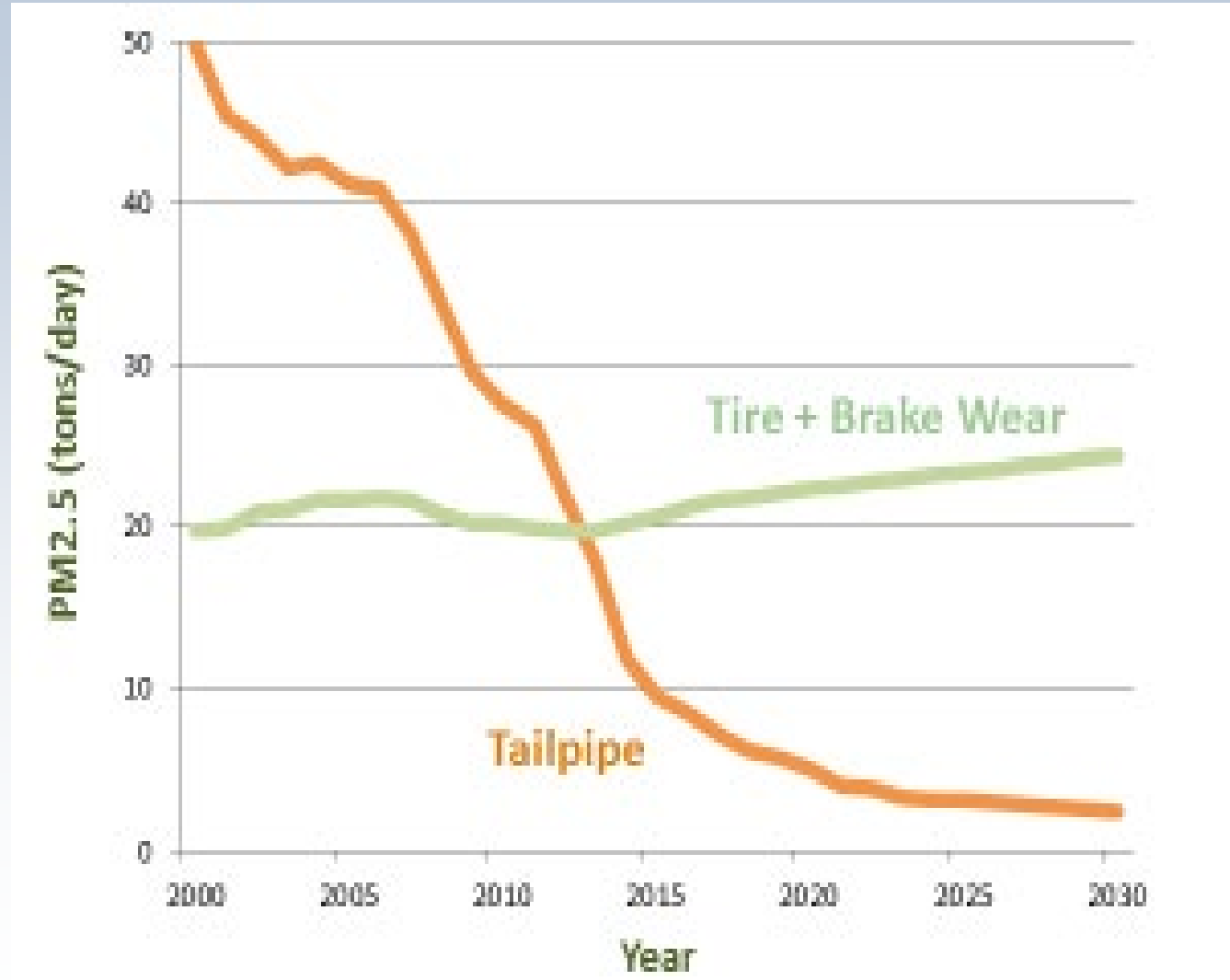


*Ozone levels sharply reduced in Los Angeles and most other cities*



# Tailpipe Emissions For Cars and Trucks Shrinking So Much That Exceeded Now By Tire and Brake Particulate Emissions

Tire and brake wear includes toxic metal emissions



CARB, Proposed Triennial Strategic Research Plan, April 23, 2018

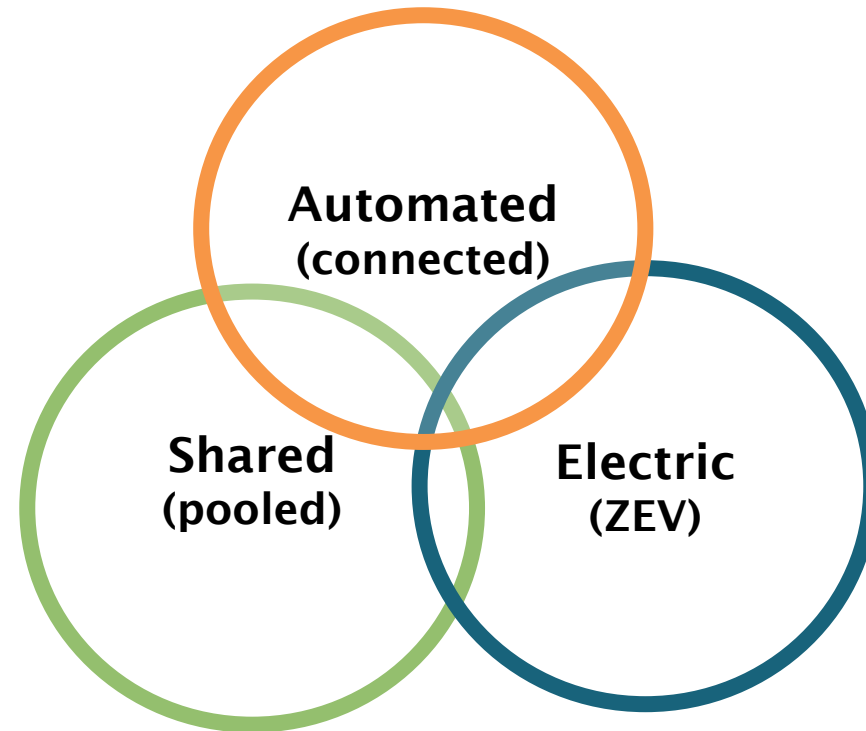
# Major (Health-Related) Challenges

- People don't walk/bike
- Lack of mobility/accessibility by old, disabled, low income travelers
- Increasing climate change
- High emissions from old trucks
- Emissions from off-road mobile sources, especially near ports, warehouses, rail yards
- Solutions:
  - Electrification of all vehicles (and decarbonization of electricity)
  - Much more pooling of rides



...less cost, vehicle miles traveled (VMT), GHGs, pollution; and more accessibility/mobility

