The Case For More Moderate Growth in VMT: A Critical Juncture in U.S. Travel Behavior Trends

Presentation for USDOT

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Center for Urban Transportation Research

The University of South Florida
Tampa, Florida

National Center for Transit Research (NCTR/UTC)

Southeastern Transportation Center (STC/Southeastern Region 4 UTC)

National Bus Rapid Transit Institute (NBRTI)

Established by the Florida Legislature in 1988

Context

- An outgrowth of FDOT supported research:
  - Investigation of Florida Trends and Conditions
  - Exploration of the land use VMT relationship
  - Analysis of public transit implications of NHTS
- A TRB paper that got out of hand.
- Available online at http://nhts.ornl.gov/2001/articles/index.shtml

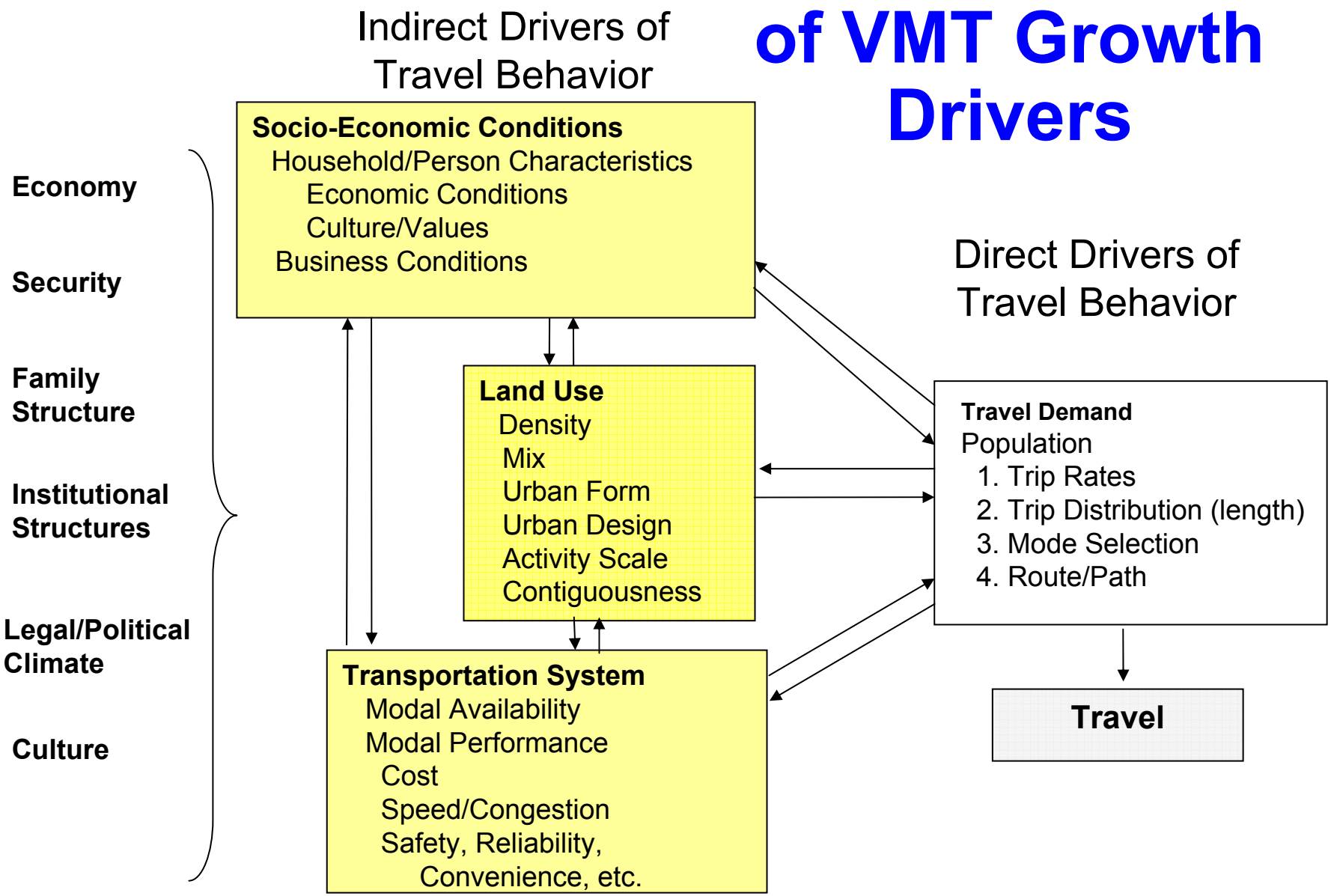
Related Work

- Charles Lave (1991) – *Things Won't Get a Lot Worse: The Future of U.S. Traffic Congestion,* discussed effects of auto availability, labor force participation, age, income and vehicle availability on the growth of VMT and congestion.
- Department of Energy (1995) – Reviewed VMT forecasting issues including age, income and licensure rates.
- Schaper and Patterson (1998) – Reviewed factors contributing to VMT growth.
- Department of Energy (2001) – Age and gender were used to model future VMT.
- FHWA (2002) – *2002 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance,* U.S. Department of Transportation, includes an estimate of VMT growth through 2020 documented in *Vehicle Miles Traveled 2001*.

