CUTR
CENTER for URBAN TRANSPORTATION RESEARCH

From Millennials to Uber to Autonomous Vehicles: How Demographics, Economics and Technologies are Changing Transportation

2015 Southeastern Regional Transit Conference

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Center for urban Transportation Research
University of South Florida
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Outline

1. What is going on in travel demand and Transit?
2. How will emerging demographic and technology trends change things?
3. What should we do about it now?

Source: Detroit News research, Google

The Detroit News

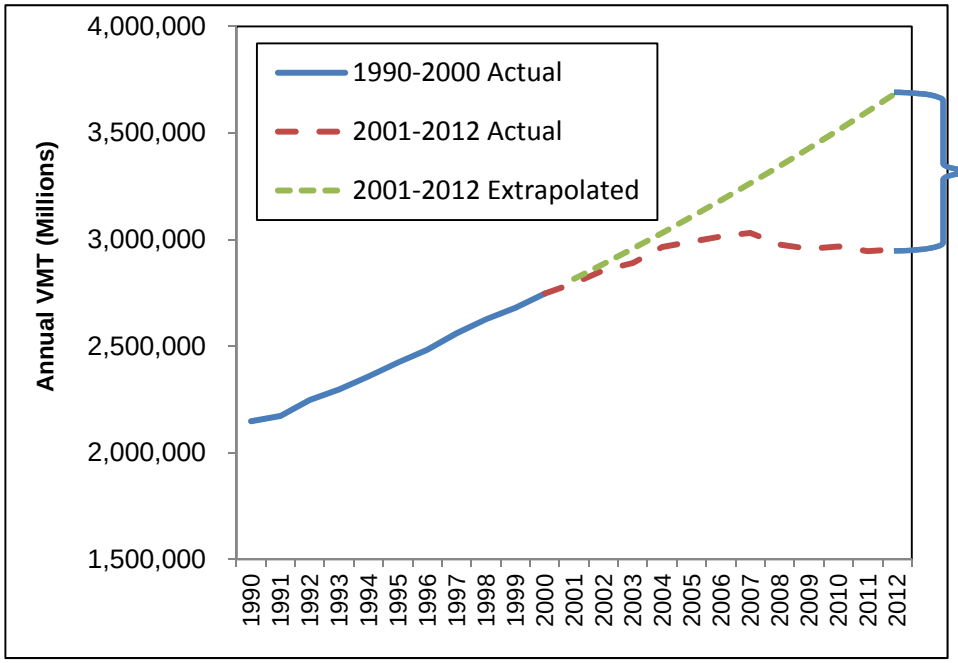
Which grew faster last Year:

Population?

VMT?

Transit Ridership?

Changes in VMT and Capacity – U.S.



≈ 25%

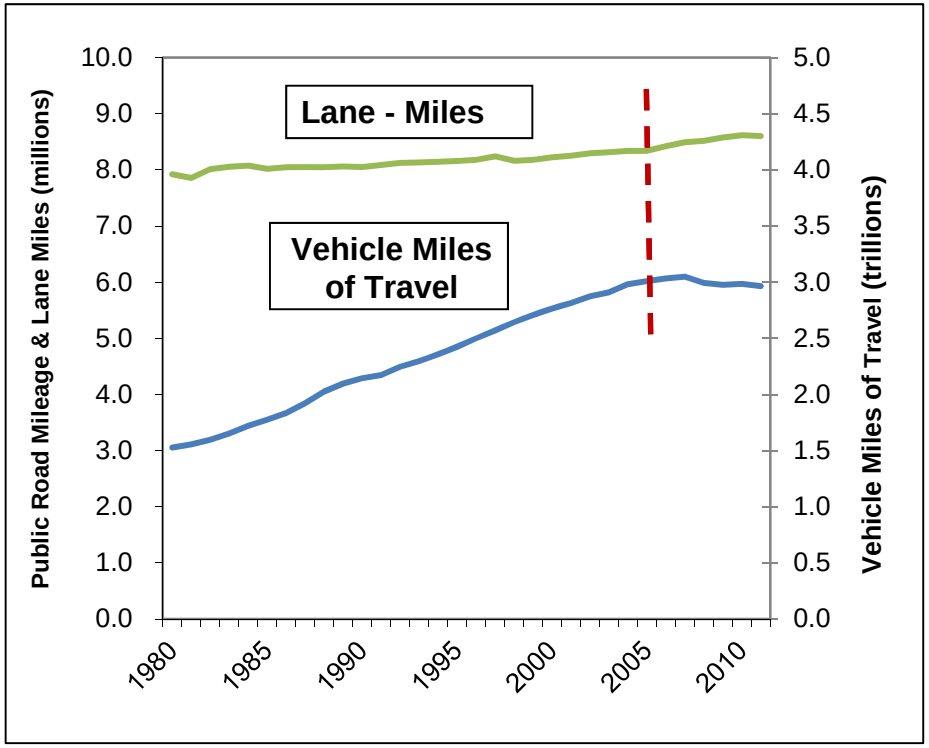
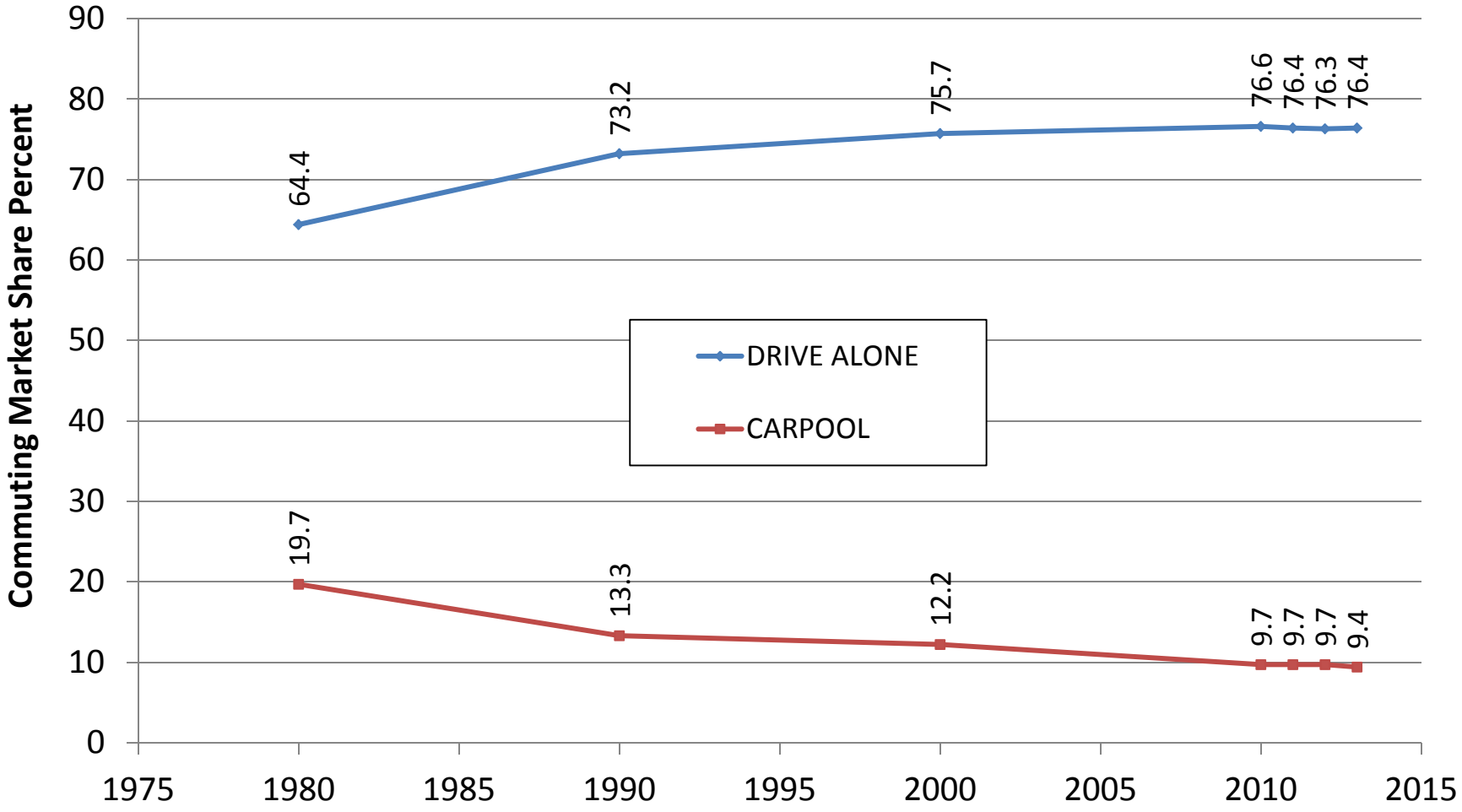


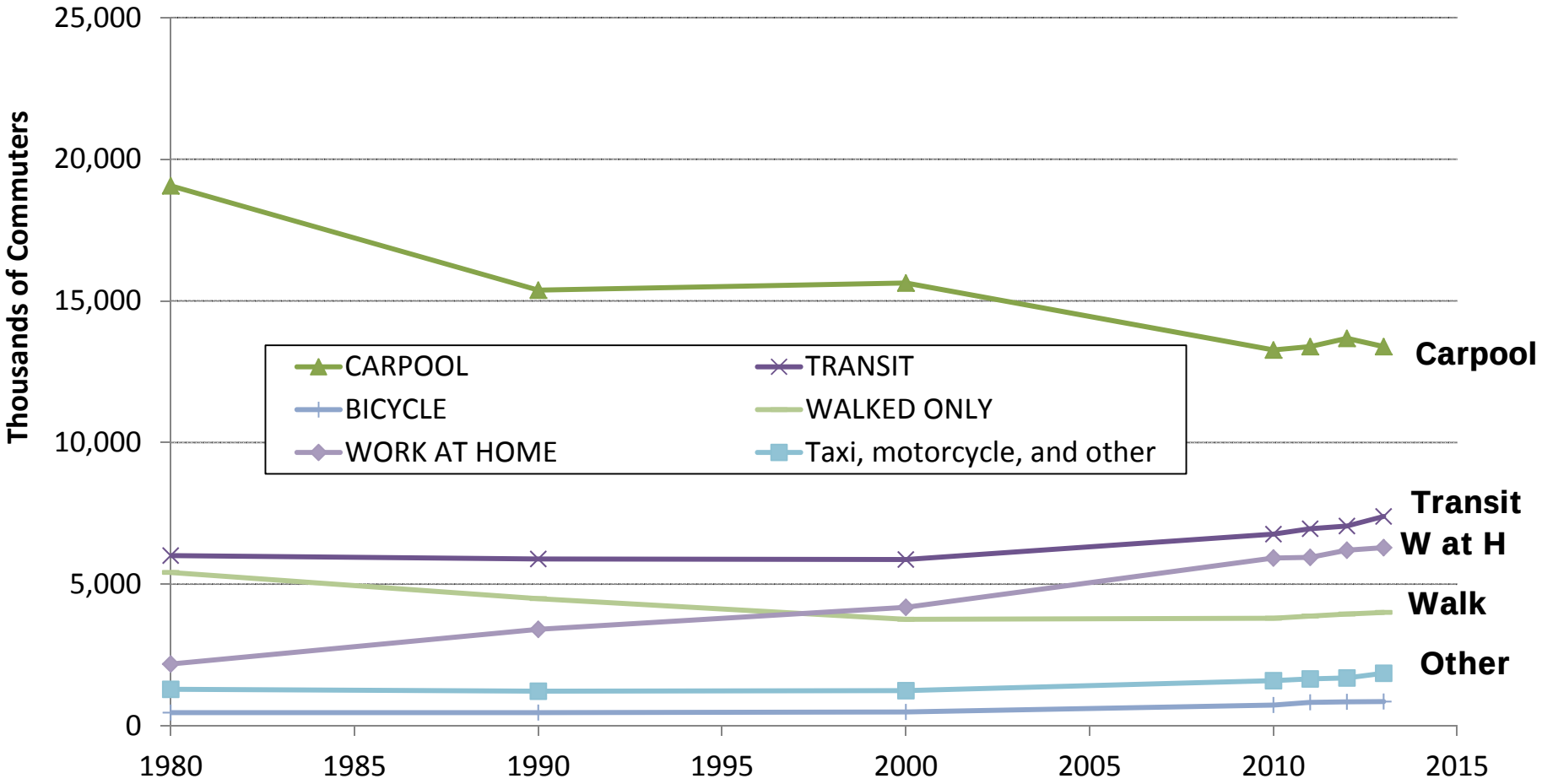
Table 2-1 Commuting in Perspective

Household Travel						
	Travel by All Modes 2009			Private Vehicle Travel 2009		
	Percent of Person Trips	Percent of Person Miles of Travel	Percent of Person Travel Time	Percent of Person Travel Time	Percent of VMT	Percent of Total Roadway VMT
Commuting	15.6	19	18.8	17.9	**27.8**	
Work Related/Business Travel	3	6.3	4.6	5.2	9	**76**
Other Resident Travel	81.4	74.7	76.6	76.9	63.2	
Subtotal	100%	100%	100%	100%	100%	
Public and Commercial Travel						
Public Vehicle Travel						2
Utility/Service Travel						12
Freight and Goods Movement Travel						10
Total						100%

