# Data and New Directions in Urban Mobility

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Boston, April 20, 2016

The future, according to GM. (Alfred Eisenstaedt/Getty Images)

# What’s New?

- Demand (demographics, life-style, online shopping/optimized delivery, telecommuting)
- Vehicle owner/operator -> buying mobility
- Urban design (transit oriented)
- Ubiquitous mobile devices
- New business models– mobility on demand (Uber, Lyft, Bridj, eBay Now, Amazon…)
- New Vehicle types (Connected, Automated, Right sized, Electric)
- Ubiquitous sensors and controls (including video)
- Vast amounts of data and powerful new data tools to describe, predict, and prescribe

# Metrics

- Economic (efficiency, supply chain)
- Social (access, opportunity,equality)
- Energy & Environment (cut waste, accelerate electric)
- Health (access, safety, air quality)
- Disaster management (evacuations)

# Data

- From personal vehicles and trucks (location, speed, bumps, maintenance)
- From emergency vehicles & transit
- From Infrastructure sensors including cameras
- Weather
- Specially instrumented vehicles

# Example Analytical Challenges: Learning

**Driver Assist/ Connected, Automated Vehicles**

- Hazard detection
- Anticipate driver/pedestrian behavior
- Route planning (people & delivery)

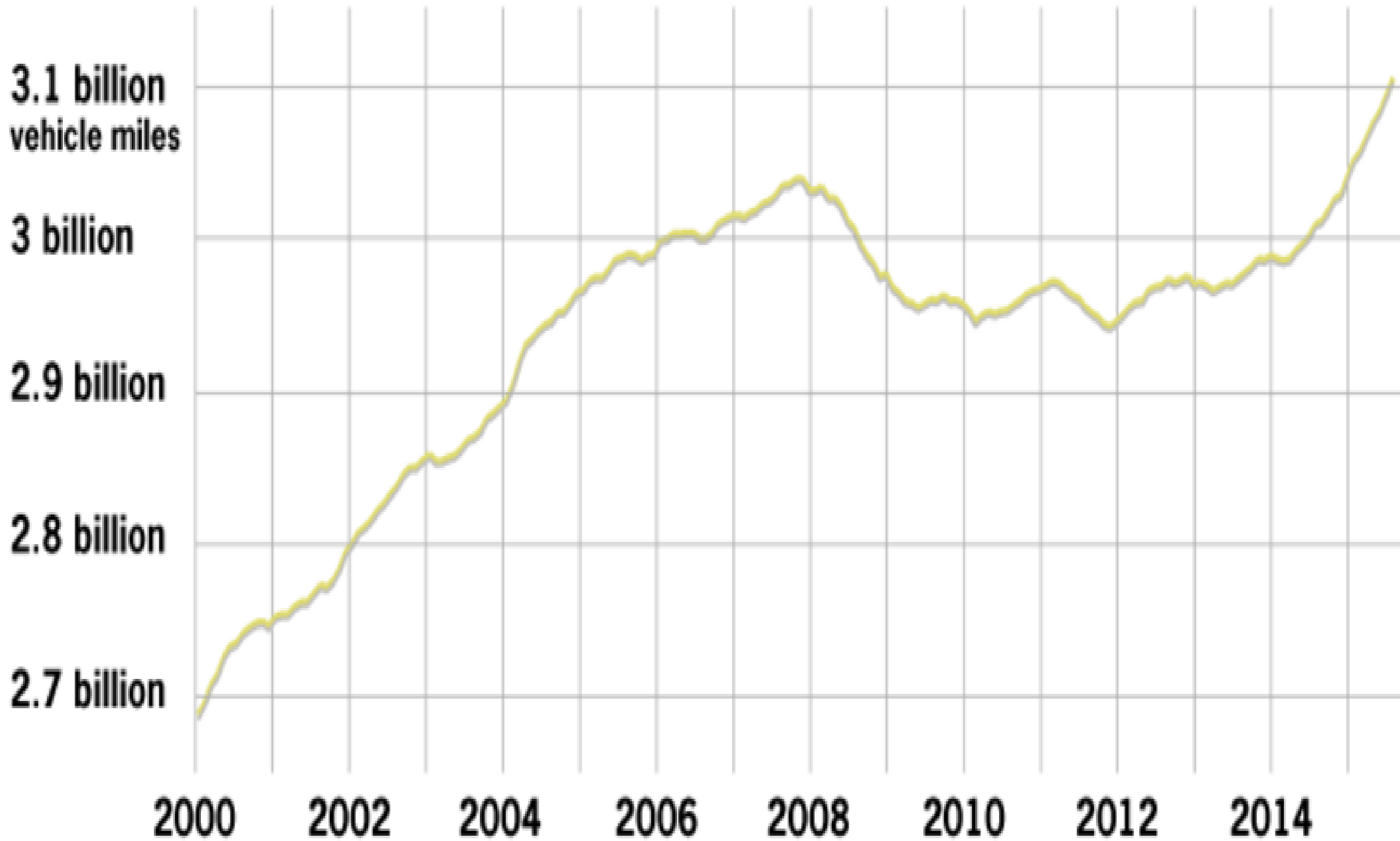
**Traffic Management**

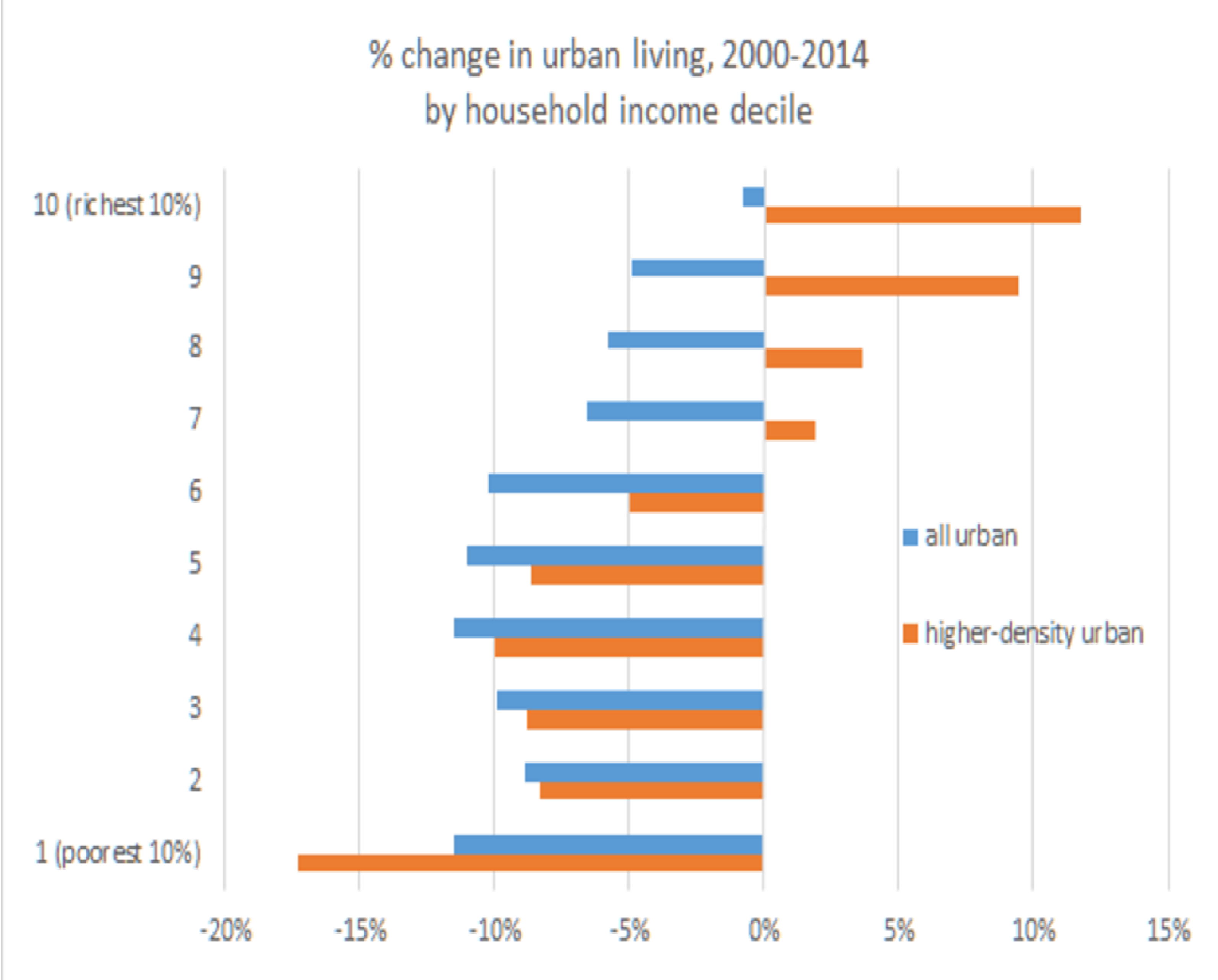
- anticipate driver route choice behavior
- manage traffic under routine conditions
- manage traffic under emergency conditions