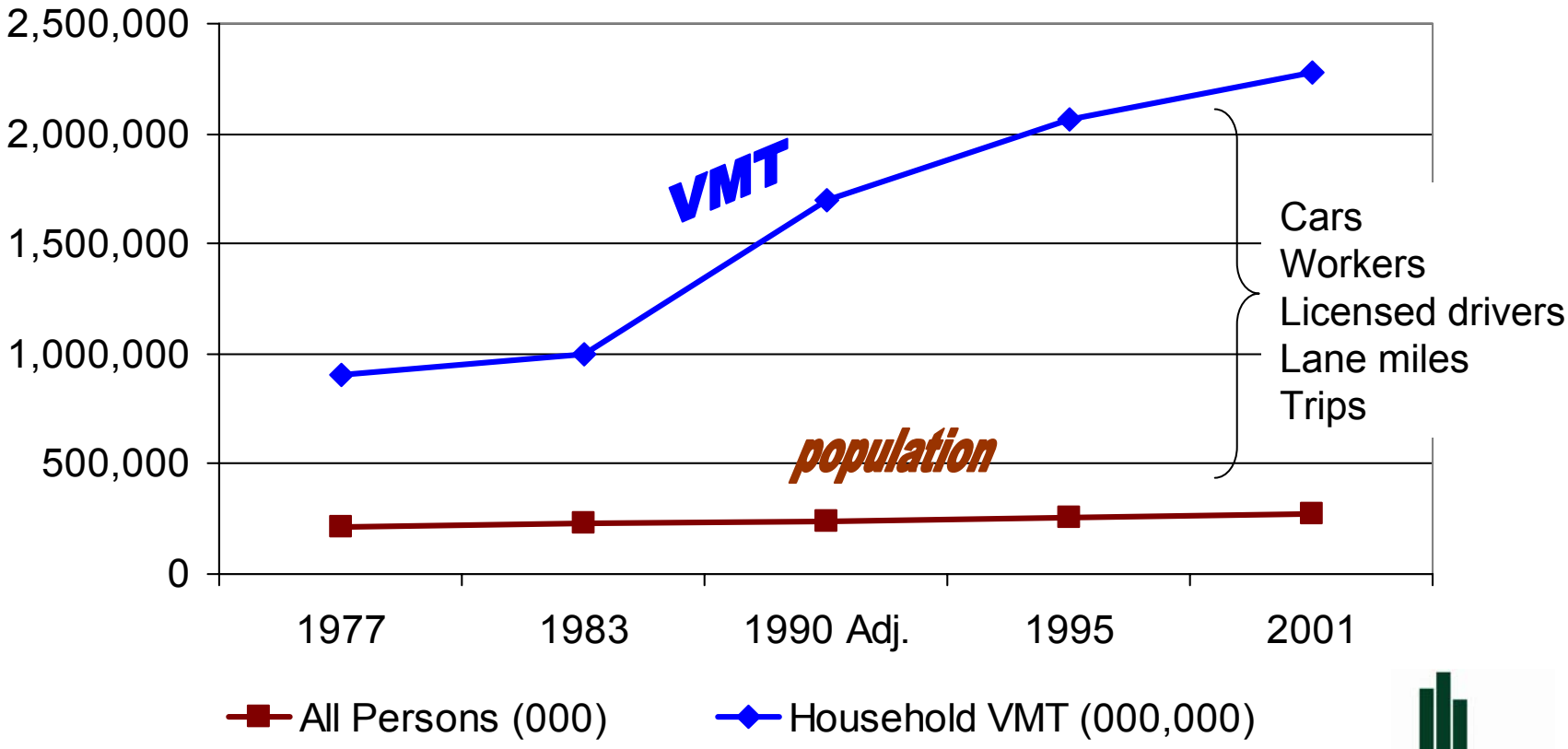
Key Concepts

- NHTS and Census data help paint a picture of what is going on regarding travel and travel behavior.
- Several socio-demographic and transportation system performance trends are at critical juncture points.
- We are seeing a slowing in the pace of VMT growth that will continue absent new intervening phenomenon.
- Yet congestion may get worse.
- The rate of trip making appears to be the single largest contributor to growing travel demand.
- And there is much we do not yet know.