Drive Alone and Carpool Mode Share

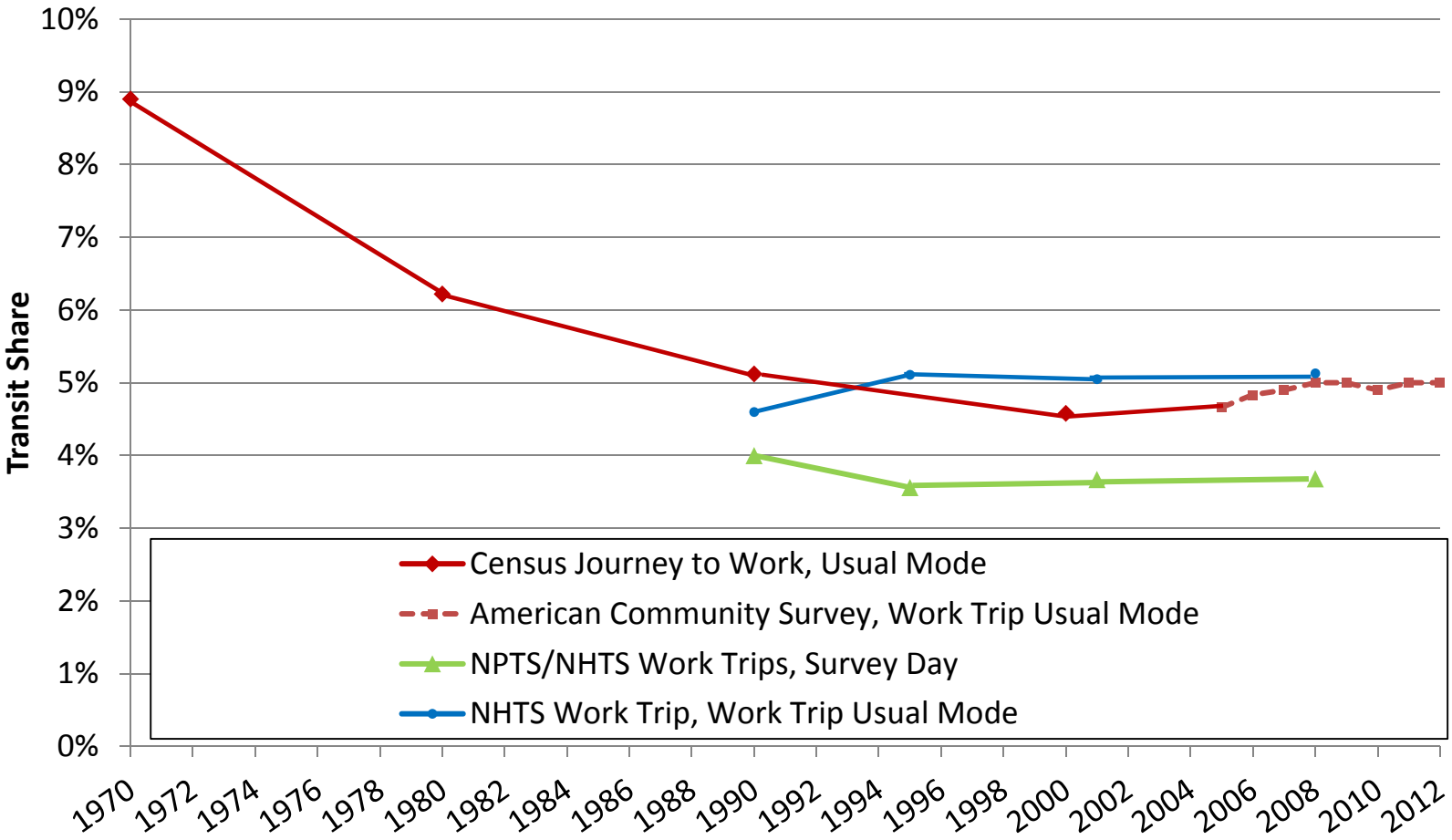


"Usual Commute" Market Size



Source: Census, American Community Survey

Figure 13-1 Long-Term Trends in Transit Mode Share



Commuting in America, 2013, Brief 13, AASHTO

Figure 13-7 Trend in Mode Use with Time in America

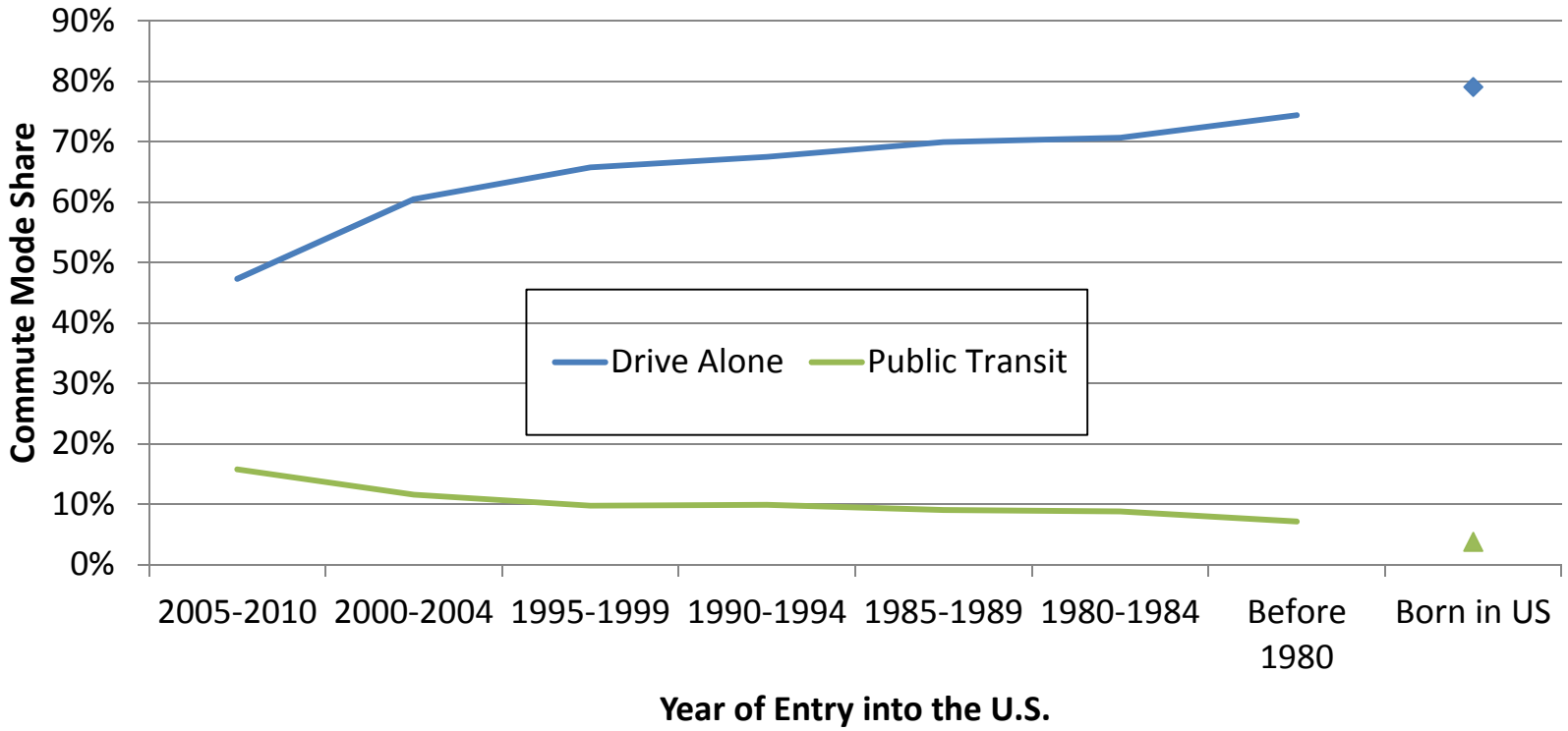


Figure 13-9 Transit Commuter Mode Shares by Household Income Category

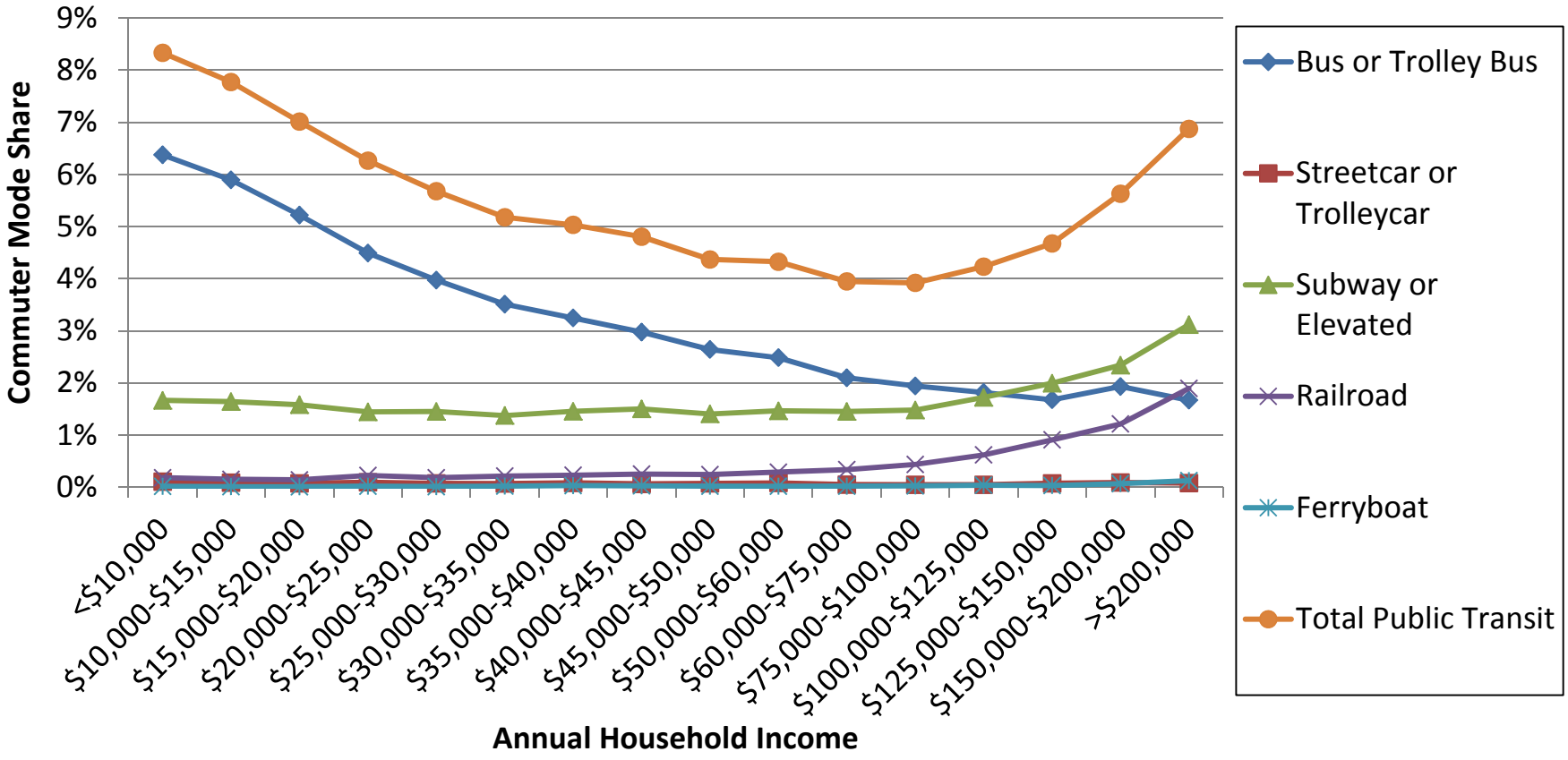
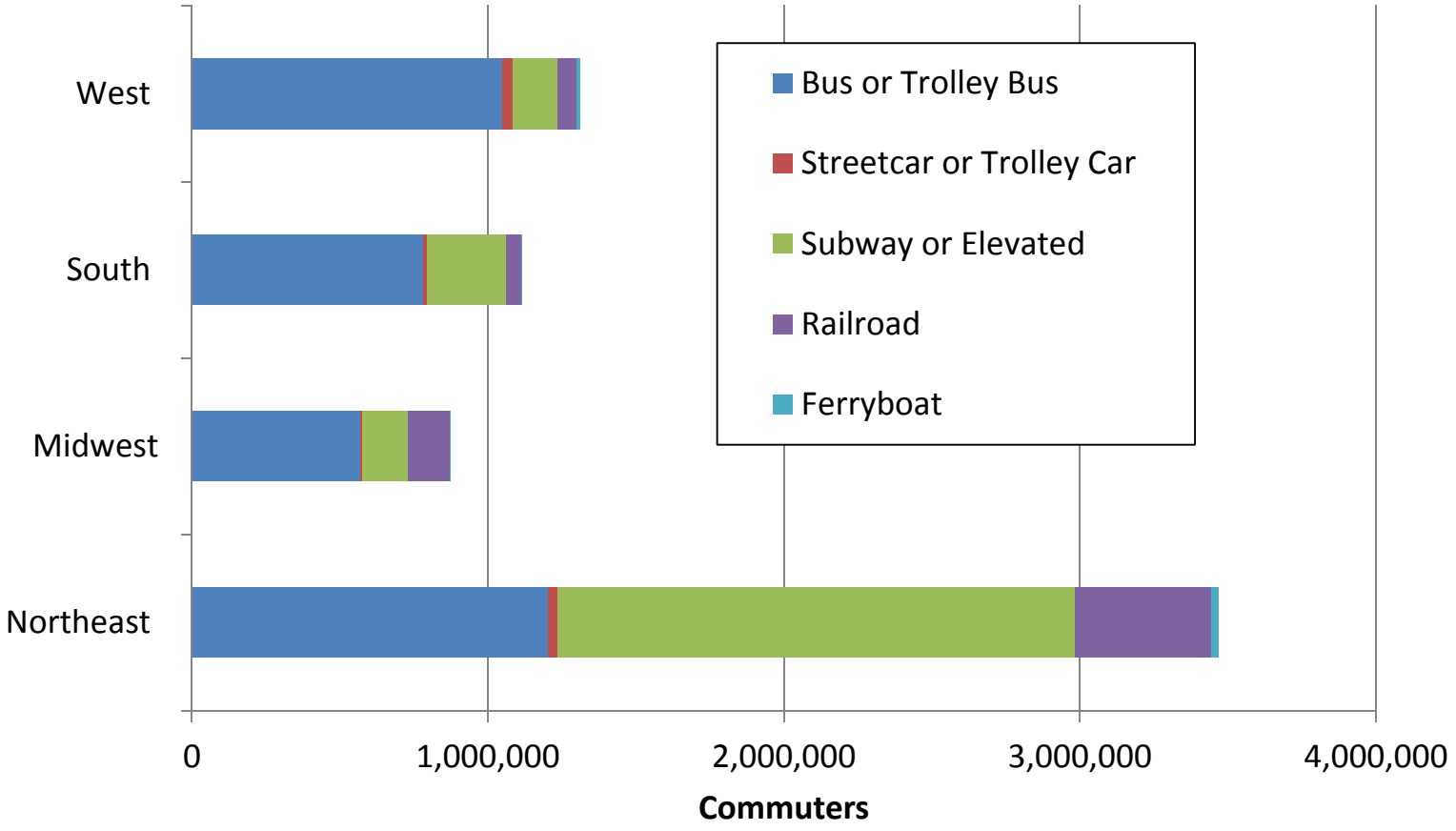


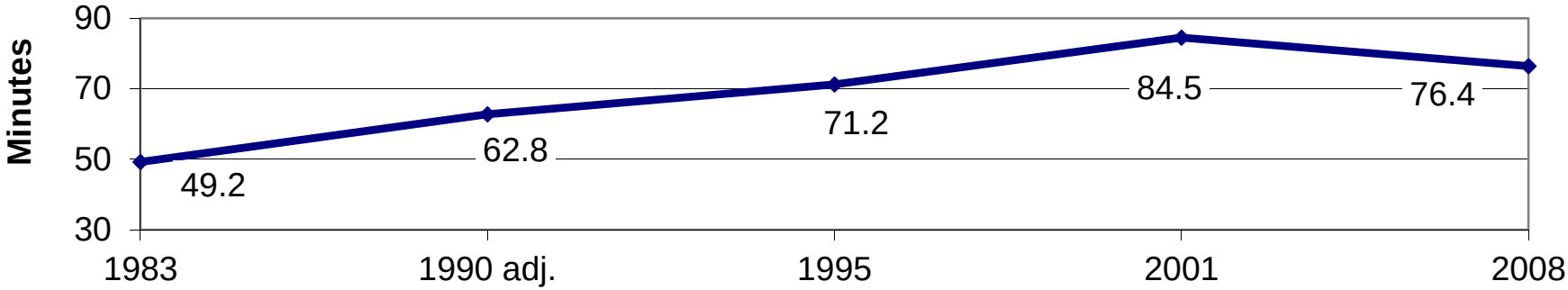
Figure 13-3 Transit Commuting by Region and Transit Sub Mode by Region



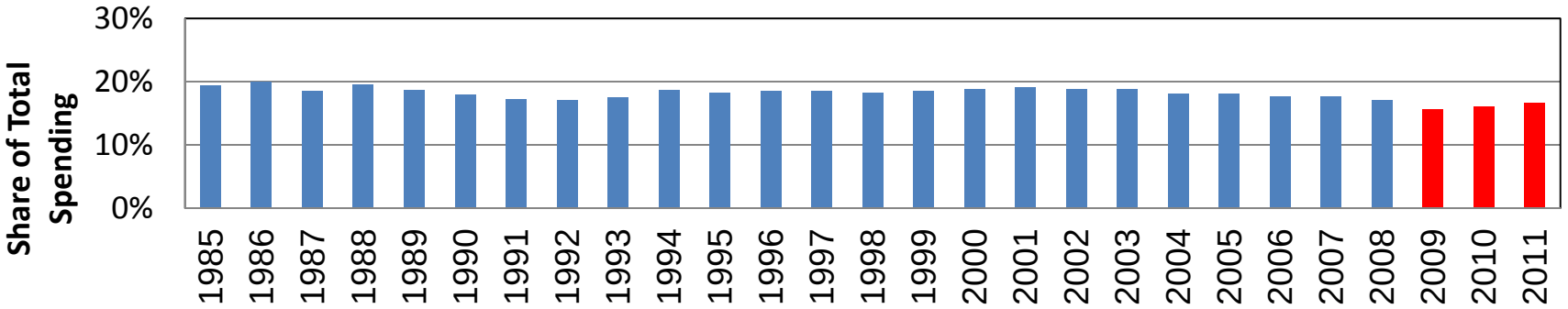
Commuting in America, 2013, Brief 13, AASHTO