**System Planning**

- Infrastructure/urban design
- Transit design and anticipated operations
- Simulations

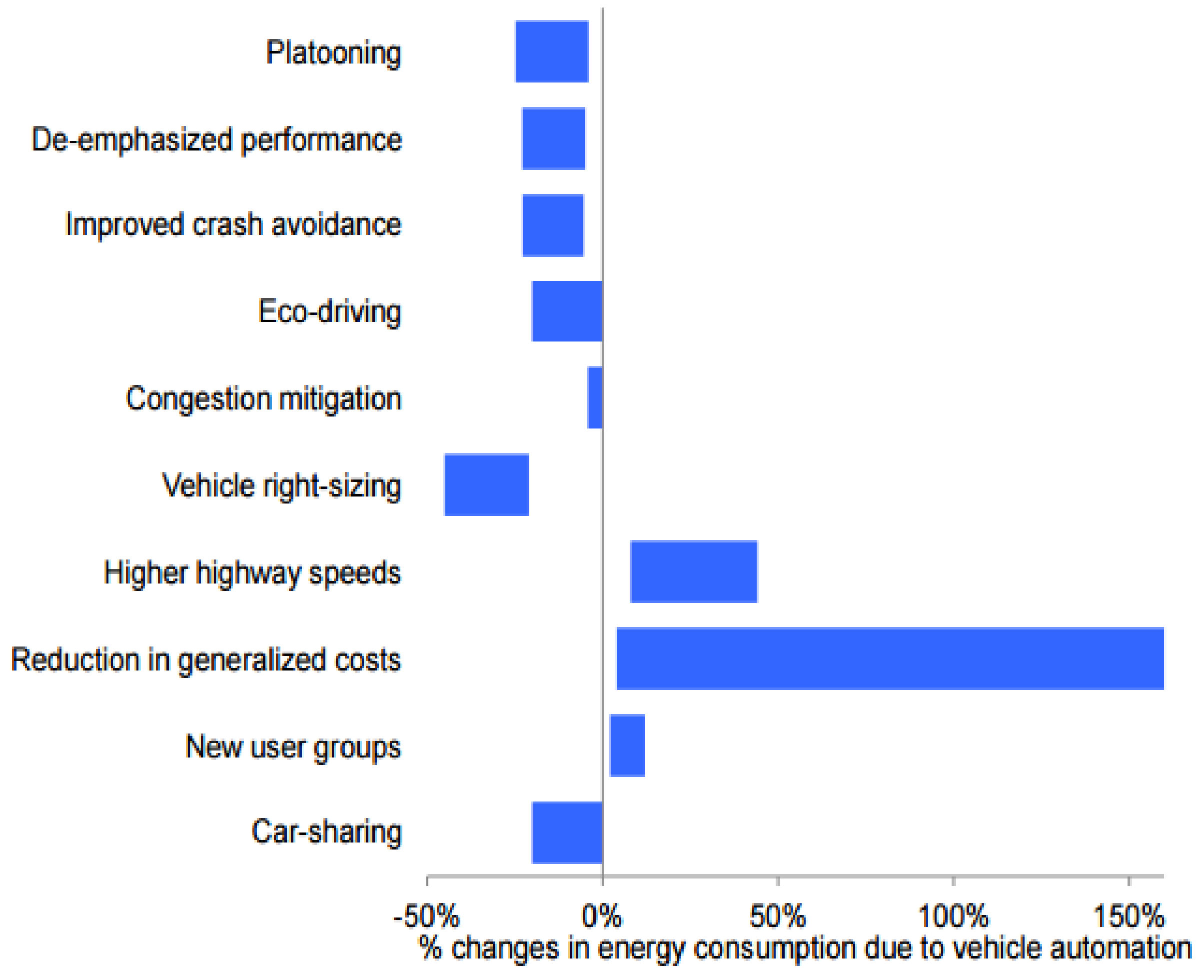
# US Vehicle Miles Traveled






Source: Kolko, Terner Center for Housing Innovation, UC Berkeley 2016

# Impact of Automated Vehicles on Energy Consumption

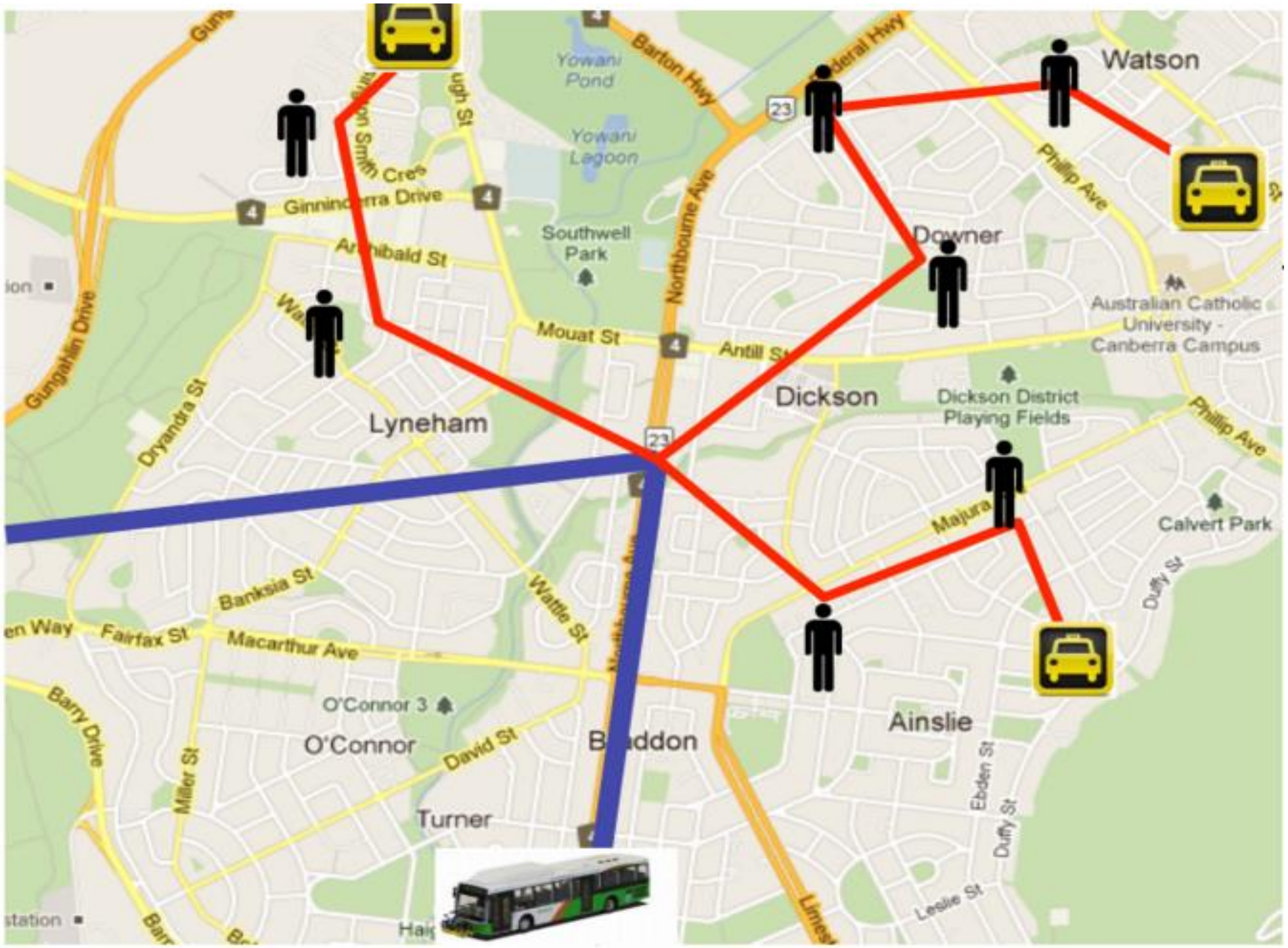



MacKenzie, Wadud, Leiby: Oak Ridge National Lab, 2014

# Energy Use Impact of Automated Vehicles

| Study | Metric | Effect Magnitude | Time Frame | Notes |
|---|---|---|---|---|