# Electrification + Automation + Pooling/Sharing



# The 3 Revolutions Will Be Disruptive

... exacerbated by slow (non-strategic) response by governments

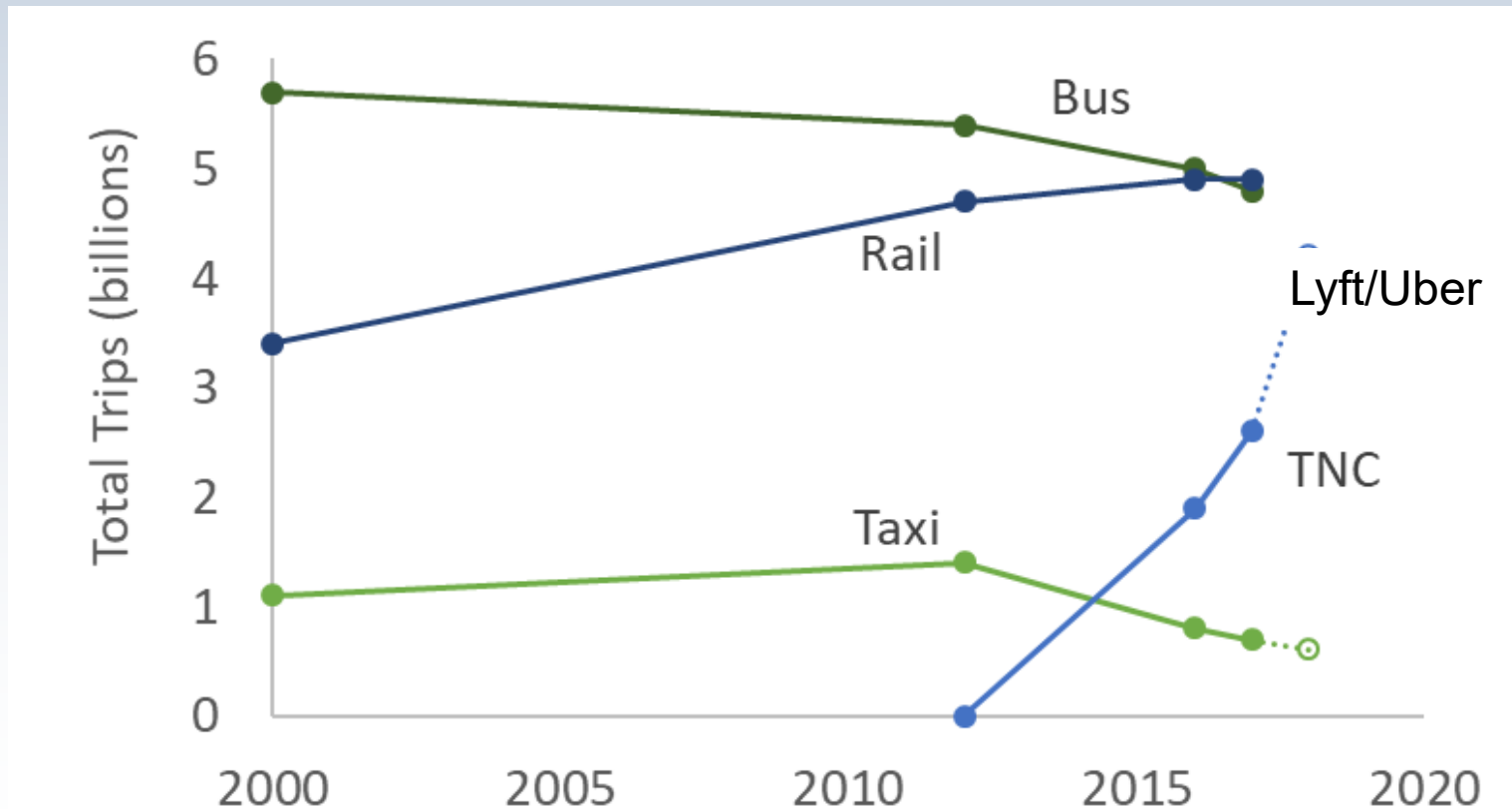
- Taxis
- Transit
- Automotive industry
- Oil companies
- Jobs

.... plus rental cars, insurance, parking, vehicle service and repair, aftermarket vehicle parts suppliers, etc.



# First Disruption: Taxis

In US, taxis lost half the market and continuing to decline



Transit data from APTA, Taxi data from US Census, and projections from Schaller Consulting (2018)

# Electric Vehicles Will Dominate... Not If, But When

(battery electric, plug-in hybrid, and hydrogen fuel cell electric)

## Auto Industry Ready

- Automakers have developed the technology
- Supply chains in place
- Battery costs continue to drop