Transportation is Profoundly Important

- Consumes approximately 76 minutes per day per person

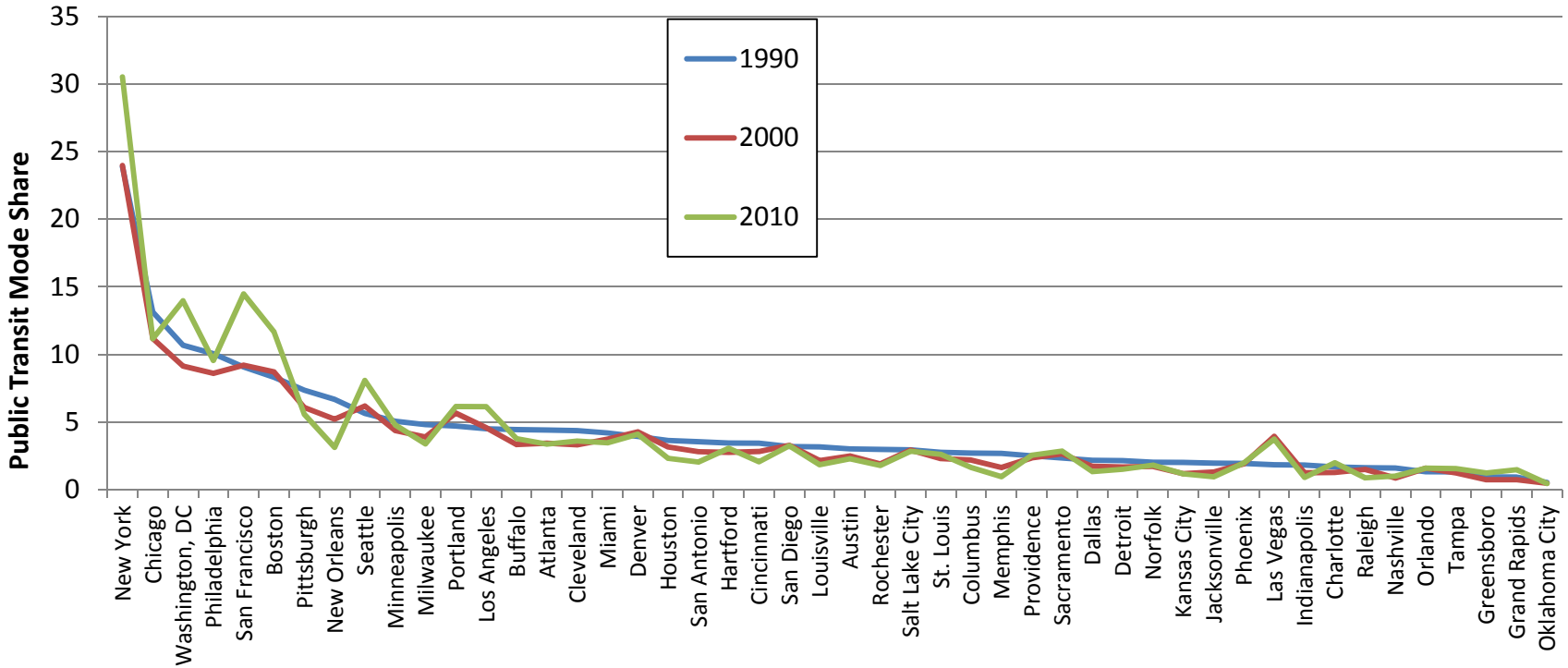


- Consumes approximately 17% of household spending



Sources: National Household Travel Survey, Consumer Expenditure Survey

Figure 13-5 Twenty-Year Trend in Public Transit Shares among Metropolitan Areas with 1+ Million Population



Commuting in America, 2013, Brief 13, AASHTO

Figure 13-6 Public Transit Share by Metro Size Group

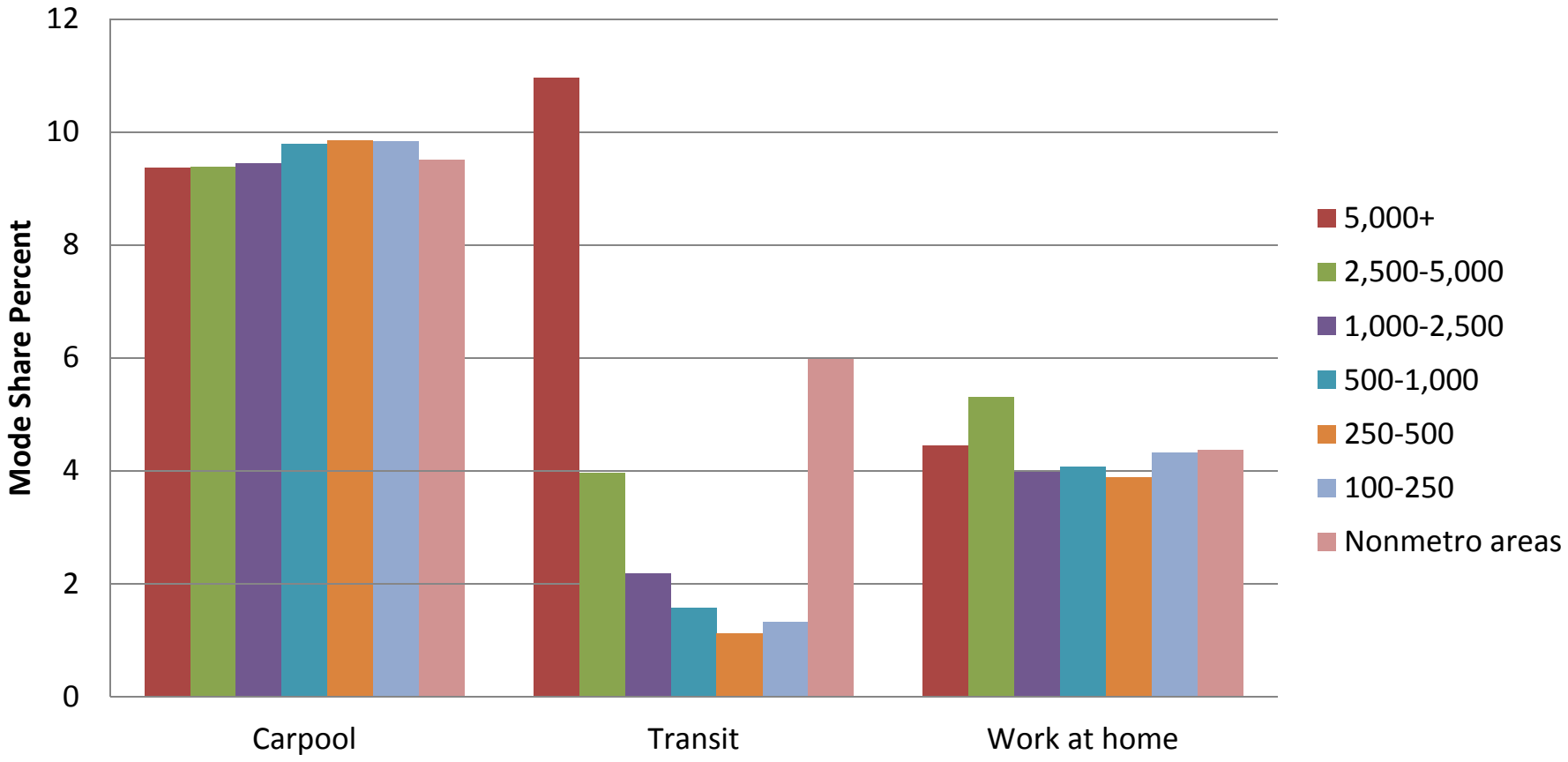
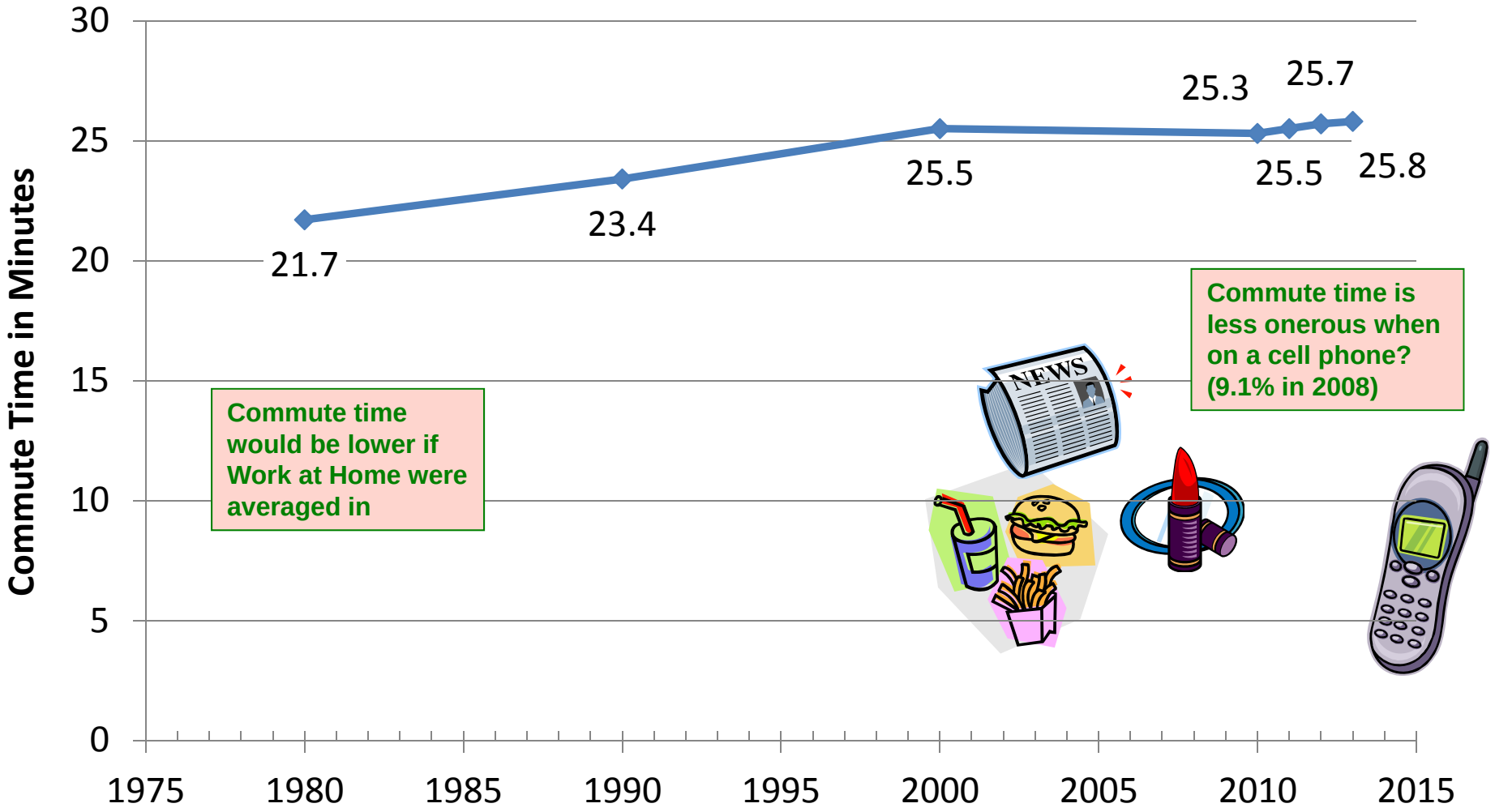


Table 13-2 Metro Areas with Major Changes in Public Transit Share, 2000-2010

Gaining Share	Difference in Percentage Points, 2000–2010		Losing Share	Difference in Percentage Points, 2000–2010
New York	6.55		Las Vegas	-0.2
San Francisco	5.27		Miami	-0.28
Washington, DC	4.83		Louisville	-0.3
Boston	2.97		Indianapolis	-0.34
Seattle	1.88		Jacksonville	-0.35
Los Angeles	1.55		Dallas	-0.39
Philadelphia	0.95		Pittsburgh	-0.5
Grand Rapids	0.75		Milwaukee	-0.51
Charlotte	0.72		Columbus	-0.54
Greensboro	0.5		Raleigh	-0.62
Portland	0.49		Memphis	-0.67
Buffalo	0.44		Cincinnati	-0.75
Minneapolis	0.42		San Antonio	-0.77
St. Louis	0.32		Houston	-0.84
Tampa	0.31		New Orleans	-2.09