Conceptual Model of VMT Growth Drivers

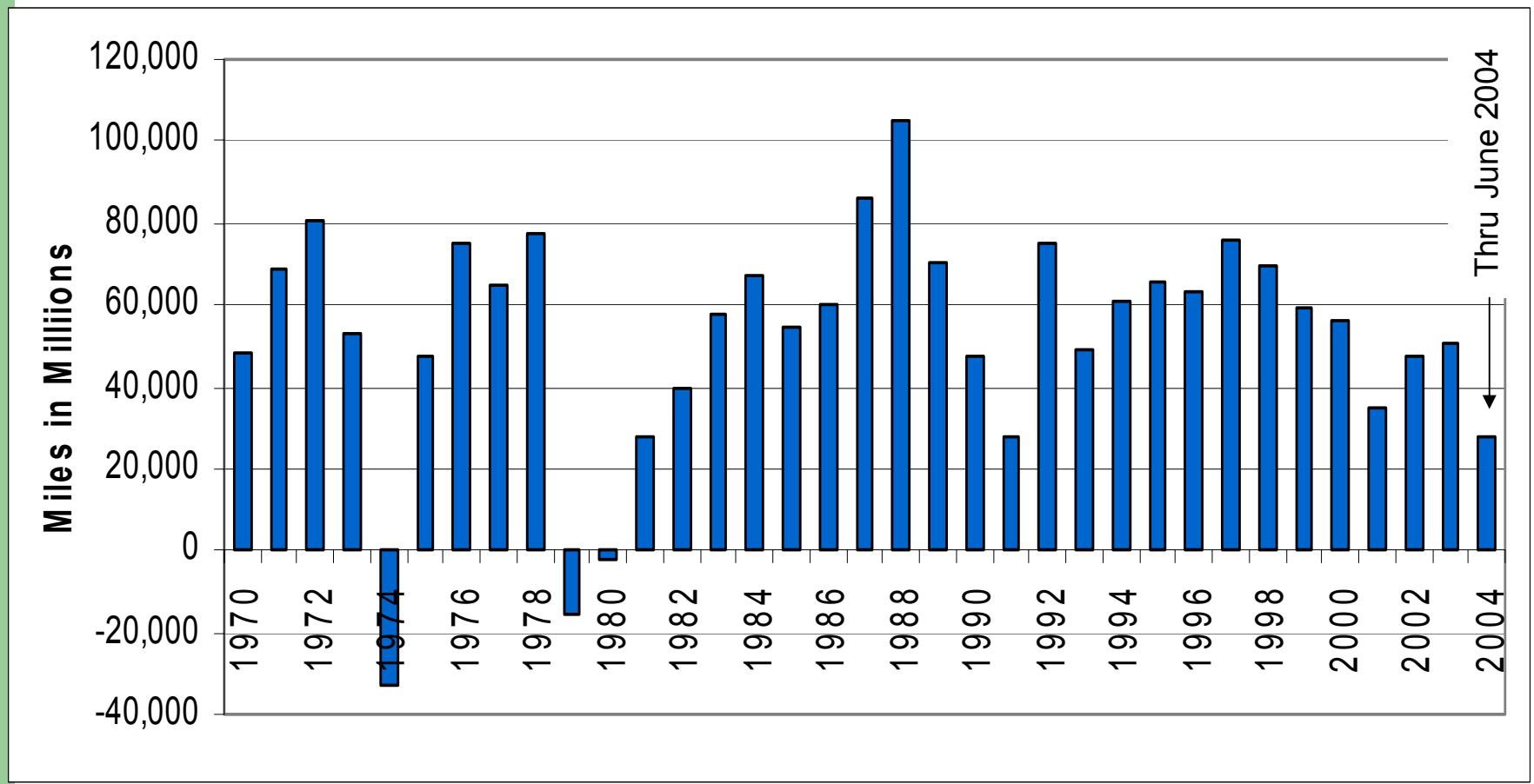


Household VMT Growth Outpaces Population Growth