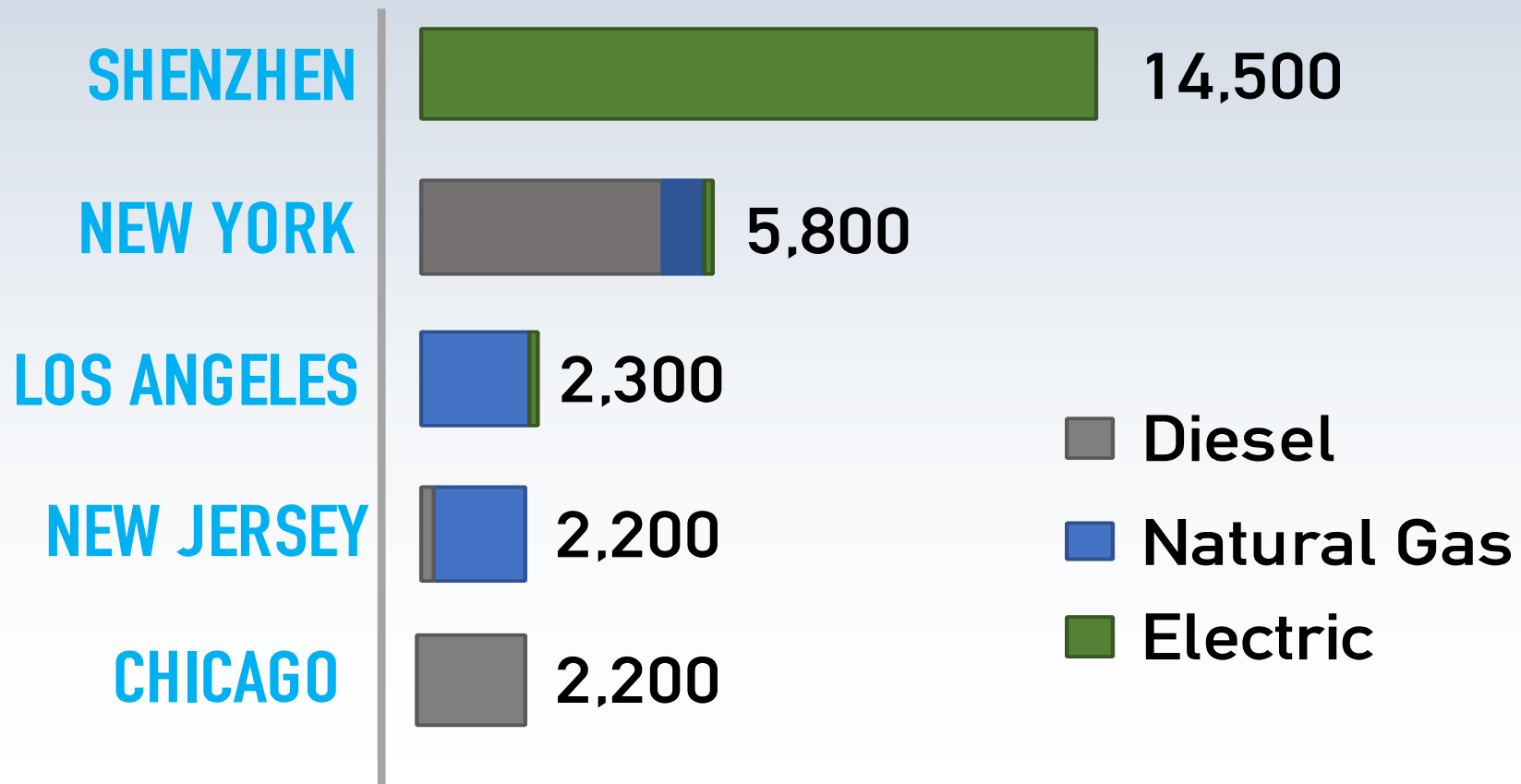
## Policies in Place?!

- Strong performance standards in all major markets to reduce GHGs/energy (though “issues” in one large market☹)
- Zero Emissions Vehicle (ZEV) mandates in China and 30% of US
- Strong political declarations for Electric Vehicles (EVs) in many cities and some countries (e.g., Los Angeles 80% EVs in 2035)

Not just cars...