Commuting in America, 2013, Brief 13, AASHTO

Commute Time Trends: The Stable Decade



Source: Census, American Community Survey

2005 National Household Travel Survey (NHTS) and National Highway Traffic Safety Administration (NHTSA).

Figure 13-11 Trip Duration Distribution Transit Versus Drive Alone

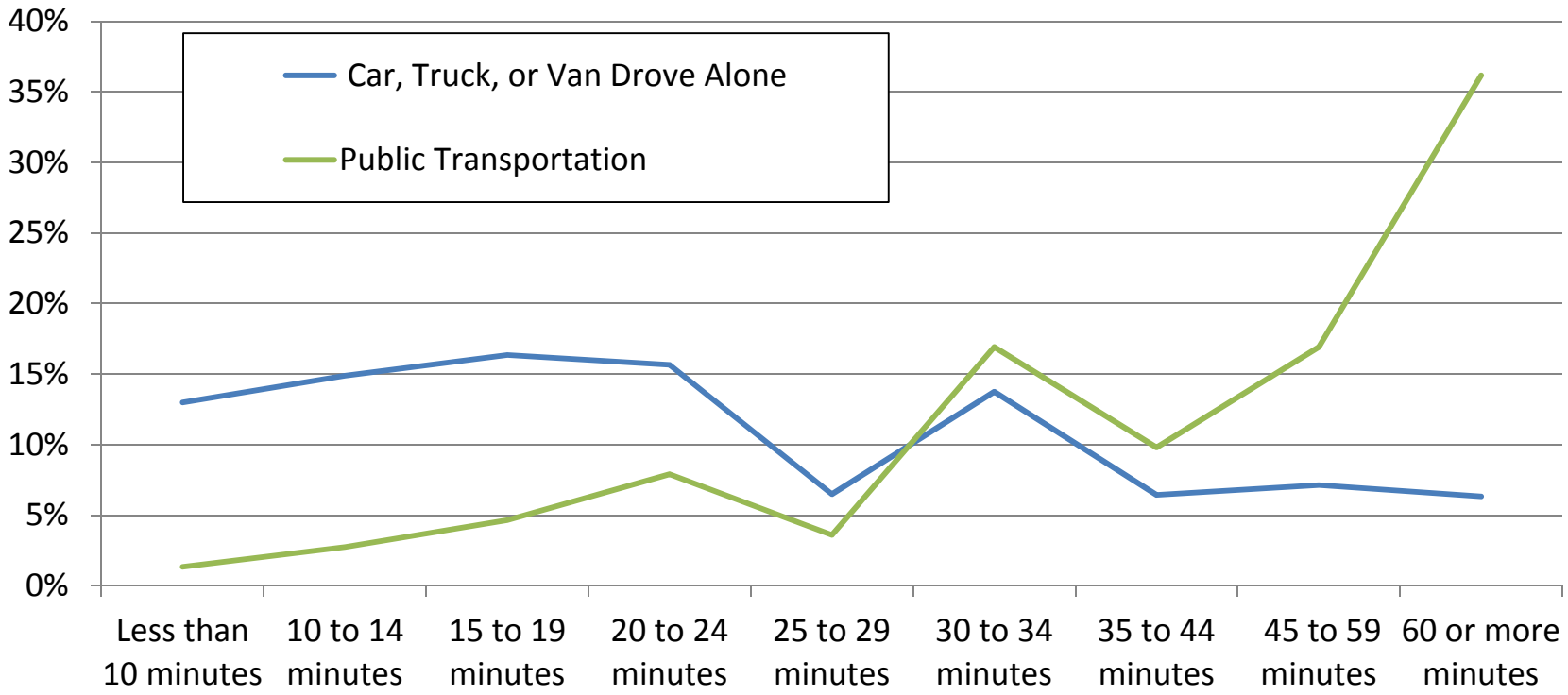
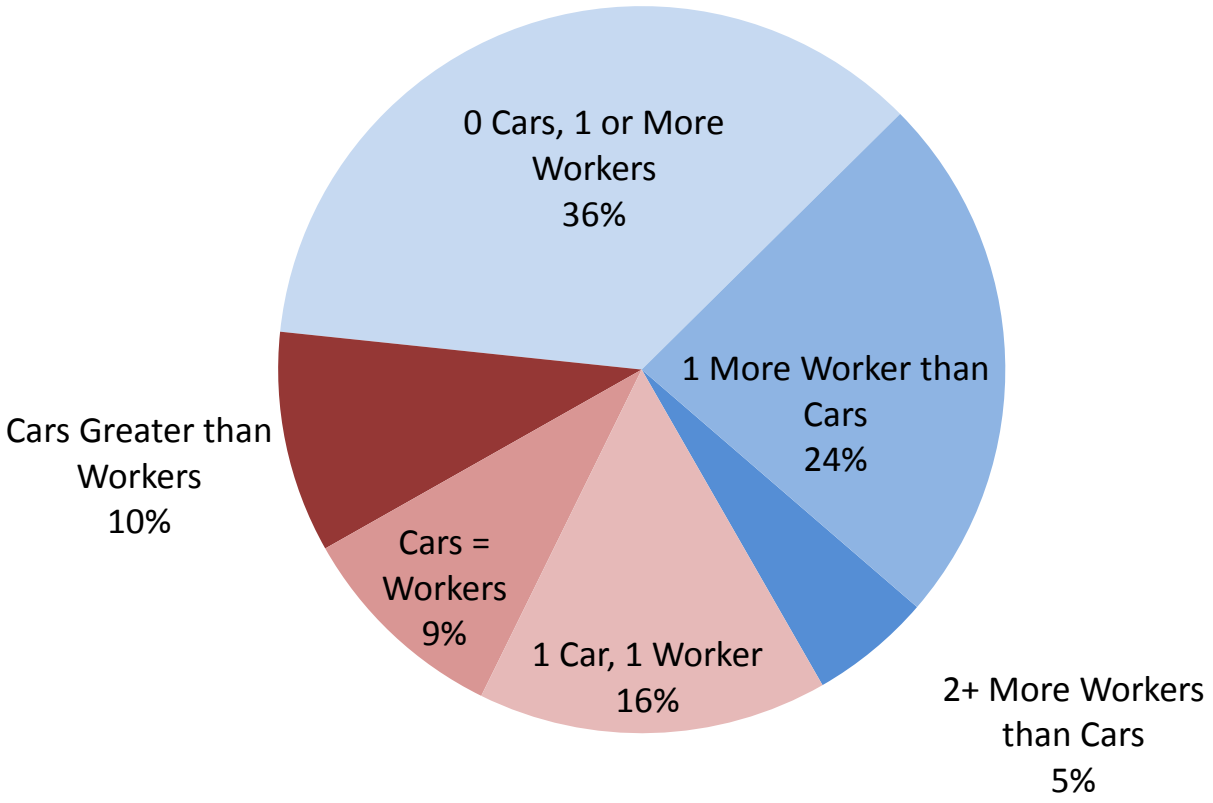


Figure 13-10 Transit Commuting by Household Car Availability



Commuting in America, 2013, Brief 13, AASHTO

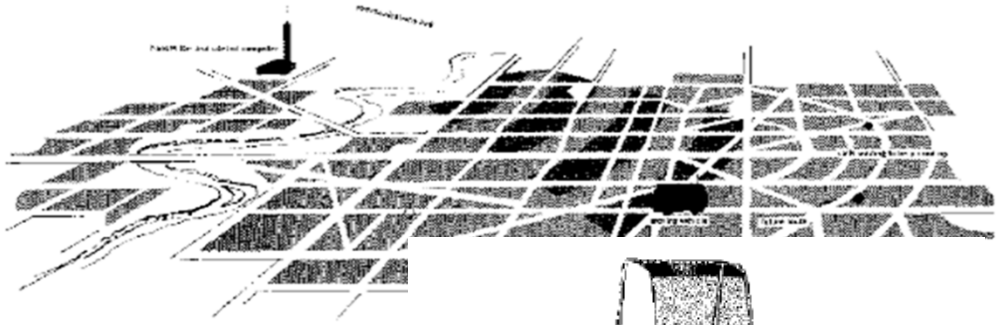
Prognosticating the Future of Transportation

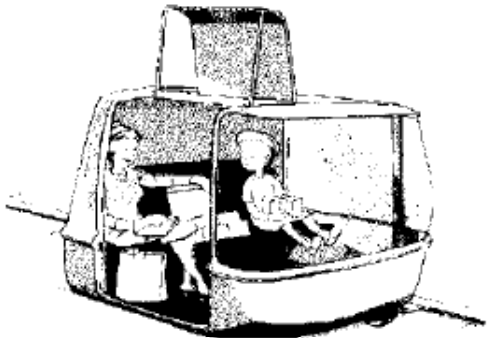
"Prediction is very difficult, especially if it's about the future."

Nils Bohr, Nobel laureate in Physics

Prognosticating

A Dial-a-Bus, with it's position established by automatic vehicle monitoring, can be routed by computer and a communication link to collect passengers who have called for service.

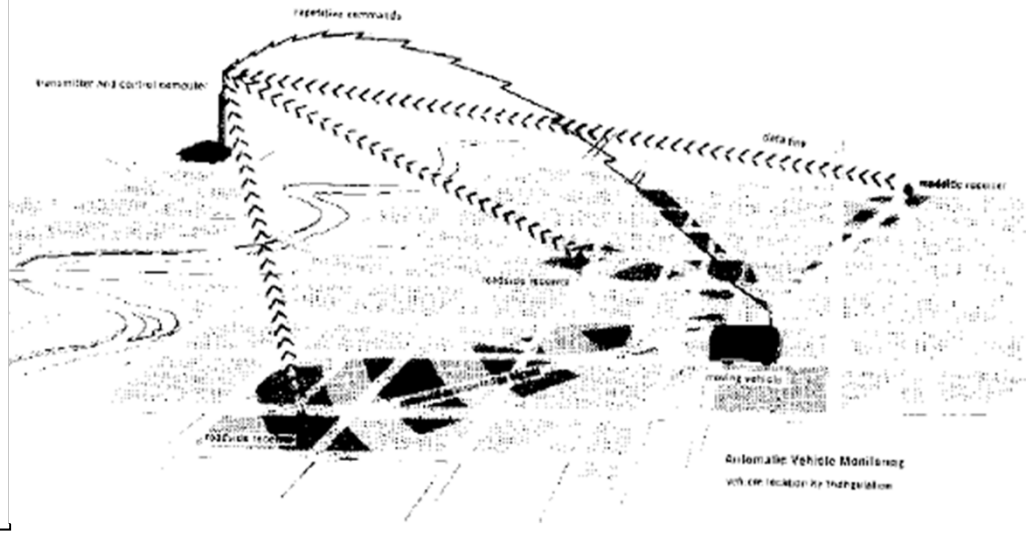




tomorrow's transportation

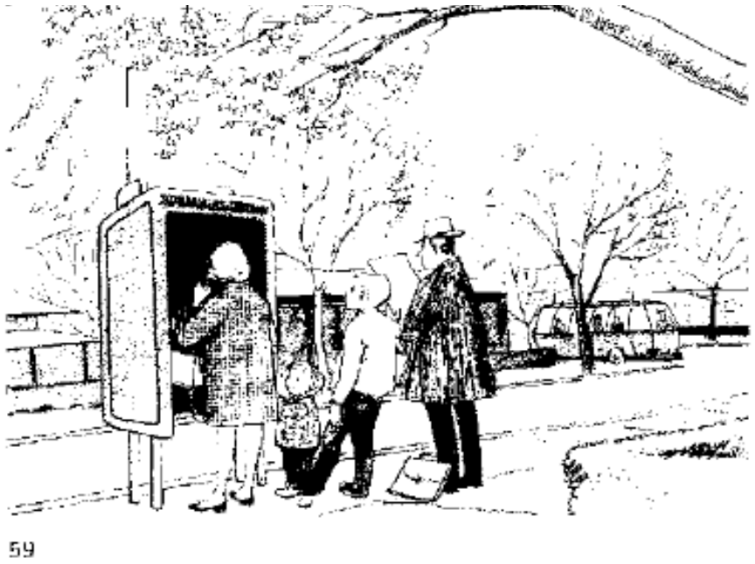
NEW SYSTEMS FOR THE URBAN FUTURE

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Office of Metropolitan Development, Urban Transportation Administration
Washington, D.C. 1968



We Can't Always Predict

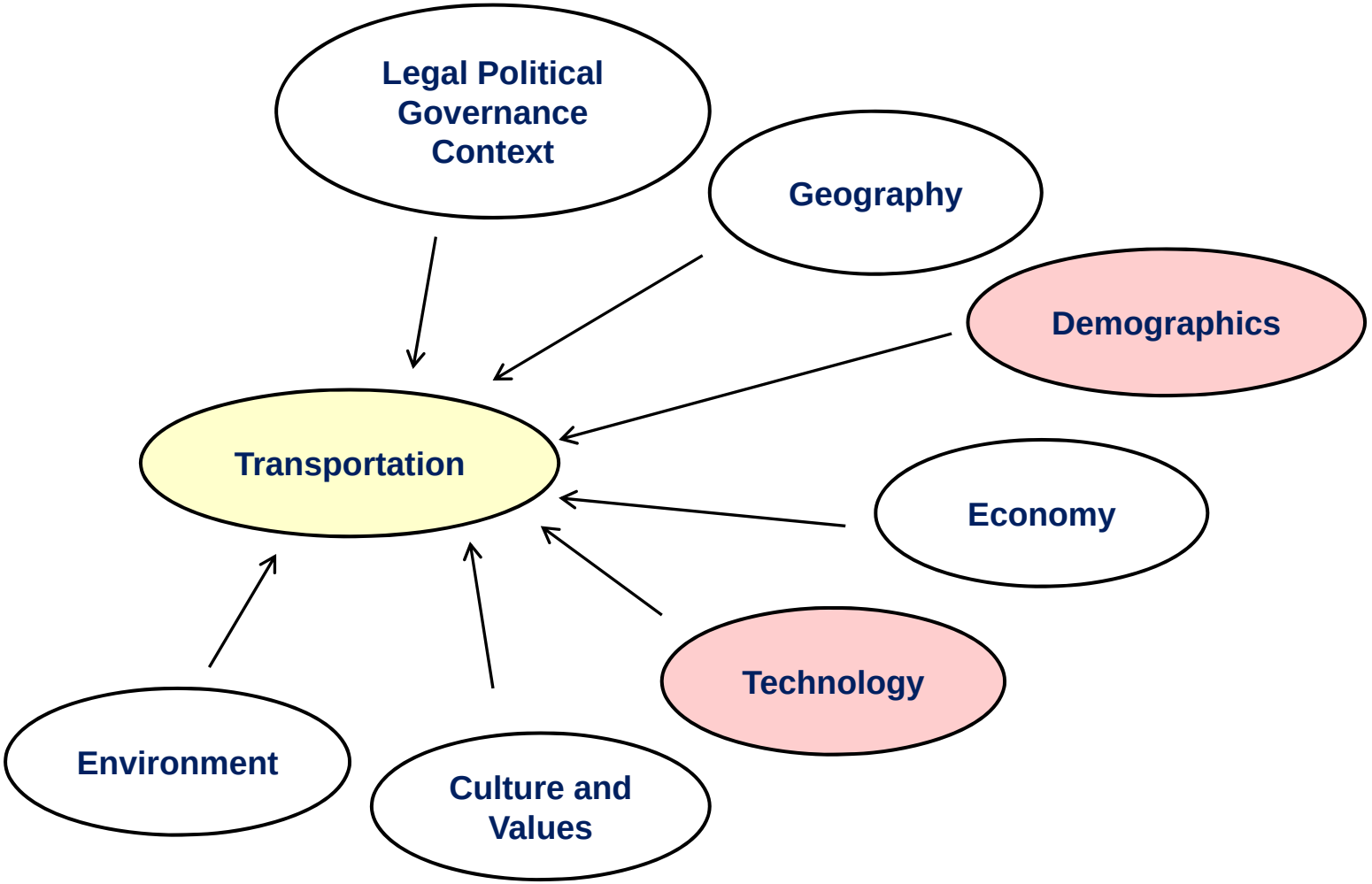
"***Dial-a-bus call stations could be installed at convenient intervals throughout a suburban area***."



Source: *Tomorrow's Transportation, New Systems for the Future*, 1968

- Weather
- Next election
- Hot toys for Christmas
- Box office success
- Hot stocks
- Pace of technology deployment

Everything Affects Transportation and Transportation Affects Everything



Fundamental Economic and Demographic Changes

Student Loans Could Cripple the U.S. Economy…
…student debt reaching almost $1.2 trillion last year, its highest level ever.
- Bloomberg Business, May 2015

Hispanics to reach 23% of the U.S. population by 2035
- Washington Examiner, May 2015

U.S. Birth Rate Hovers at All-Time Low
- Health Day, May 2015

Millennials make up the largest share of the U.S. workforce…
- Wall Street Journal May 2015

Women now hold the majority (52%) of management and professional related positions…
- BMO Wealth Institute March 2015

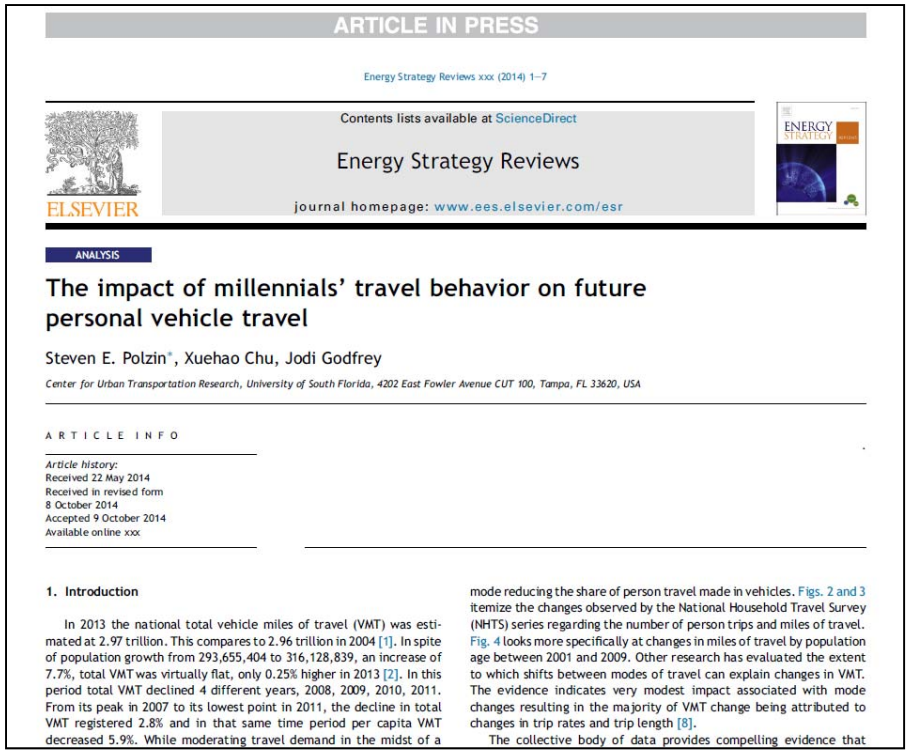
Homeownership Rate Drops to Quarter-Century Low
- Market Watch, April 2015

Census: Immigrant Population to Explode 85 Percent by 2060…
- Breitbart.com, March 2015