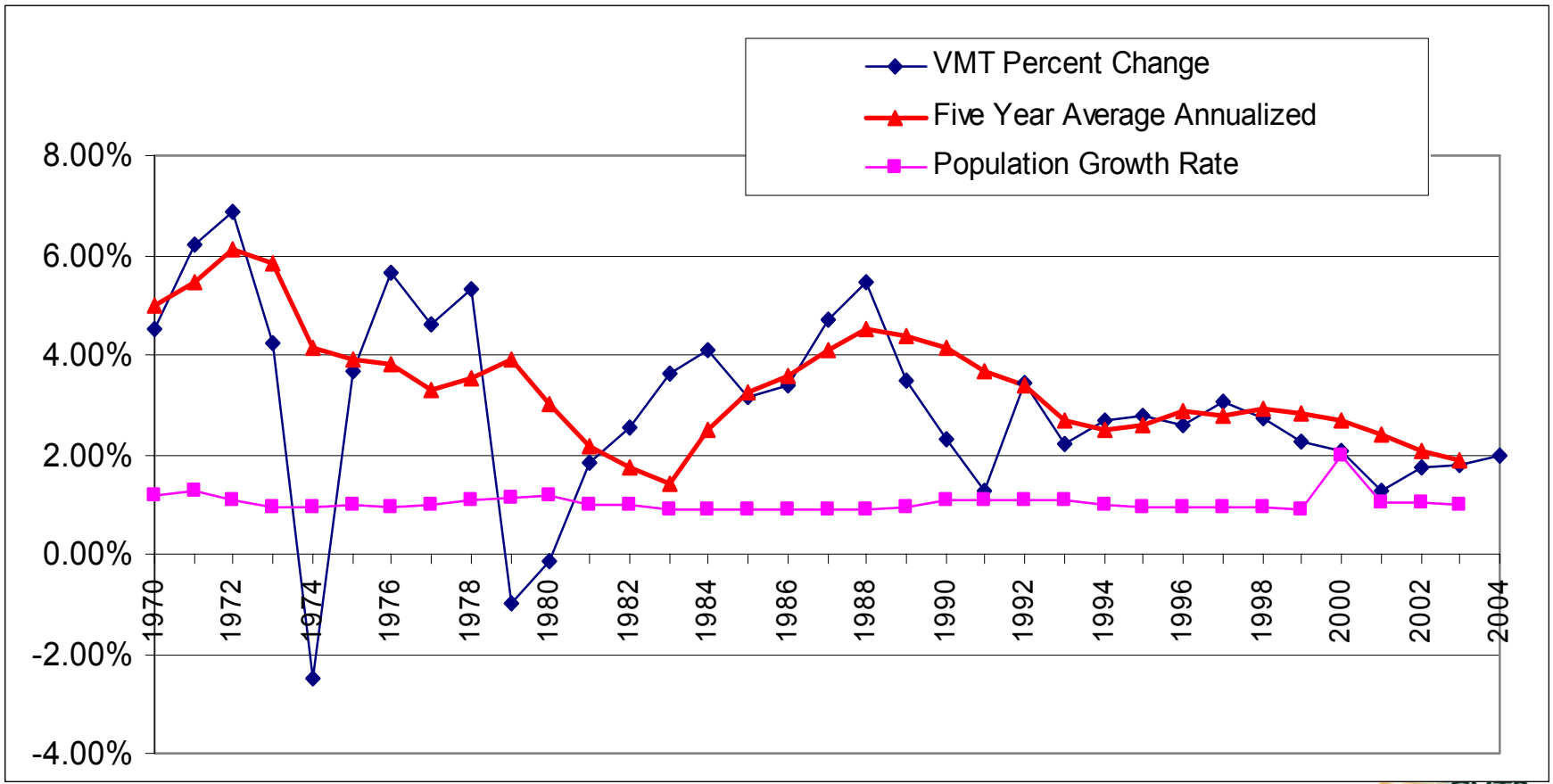


Source: U.S. Census Bureau, NHTS

Incremental Annual Growth in VMT