# California Adopted Requirement for 100% E-Buses by 2040

## BUS FLEET SIZE BY FUEL TYPE



# CARB Is Preparing Zero Emissions Vehicle (ZEV) Mandates for Trucks



**Fuel Cell  
Truck  
(Toyota)**

**Electric Truck With Overhead Wires**



**Battery Electric Truck  
(Thor and Tesla)**



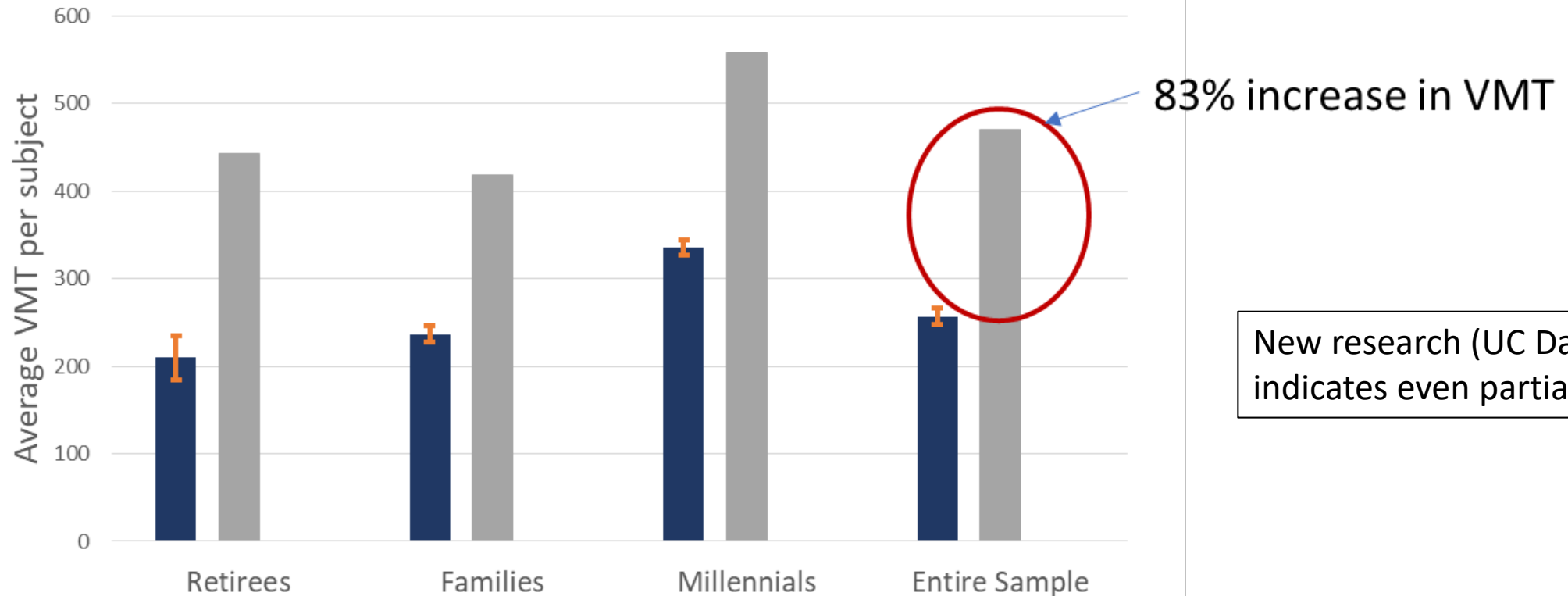
What about vehicle miles traveled (VMT)?

# Autonomous Vehicles (Avs) Will Dominate (Eventually) ... But Will They Be “Pooled” or Individually Owned?

- Ridehailing and some automotive companies embrace “pooling”
  - Business model of Lyft, Uber, Didi; GM, Zoox:
    - Lower price  $\Rightarrow$  more customers (price elastic)  $\Rightarrow$  more revenue  $\Rightarrow$  more profit



# If Individually Owned, Autonomous Vehicles (AVs) Will Greatly Increase VMT (Hell Scenario)



■ Non-chauffeur weeks (average) ■ Chauffeur week ■ Offset from pre/post chauffeur weeks