Millennial Demographics

- Urban/rural residency
- Race/ethnicity
- Labor force/ education participation
- Income/economic status
- Living arrangements
- Lifecycle status
- Licensure status
- Vehicle availability
- Values

- Propensity to use technology as a substitution for travel



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journal homepage: www.ees.elsevier.com/esr

ANALYSIS

The impact of millennials' travel behavior on future personal vehicle travel

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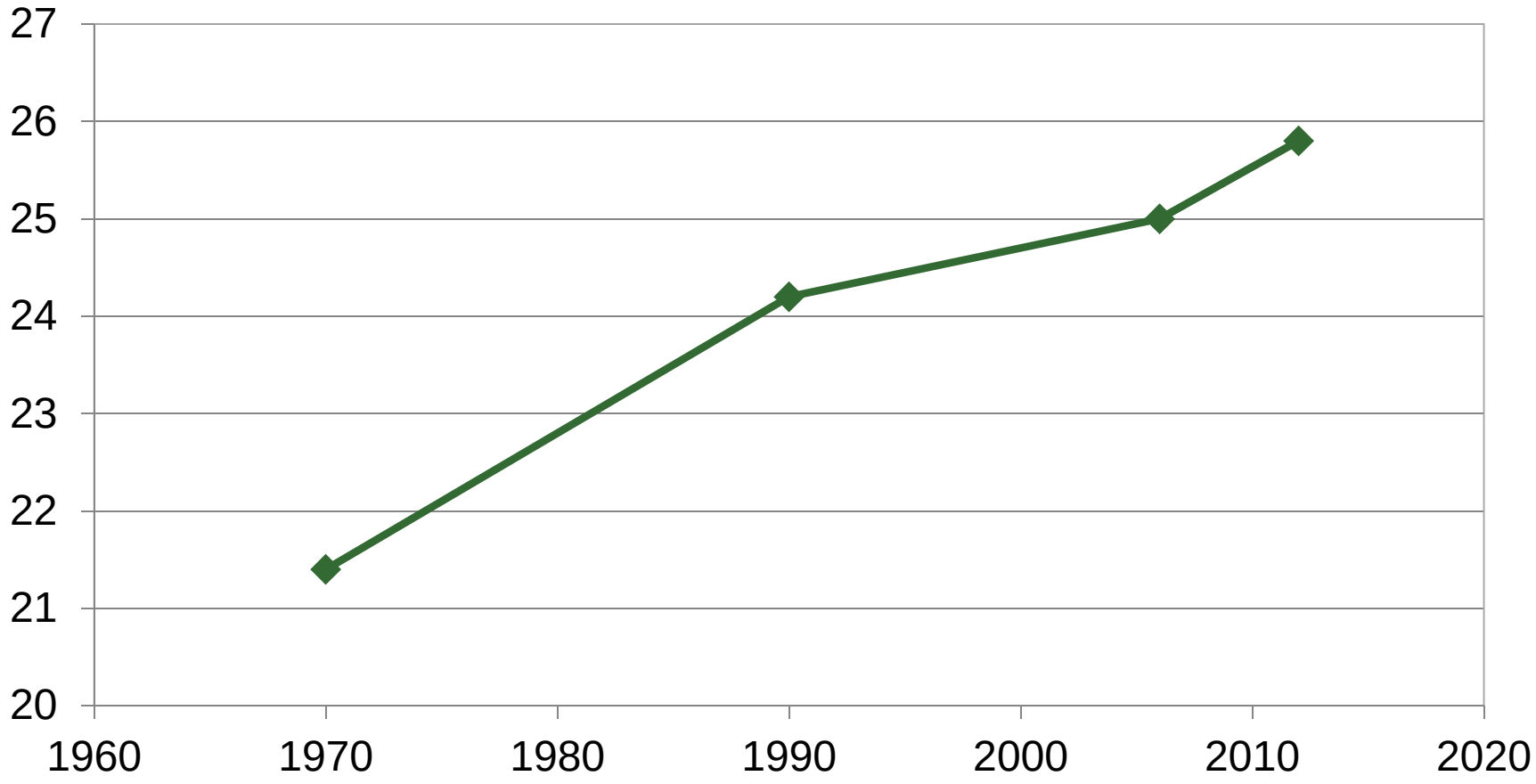
1. Introduction

In 2013 the national total vehicle miles of travel (VMT) was estimated at 2.97 trillion. This compares to 2.96 trillion in 2004 [1]. In spite of population growth from 293,655,404 to 316,128,839, an increase of 7.7%, total VMT was virtually flat, only 0.25% higher in 2013 [2]. In this period total VMT declined 4 different years, 2008, 2009, 2010, 2011. From its peak in 2007 to its lowest point in 2011, the decline in total VMT registered 2.8% and in that same time period per capita VMT decreased 5.9%. While moderating travel demand in the midst of a mode reducing the share of person travel made in vehicles. Figs. 2 and 3 itemize the changes observed by the National Household Travel Survey (NHTS) series regarding the number of person trips and miles of travel. Fig. 4 looks more specifically at changes in miles of travel by population age between 2001 and 2009. Other research has evaluated the extent to which shifts between modes of travel can explain changes in VMT. The evidence indicates very modest impact associated with mode changes resulting in the majority of VMT change being attributed to changes in trip rates and trip length [8].

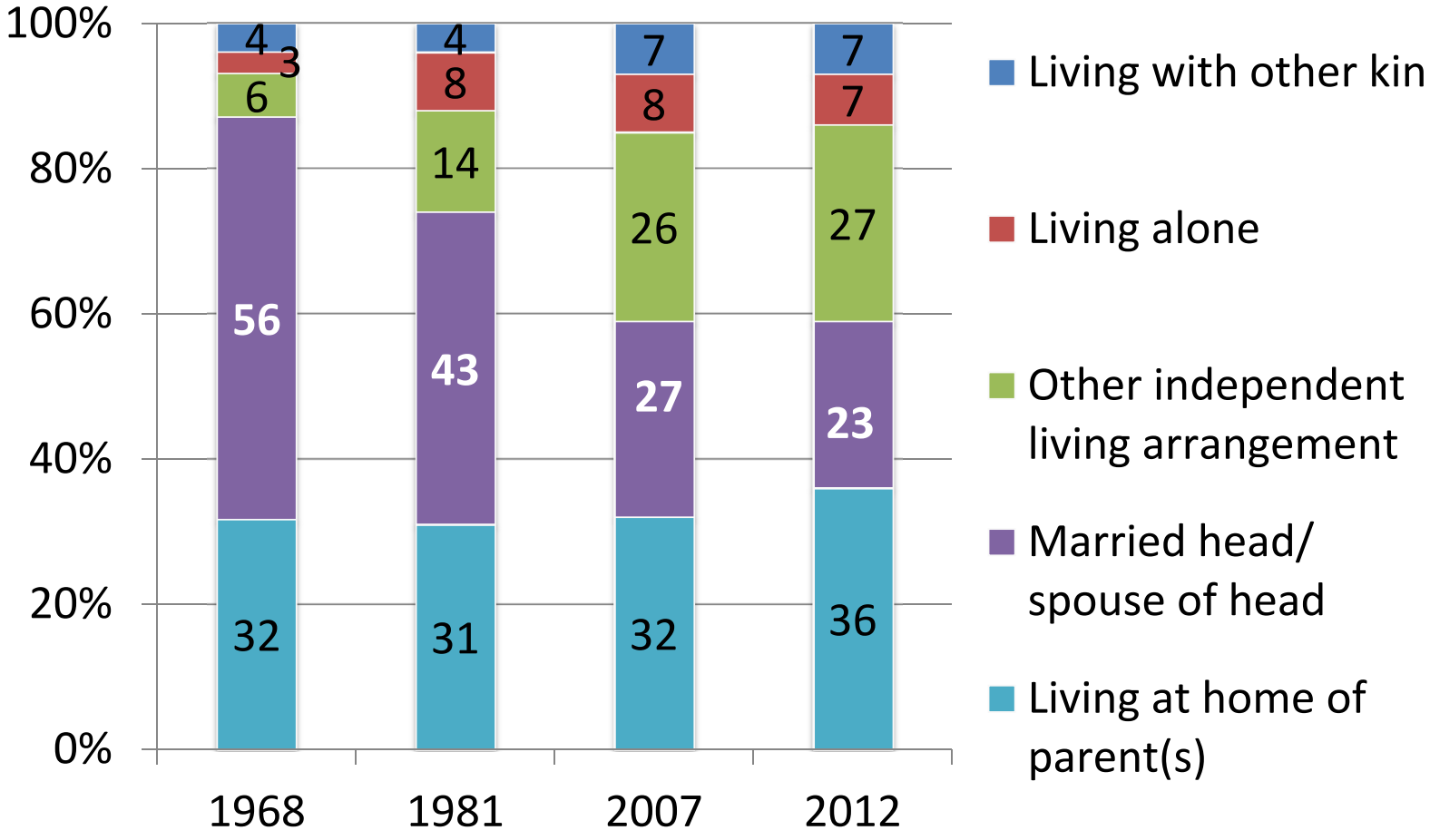
The collective body of data provides compelling evidence that

Age of Mother at First Birth



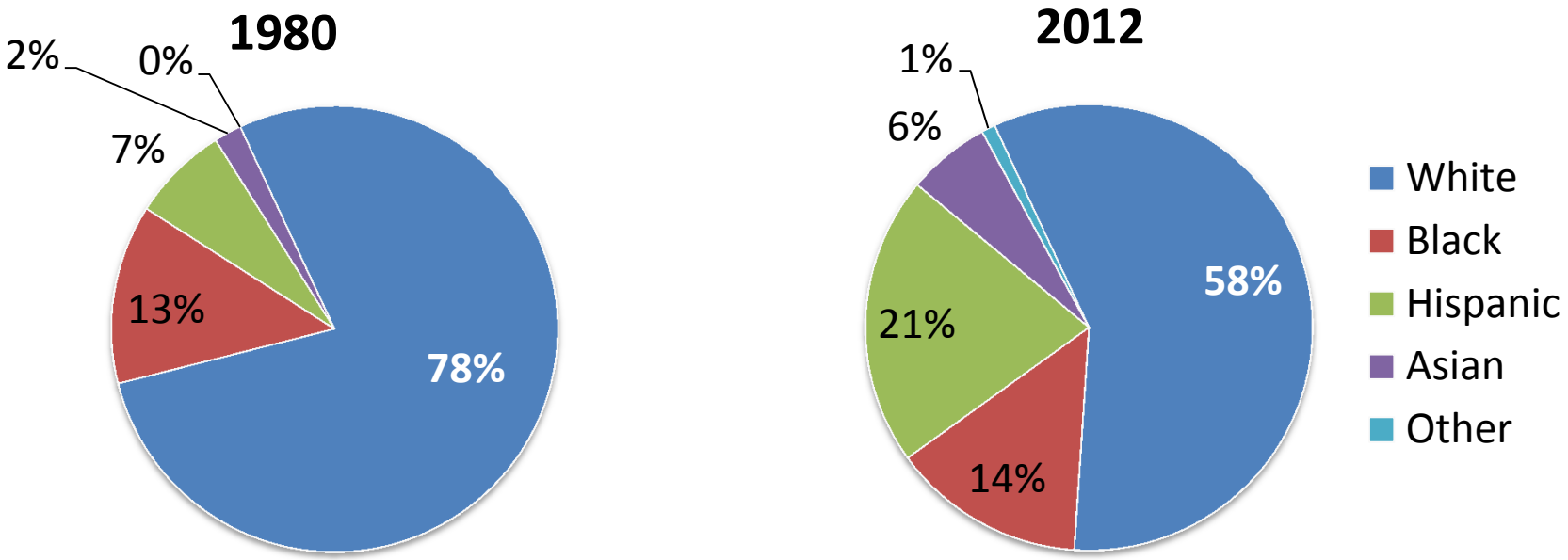
Source: Center for Disease Control and Prevention

Living Arrangements (Ages 15-34)



Source: PEW Research Center

Race / Ethnicity (Ages 15-34)