| Anderson et al. (RAND), 2014 | Fuel Economy | +100% - +1000% | 2050+ | Based on aggressive vehicle weight reductions |
| Brown et al., 2014 | Fuel Demand | -91% - +173% | 90% AV penetration | Range based on scenarios with different effects |
| Fagnant & Kockelman (Eno Center), 2013 | VMT | +9% | 90% AV penetration | Estimates also given for lower market share; fuel efficiency gains assumed |
| | Fleet size | -42.6% | | |
| Fagnant & Kockelman, 2014 | Energy use | -12% | Fleet is all shared AVs | Per shared AV, vs. avg. light-duty vehicle |
| | GHG | -5.1% | | |
| Spieser et al., 2014 | Fleet Size | -66% | Fleet is all shared AVs | No energy-only outputs modeled |

Raphael Barcham Goldman School of Public Policy, UCB 2014



Watson
Yowani Pond
Yowani Lagoon
Barton Hwy
Southwell Park
Northbourne Ave
Downer
Phillip Ave
Australian Catholic University - Canberra Campus
Mouat St
Dickson
Dickson District Playing Fields
Lyneham
Gungahlin Drive
Dryandra St
Calvert Park
Banksia St
Wattle St
Fairfax St
Macarthur Ave
O'Connor 3
O'Connor
David St
Turner
Ainslie
Ebden St
Duffy St
Leslie St
Barry Drive
Miller St