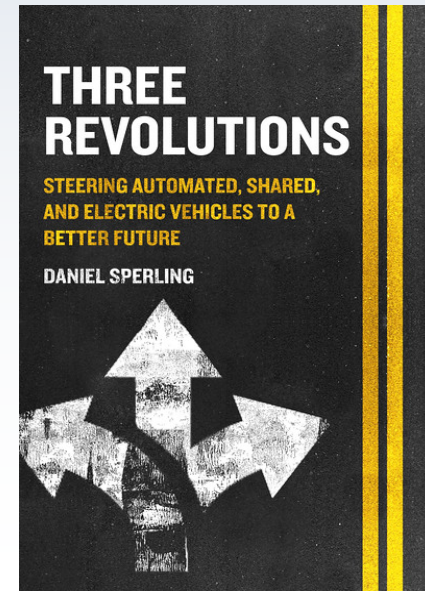
Source: Early findings from UC Davis/Berkeley “chauffer” study: Harb, M., Xiao, Y., Circella, G., Mokhtarian, P., & Walker, J., presented at TRB Meeting, Washington D.C., January 8, 2018.



# Pooling Is the Answer ... to Achieve Heaven Scenario

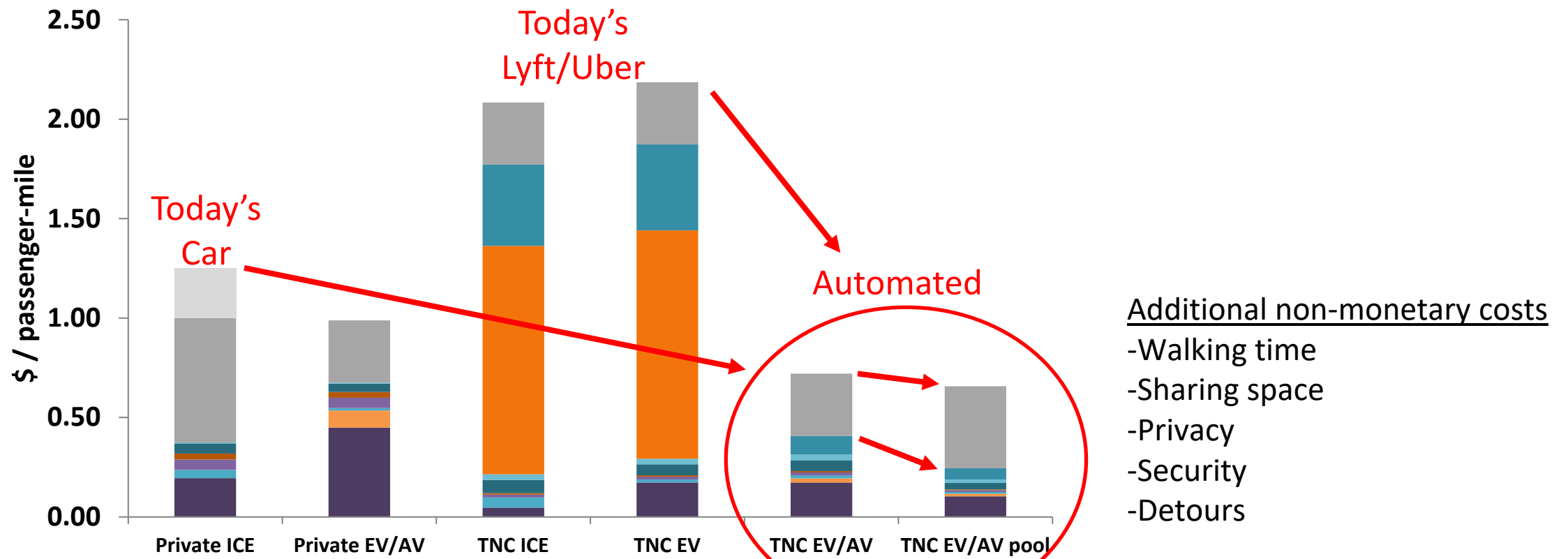
- “The answer is pooling. If the question is traffic congestion, the answer is pooling.
- If climate change, still pooling.
- **Social equity**: also pooling.
- Soaring transportation infrastructure costs: pooling!
- What to do about the potential negative effects of automated vehicles? Pooling.
- **Going forward, pooling must be the principal focus of our thinking and actions related to transportation.”**