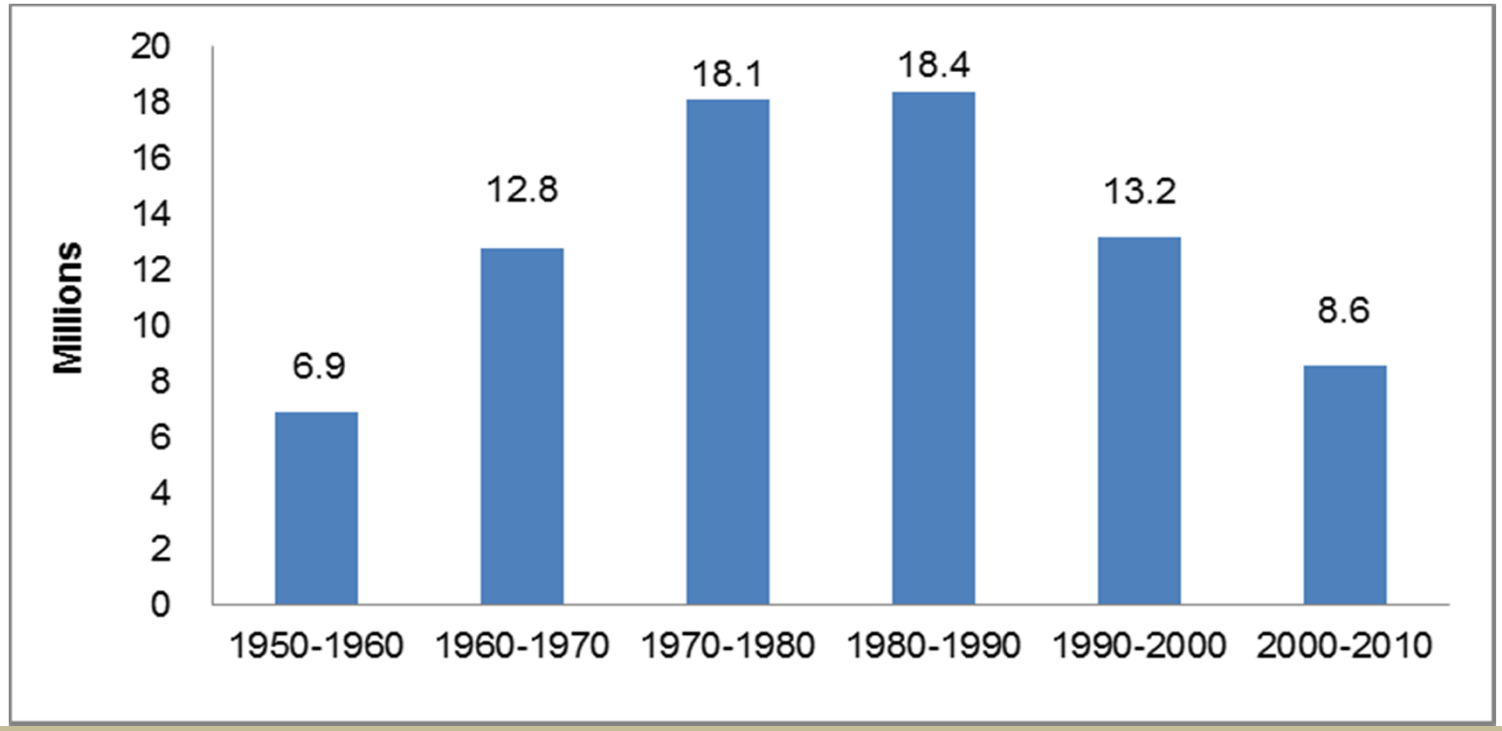
Source: U.S. Census Bureau

Millennial Observatons

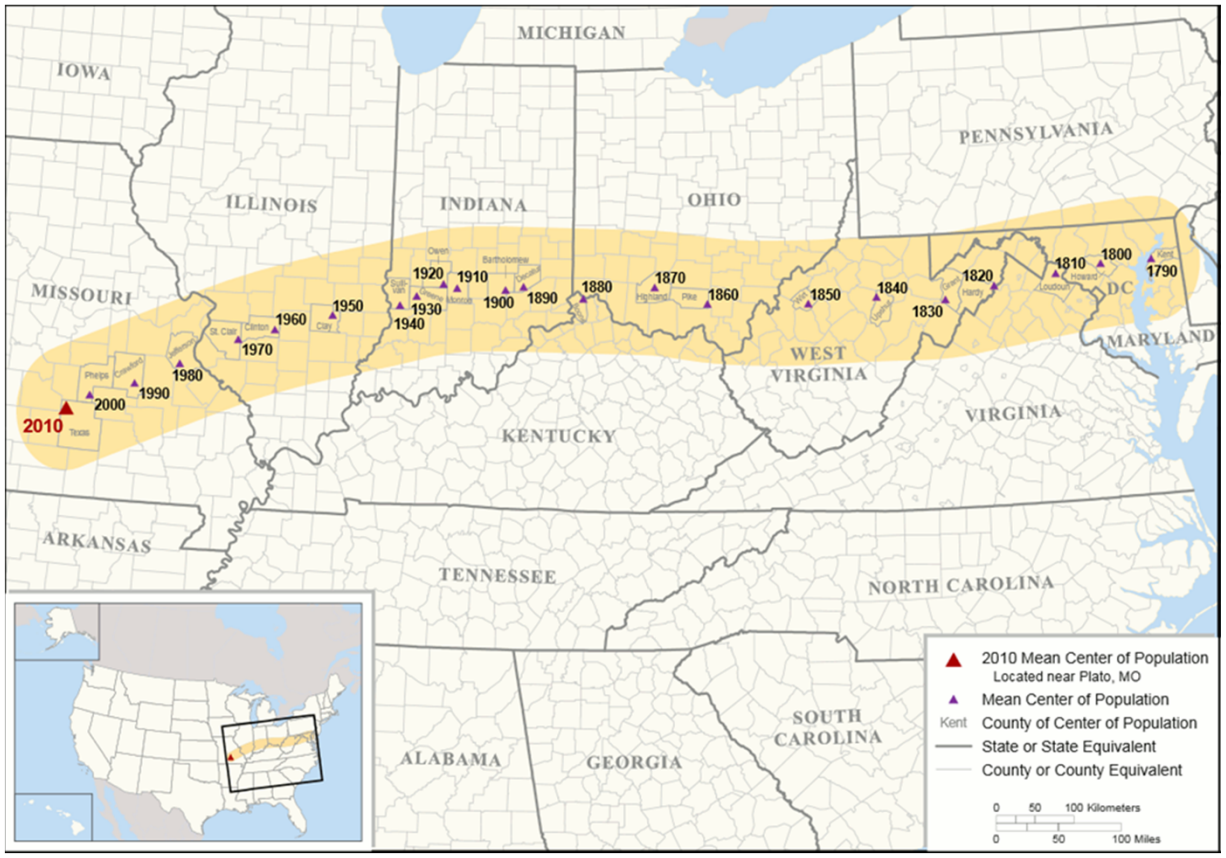
- ✓ Millennial travel levels have **declined** relative to prior points in time.
- ✓ Travel declines are substantially explained by **different socio-demographic** and **economic** characteristics.
- ✓ While some travel moderating characteristics may **persist** at higher levels than historic norms as millennials age, they are **not** anticipated to retain the same degree of diminished travel as they age.
- ✓ **Emerging technologies** will likely continue to impact travel behavior and minimize or **eliminate travels' negative impacts**.
- ✓ Travel demand growth scenarios should prudently include **more modest growth** ranges than historically observed.

Trend in Worker Availability

The declining workforce growth over the past two decades and projections of continuing declines indicate a much diminished role of commuter growth in shaping future transportation needs.

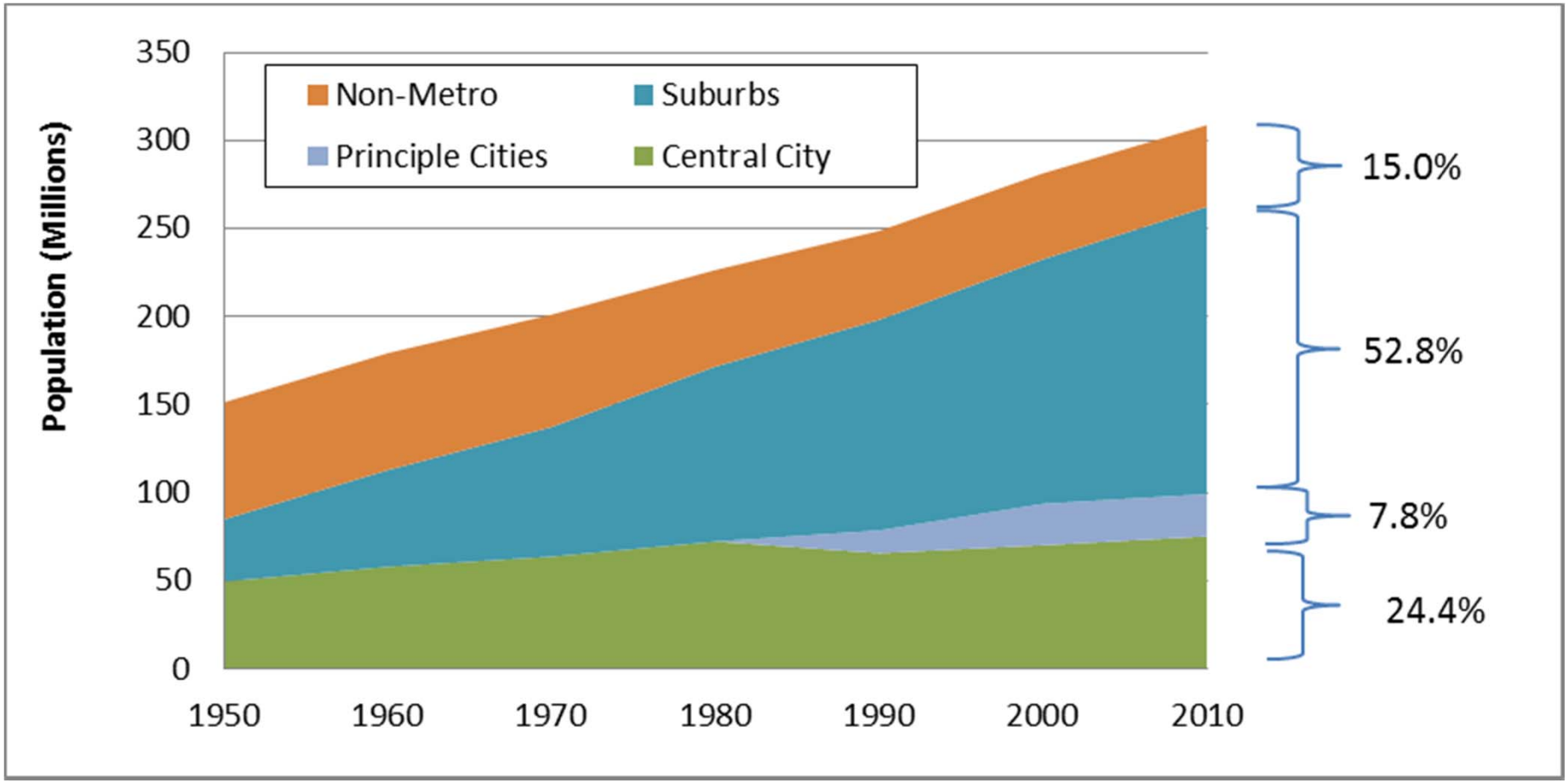


U.S. Mean Center of Population, 1790–2010



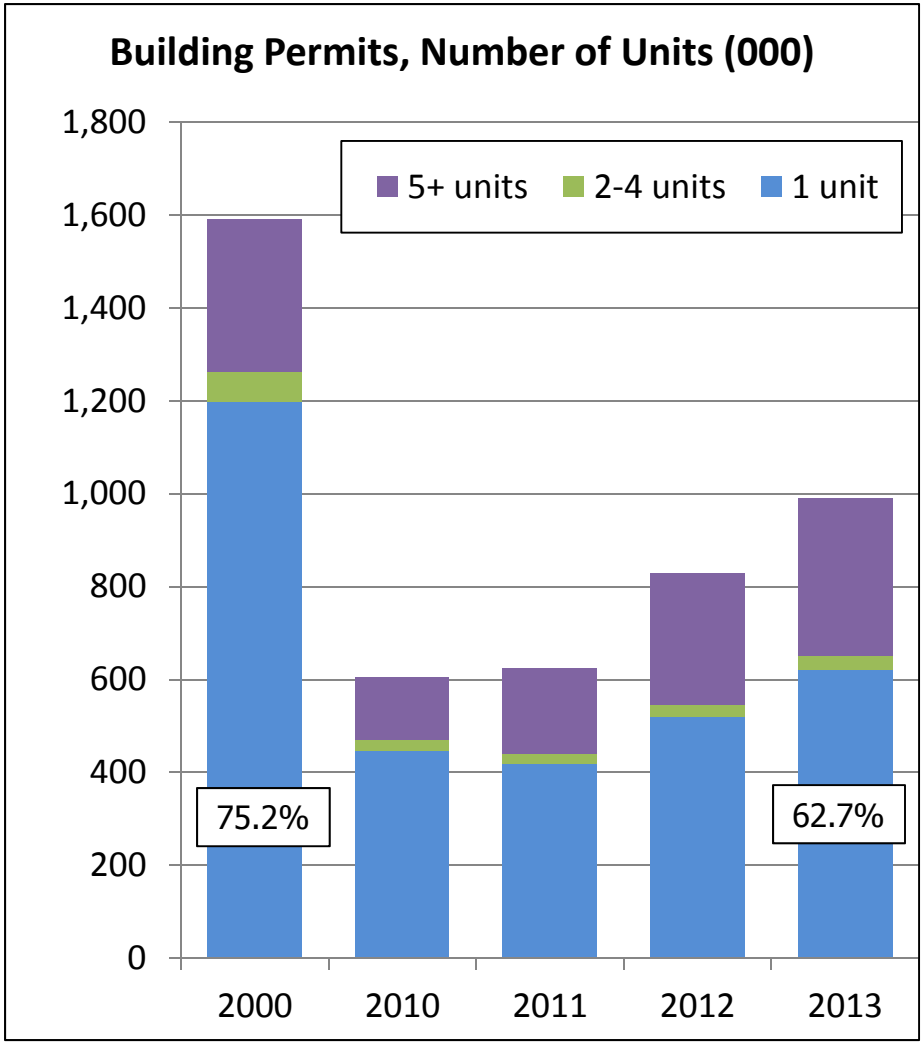
Between 2000 and 2010, of the 3,143 counties in the U.S., 1,095 had declining population and 1,058 grew slowly, accounting for only 10% of the national population growth; the remaining 990 counties were responsible for 90% of the population growth in the decade. Thus, the transportation challenges of commuting are likely to be very disparate across geography.

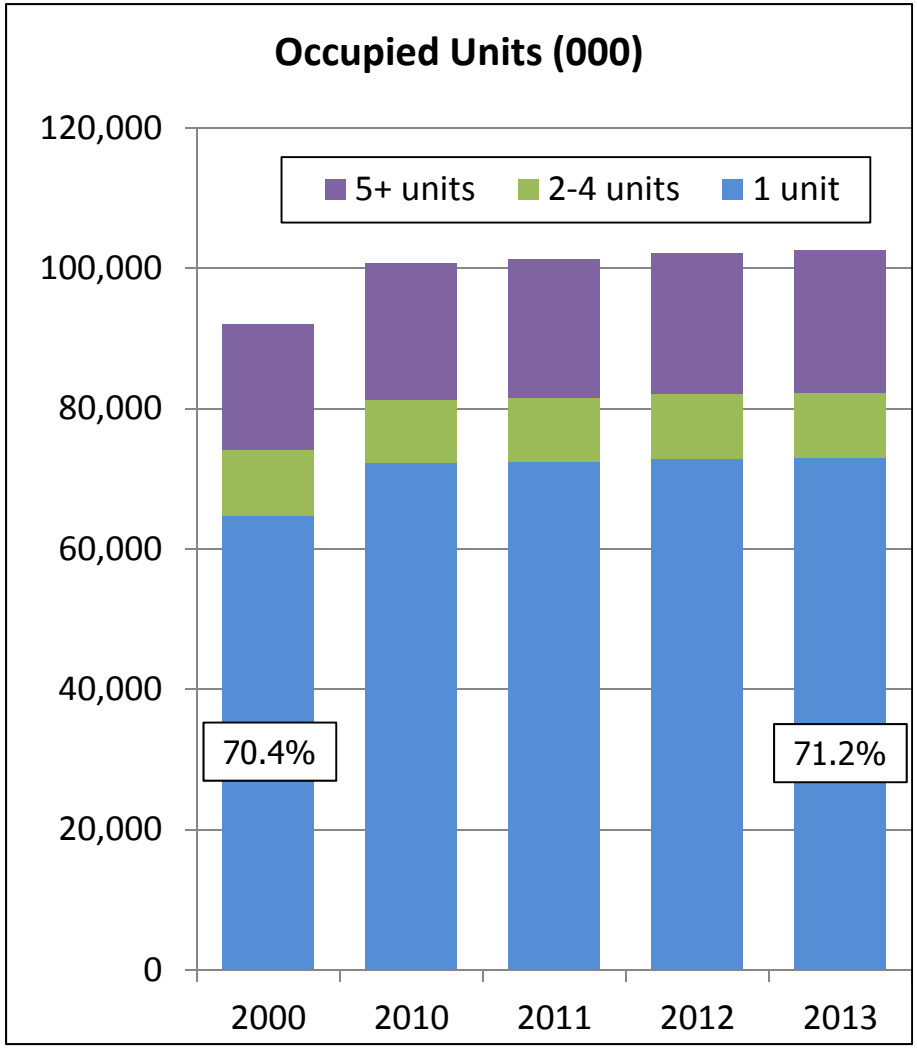
Growth Trends



Commuting in America 2013, AASHTO

Housing Trends





In 2013 new units were less than 1% of occupied inventory

No $$ no

"The inflation-adjusted net worth for the typical household was $87,992 in 2003. Ten years later, it was only $56,335, or a 36 percent decline, according to a study financed by the Russell Sage Foundation. "

Link: http://www.nytimes.com/2014/07/27/business/the-typical-household-now-worth-a-third-less.html

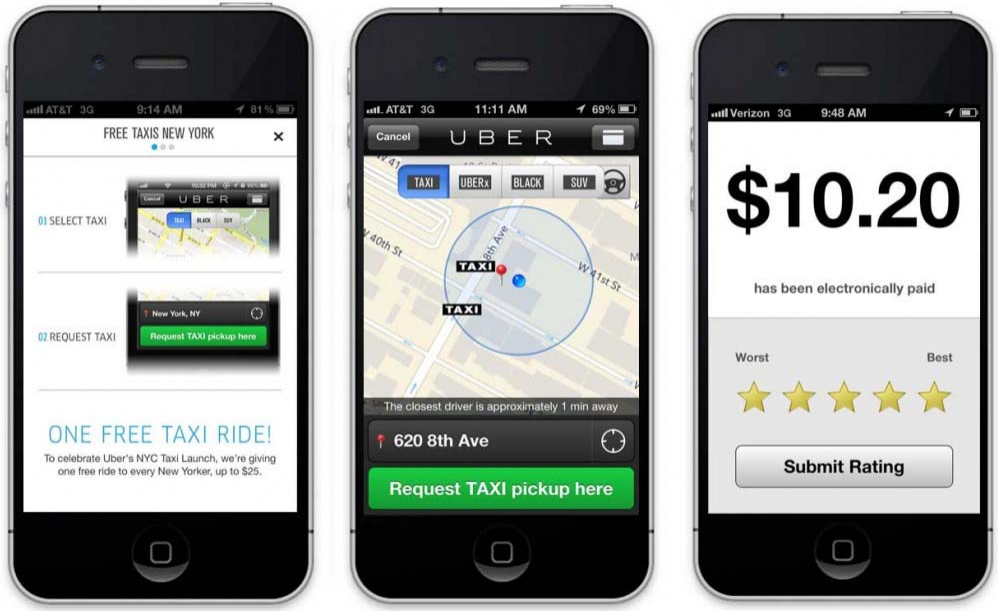
Technology

- Powerful global positioning satellites
- Ubiquitous wireless communication capability
- Powerful portable computing
- Powerful web computing capability for pathfinding and optimization
- Sophisticated sensors
- Artificial intelligence/ machine learning

Integrated with new materials, designs, propulsion systems, etc.