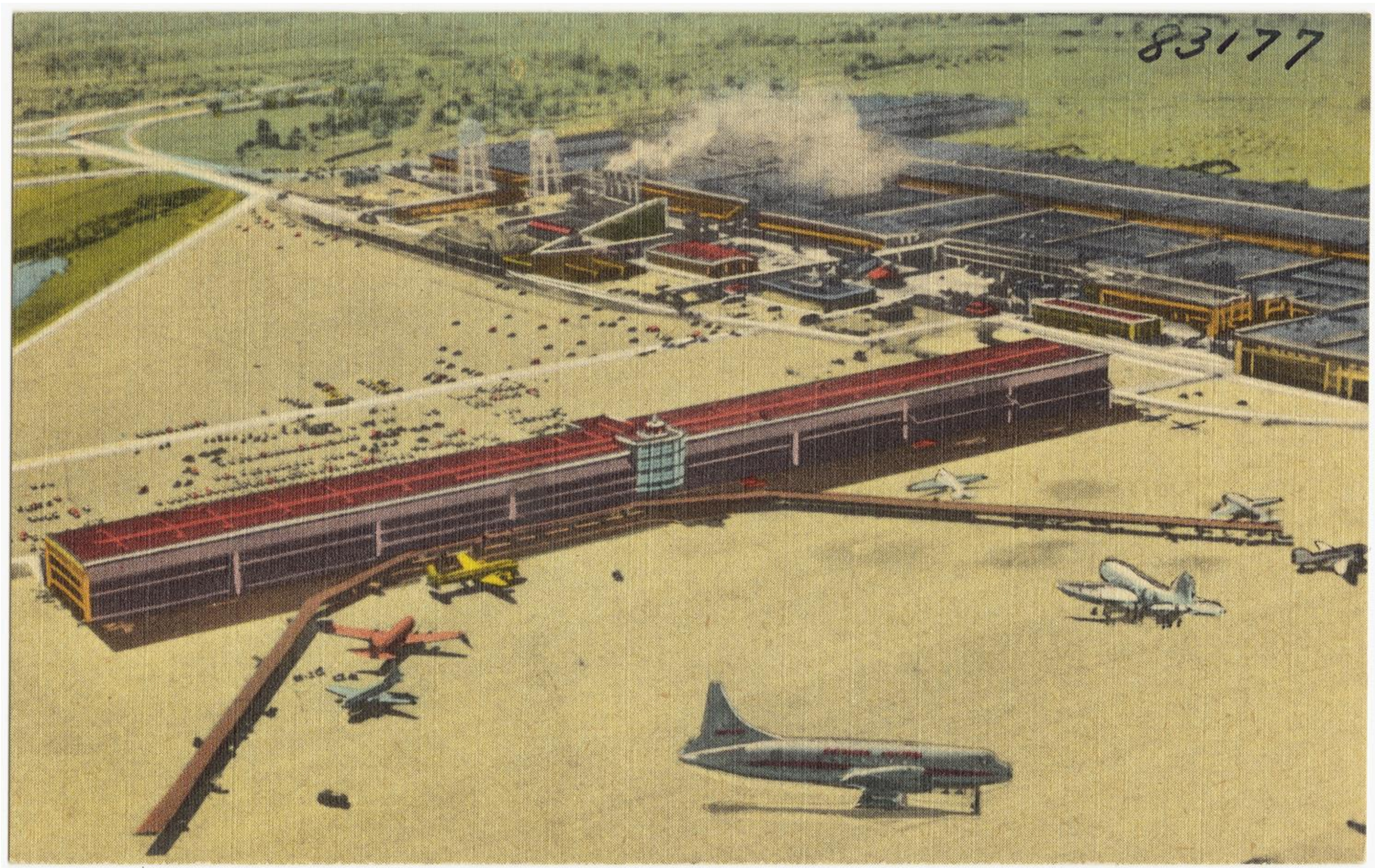
# Mobility Transformation Center

- Ann Arbor: Up to 9,000 equipped vehicles (cars, trucks, bus, bicycle, pedestrian)
- SE Michigan: 20,00 connected vehicles, 500 nodes, 5000 devices
- Ann Arbor Automated Vehicle Fleet Operational Test in M City
  - 27 square miles of coverage, including surrounding highways as well as city and suburban streets.
  - Equipped infrastructure (Mcity) includes
    - 45+ intersections
    - 3 curve-related sites
    - 12 freeway sites
  - All dedicated short-range communications (DSRC) logged
  - Testing selected vehicle-to-infrastructure functions

# Current Research Topics

- Legal and Regulatory Issues CAV
- Cybersecurity Roadmap
- Remote Intrusion Detection
- Transfer-of-Control During Automated Driving
- Drivers' Adaptation Behavior
- Age-related Differences in Driver
- Parking Guidance System in Ann Arbor
- Improving fuel economy of heavy-duty vehicles using vehicle-to-vehicle communication
- Cybersecurity Testing Center
- Simulating vehicle automation

# Willow Run: 335 Acres



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