***GOAL: Reduce vehicle miles traveled (VMT), but Increase passenger miles traveled (PMT)***



1) Automated Cars Will Be Much Cheaper Than Today's Personal Cars (and Today's Uber/Lyft)—**Especially If Pooled**

2) *But Pooling Not Much Cheaper Than Single-Passenger Service If “Non-Monetary” (Hedonic) Costs Are Included—Which Diminishes Appeal of Pooled AVs*



ICE = internal combustion engine  
EV = electric vehicle  
AV = autonomous vehicle  
TNC = transportation network company

Source: UC Davis (Austin Brown, Lew Fulton, et al), initial results



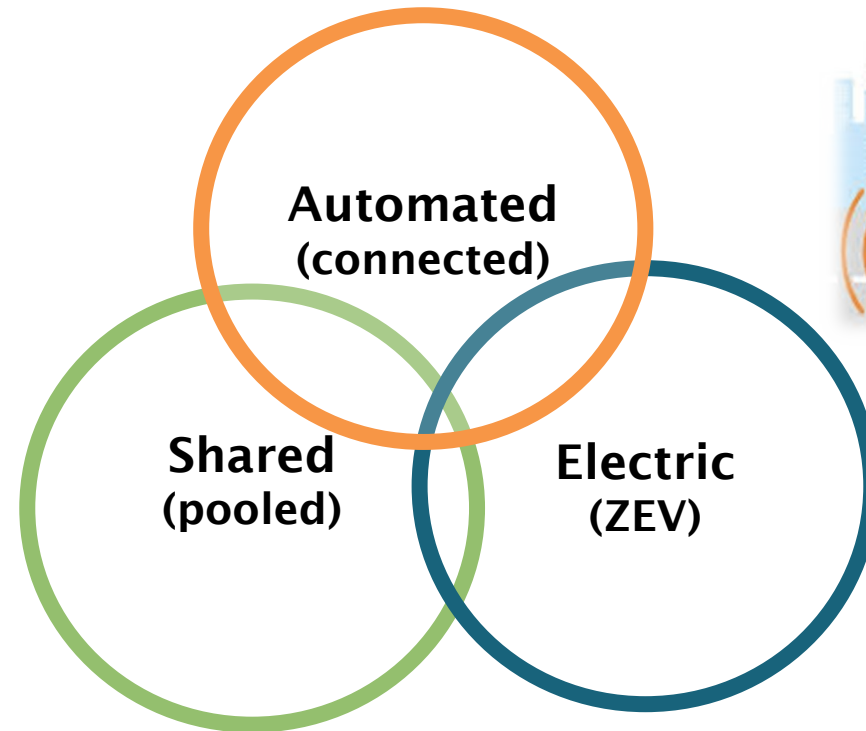
# Will Travelers Embrace “Pooling” and Relinquish Auto Ownership?

## Yes, If...

- Cars redesigned for privacy and security (passenger-centric)
- Increasingly large incentives for pooling
  - registration fees, congestion fees, curb space, High Occupancy Vehicle (HOV) lanes...
- Increasingly large disincentives for single-occupant vehicles (and zero-occupancy vehicles)

...less cost, VMT, GHGs, pollution; and more accessibility/mobility

# Electrification + Automation + Pooling/Sharing



# Strategies to Reduce Criteria, Toxic, and GHG Emissions

## Solutions

1. Electrification of all vehicles (and decarbonization of electricity)
2. Much more pooling of rides

## Strategies

1. Electric vehicles: incentives for buyers, charging infrastructure, regulations for Lyft, Uber, et al
2. More mobility choices
  - Micro-mobility (scooters, bikes), micro-transit, ride-hailing, car sharing
3. Better linkages between transit and private mobility services (including paratransit)
  - Let transit does what it does best (high density corridors)
  - More partnerships with Shared Lyft, Uberpool, micro-transit, perhaps focusing first on low-income travelers
4. More incentives for pooling, and more disincentives for single-passengers and single-occupant travel

➤ MESSAGING: PMT  VMT 

PMT = passenger miles traveled  
VMT = vehicle miles traveled

# *Thank You*

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