Transportation Network Companies (TNC)

TNC – a company that leverages smart phone aps to hail livery services. Sometimes referred to as e-hailing or ridesourcing. Not Ridesharing



Offers real time information on arrival, electronic payment, electronic customer feedback. Perceived as cleaner, more convenient and safer than taxis. Generally lower cost and more quickly available than traditional taxis.

Transportation Network Companies (TNC)

- **Challenging the Taxi industry**
- **Considered as a contingency for transit**
- **Potential first mile, last mile mode**
- **Enables the delay or foregoing auto ownership**
- **Interest in shared ride opportunities – aggregating trips**

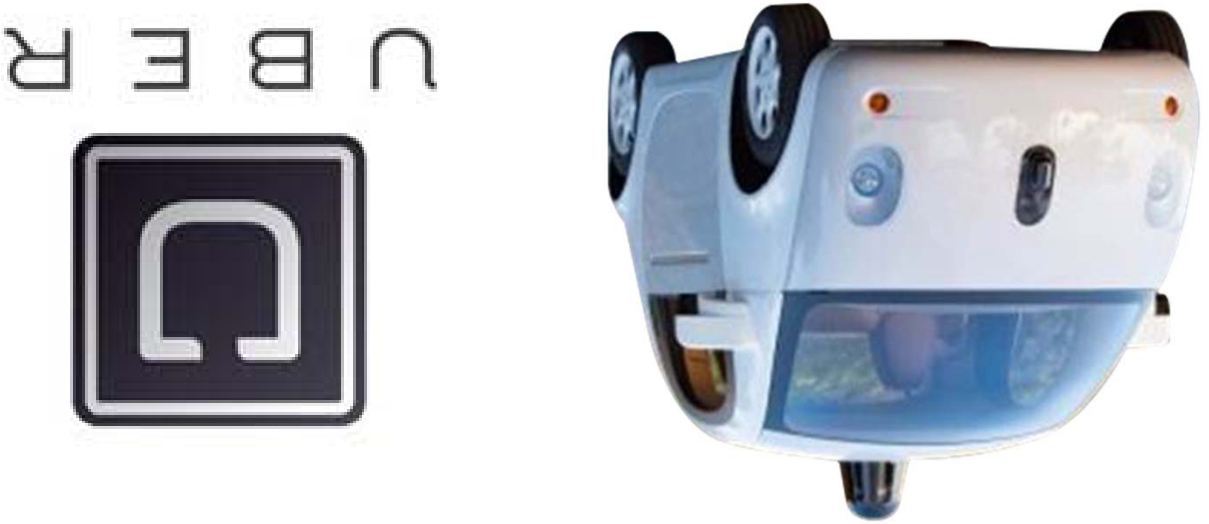
Automated/Connected Vehicles

Free up Driver Time?

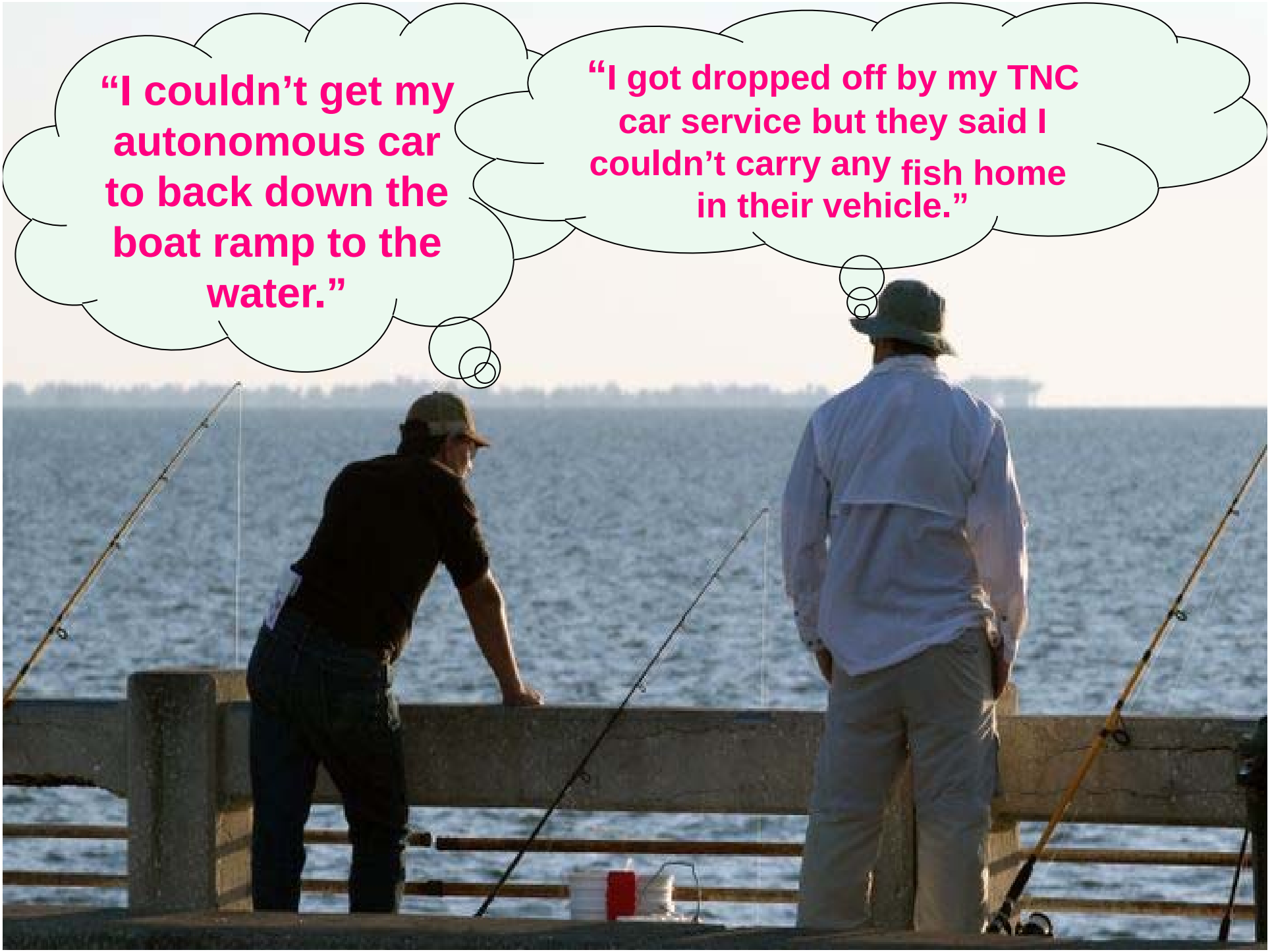
Consensus? Thoughts

- Some safety benefits evident by mid 2020s
- Some capacity impacts (incident reductions benefits) by late 2020's
- Sufficient market penetration for some dedicated high capacity exclusive lanes in high volume corridors in 2040s

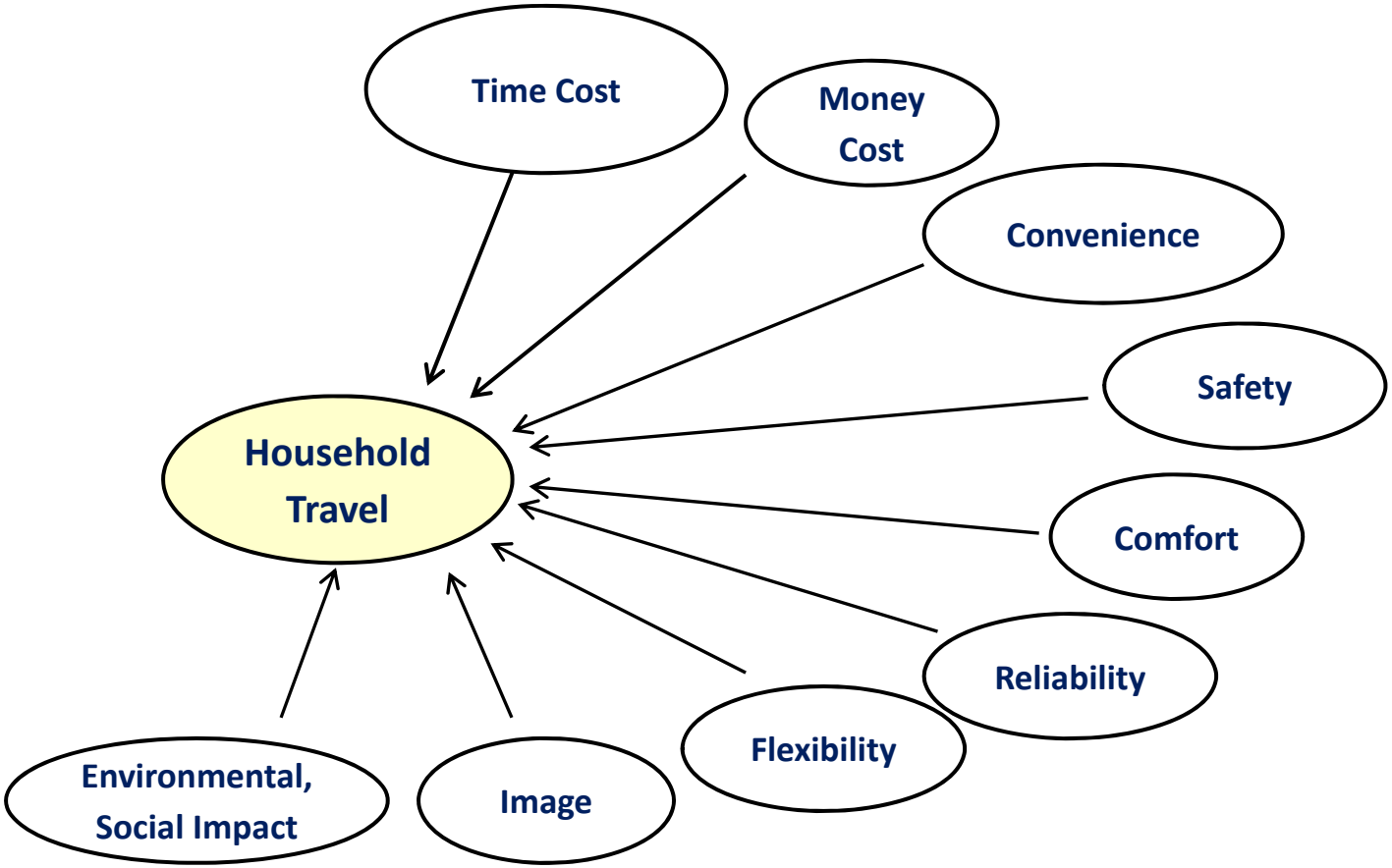
Will TNC's and Autonomous Vehicles Turn Transportation on its Head?



1. Enabler of reduced auto ownership transforming mode choice
2. Enabler of trip aggregating (sharing rides) impacting overall occupancies

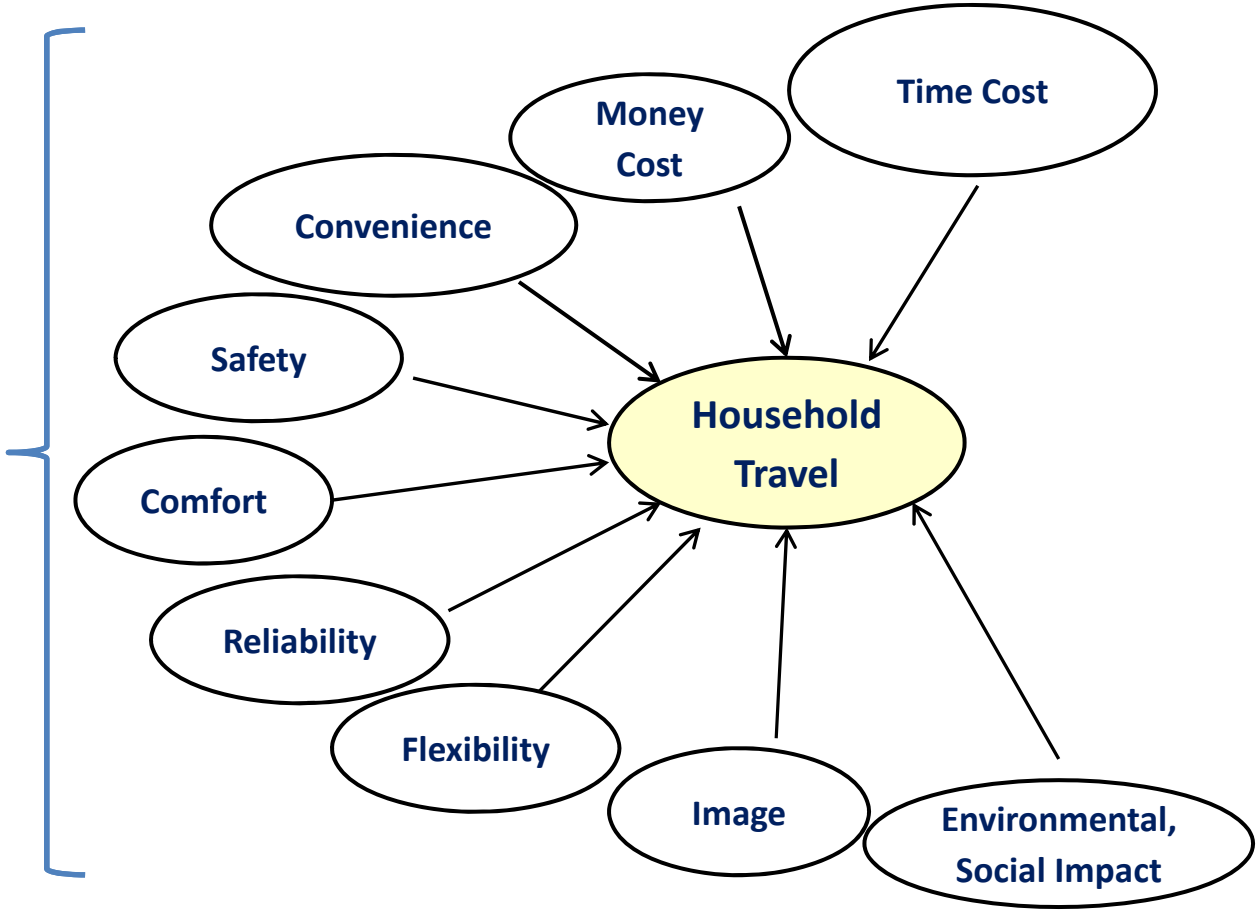

“I couldn’t get my autonomous car to back down the boat ramp to the water.”
“I got dropped off by my TNC car service but they said I couldn’t carry any fish home in their vehicle.”

Factors that Influence Travel Behavior

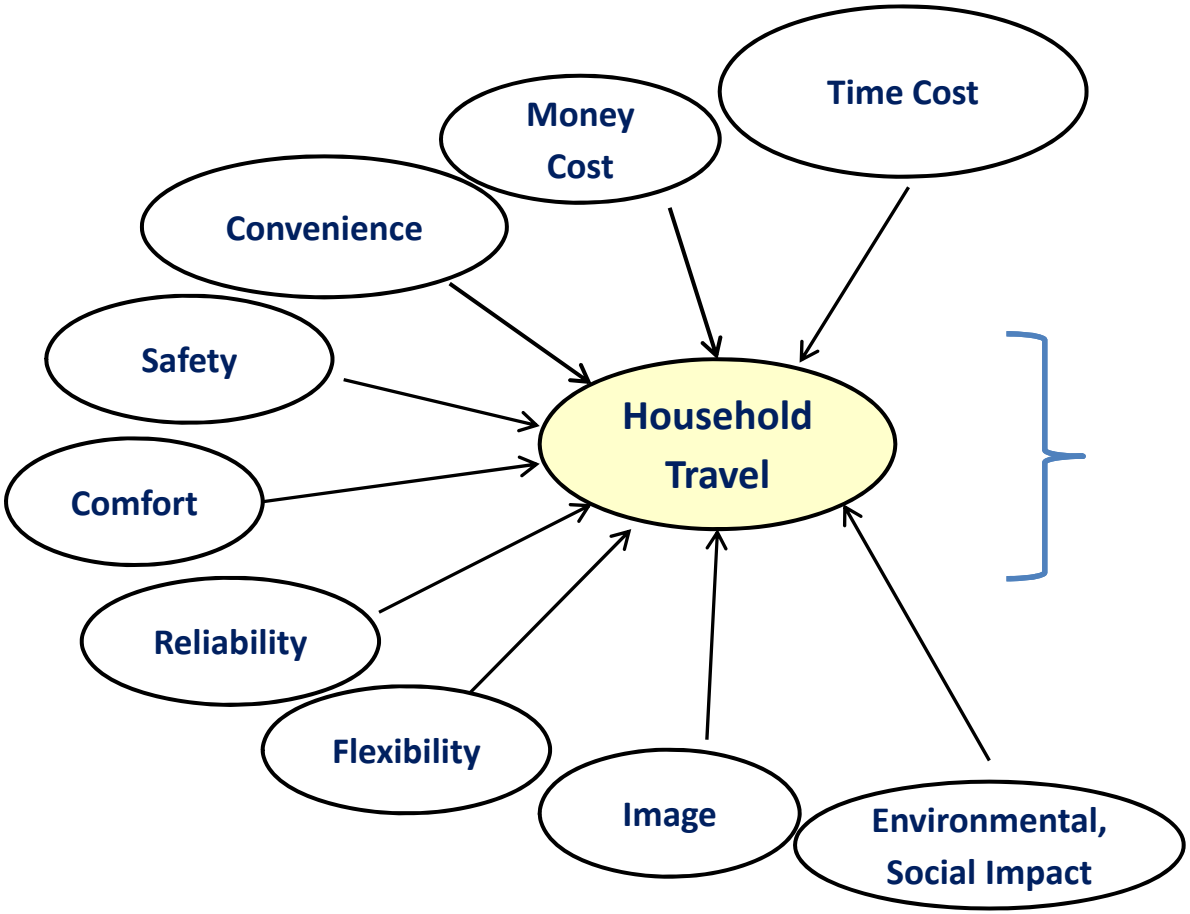


Factors that Influence Travel Behavior

- Real time information
- Electronic payment
- Matching services
- Trip planning
- Trip scheduling
- Navigation / trip tracking
- Electronic hailing
- Trip aggregating / ride matching
- Dynamic pricing
- Electronic satisfaction feedback

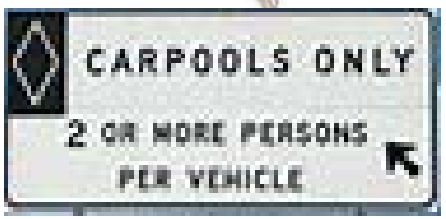


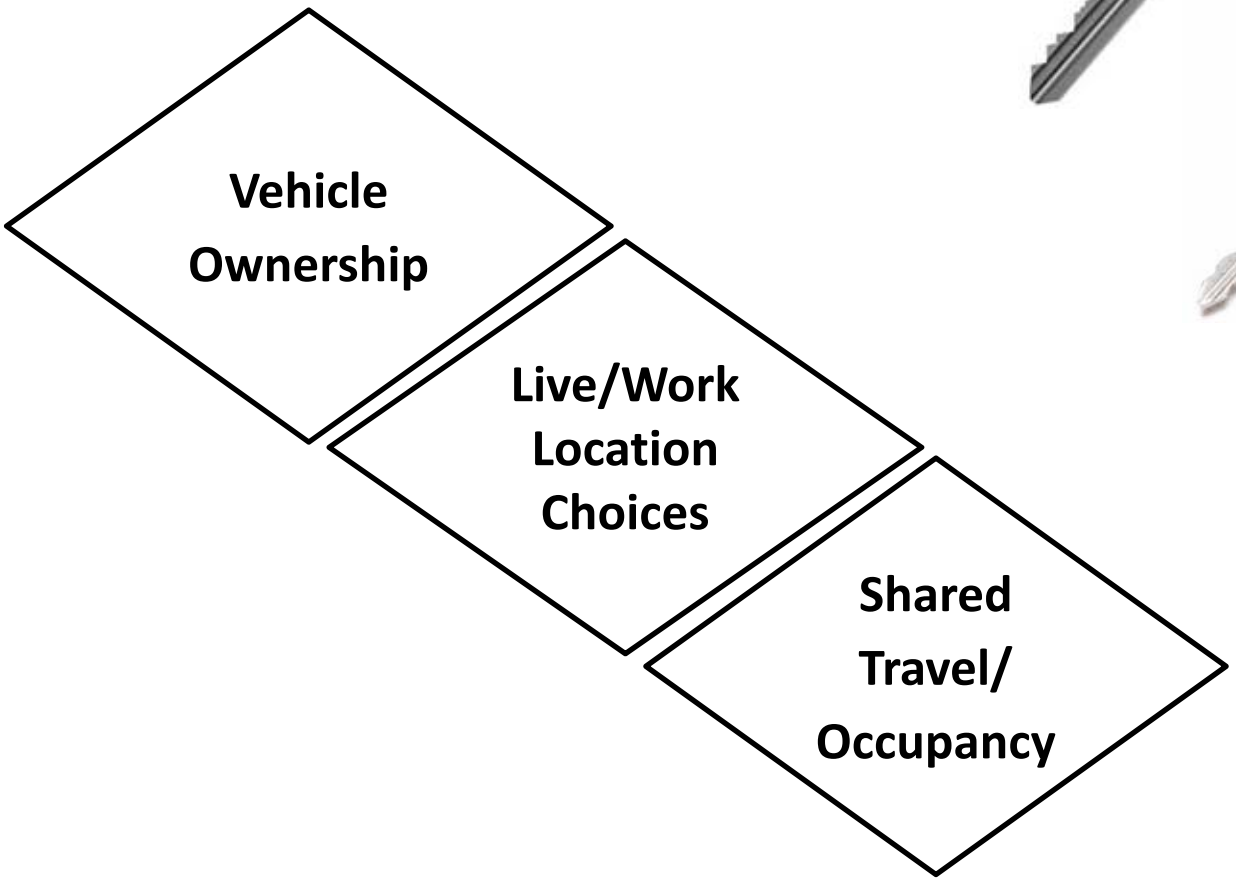
Factors that Influence Travel Behavior



1. Number of trips made
2. Mode
   - Drive personal car
   - Ride with family/friend
   - Taxi
   - Ridesourcing, e-hailing
     - Uber, Lyft, Sidecar
   - Rideshareing
     - Carma, eRideShare
   - Carsharing
   - Personal bike
   - Bikesharing
   - Transit
   - Transit Alternatives/Feeders "microtransit"
     - Bridj, Leap transit, MetroBee, TransLoc
   - Walk
3. Destination
4. Path

Key Decisions





Vehicle Ownership and the Mode Choice Decision

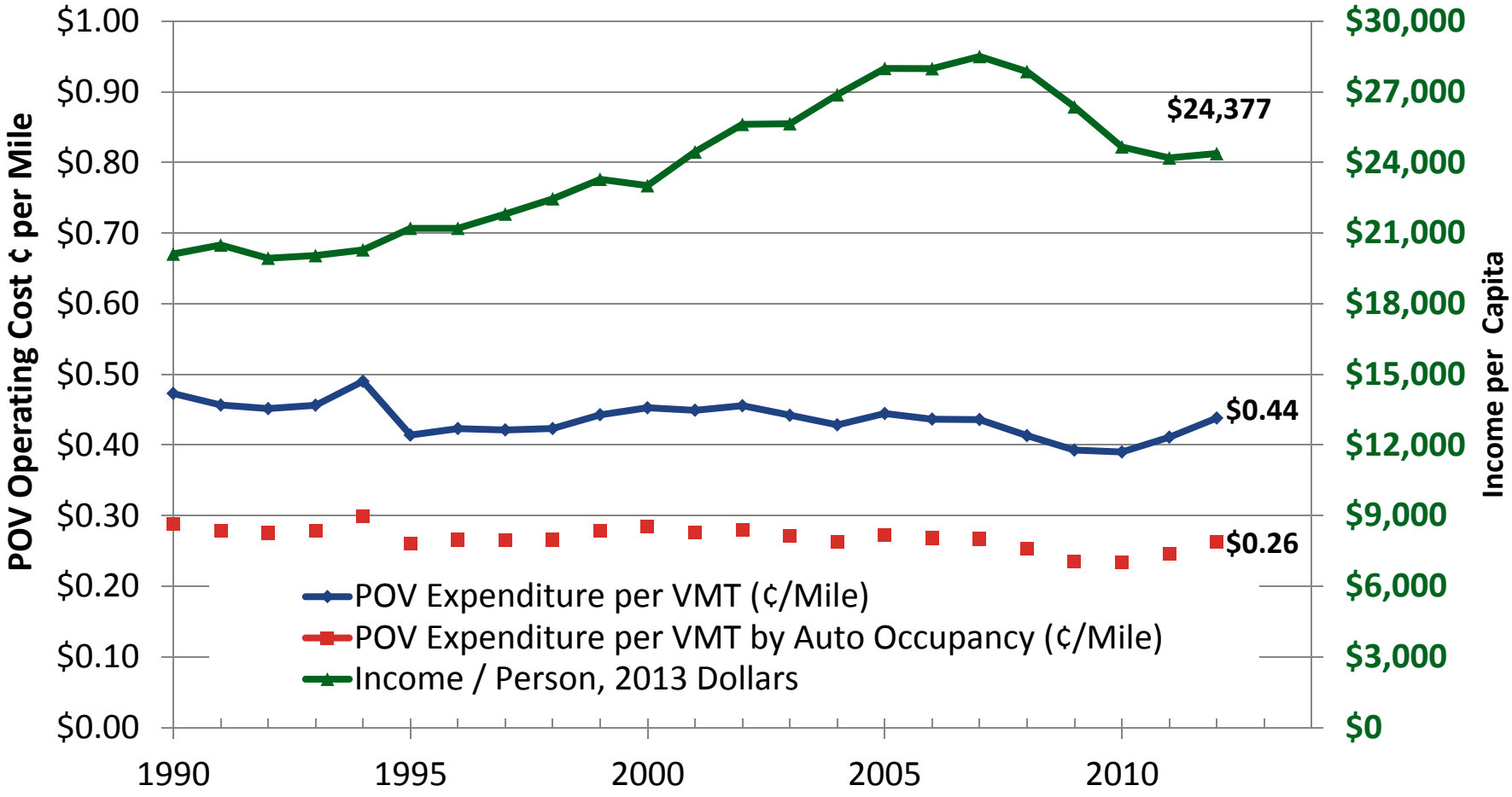
Fully Amortized Auto Operating Cost	$0.575 / mi.
Maintenance and Operation	$0.23
Out of Pocket	$0.14

Source: IRS

Auto owners "feel" $0.14 per mile costs in mode choice decision.

Transit fares of ~ $0.25/mi or TNC at ~$1.00/mi seem reasonable to non-car owner

What are people spending to travel by POV



Source: CUTR analysis of NHTS, BLS

Household Vehicle Ownership Distribution

HH Vehicles	National Household Vehicle Ownership Distribution, 2009					
	Number of Adults in HH					All
	1	2	3	4	5+	
0	3.49%	1.12%	0.15%	0.04%	0.01%	4.80%
1	17.29%	8.94%	0.62%	0.12%	0.02%	26.99%
2	3.72%	34.89%	2.10%	0.34%	0.05%	41.10%
3	0.77%	12.56%	3.75%	0.59%	0.07%	17.75%
4	0.20%	3.63%	1.50%	0.73%	0.10%	6.17%
5+	0.12%	1.72%	0.75%	0.44%	0.17%	3.20%
All	25.59%	62.84%	8.86%	2.27%	0.43%	100.00%

2009 NHTS

5% no veh

13% veh < than adults

57% veh = adults

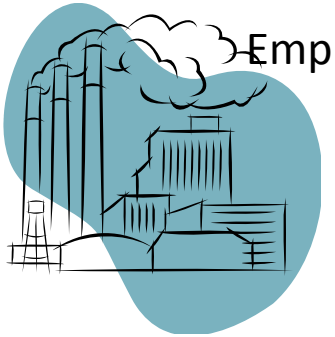
25% veh > adults

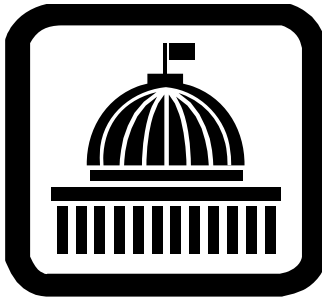
Ownership Not Just a Mobility Decision

Functional transportation

Transportation plus?

Are the Institutional Roles and Cost Structures Governing Mobility Going to Remain the Same?





Government

Community

Family

Private sector

Church


Mobility Services Center
Single Payment Plan – Bundled Mobility Services – Govt . Vouchers Accepted
Transit passes - Bikes - Motorcycles - Autonomous vehicles - TNC Vouchers
Amtrak HSR Tickets
– One Low Monthly Fee

Land Use Impacts

Drive till you qualify becomes
Nap till you qualify?

Or do new technologies make urban living more convenient and affordable?

Travel and Economic Theory are Clear

- Better/lower cost mobility means more travel
- More travel means better quality of life for travelers – greater employment access, access to more and better education, services, products, etc.
- **And society benefits if** externalities of more travel (congestion, air quality, energy use, safety, etc.) do not offset the benefits of greater mobility

What Does it Mean?

Implications

- Transportation network companies (TNC's) have visions of shared ride strategies providing low-cost mobility and spurring the shared economy.

- Autonomous vehicle advocates envision shared ride strategies enabling autonomous vehicles to replace public transportation and provide environmentally and financially sustainable mobility.

A Different Planning World

- Time frames for investment implementation and amortization exceed our window of confident predictions
  - 10 years to plan,
  - 10 years to construct,
  - 50 years to amortize investment

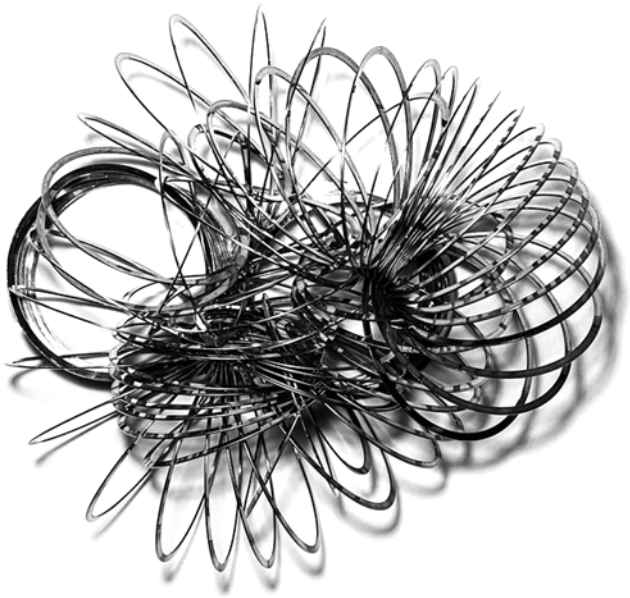
- This multiplies risk and uncertainty in a world of rapid change

And for Transit?

- Some markets will need high capacity vehicles

- Some users will need the mobility subsidy inherent in today's transit.

Contact Information



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