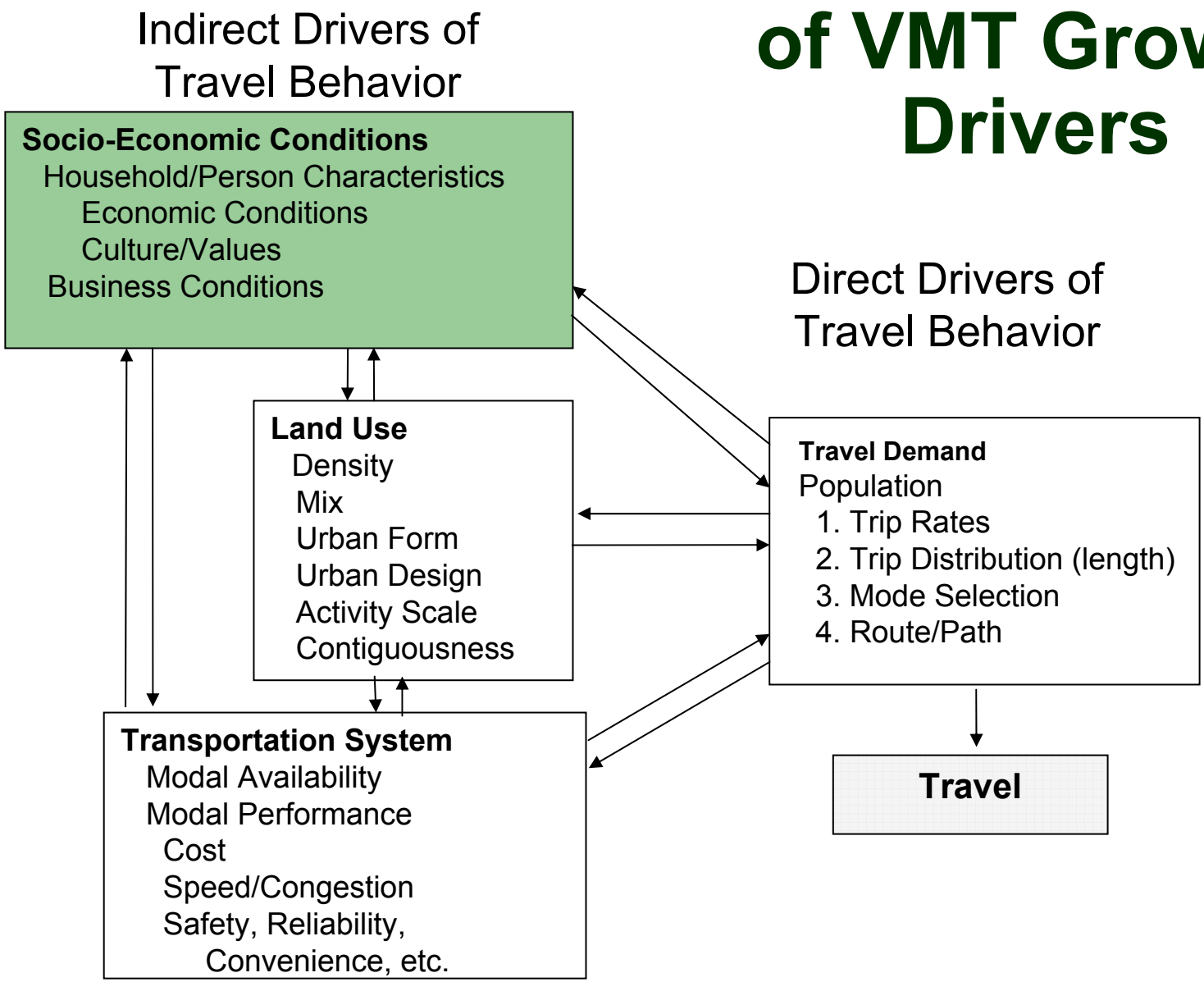


Annual Change in VMT and Population

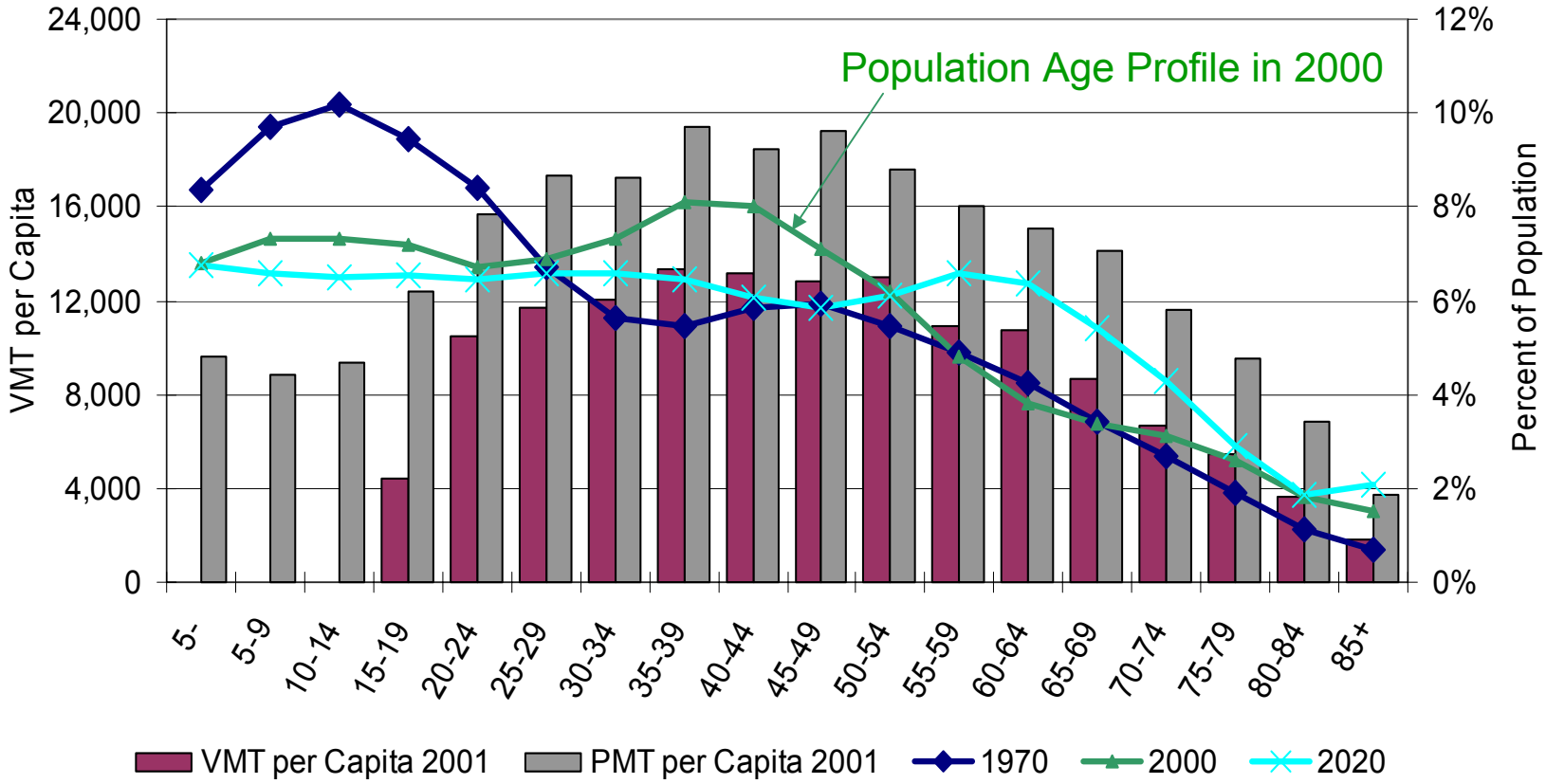


Source: FHWA, Highway Statistics Series, Census population estimates

Conceptual Model of VMT Growth Drivers

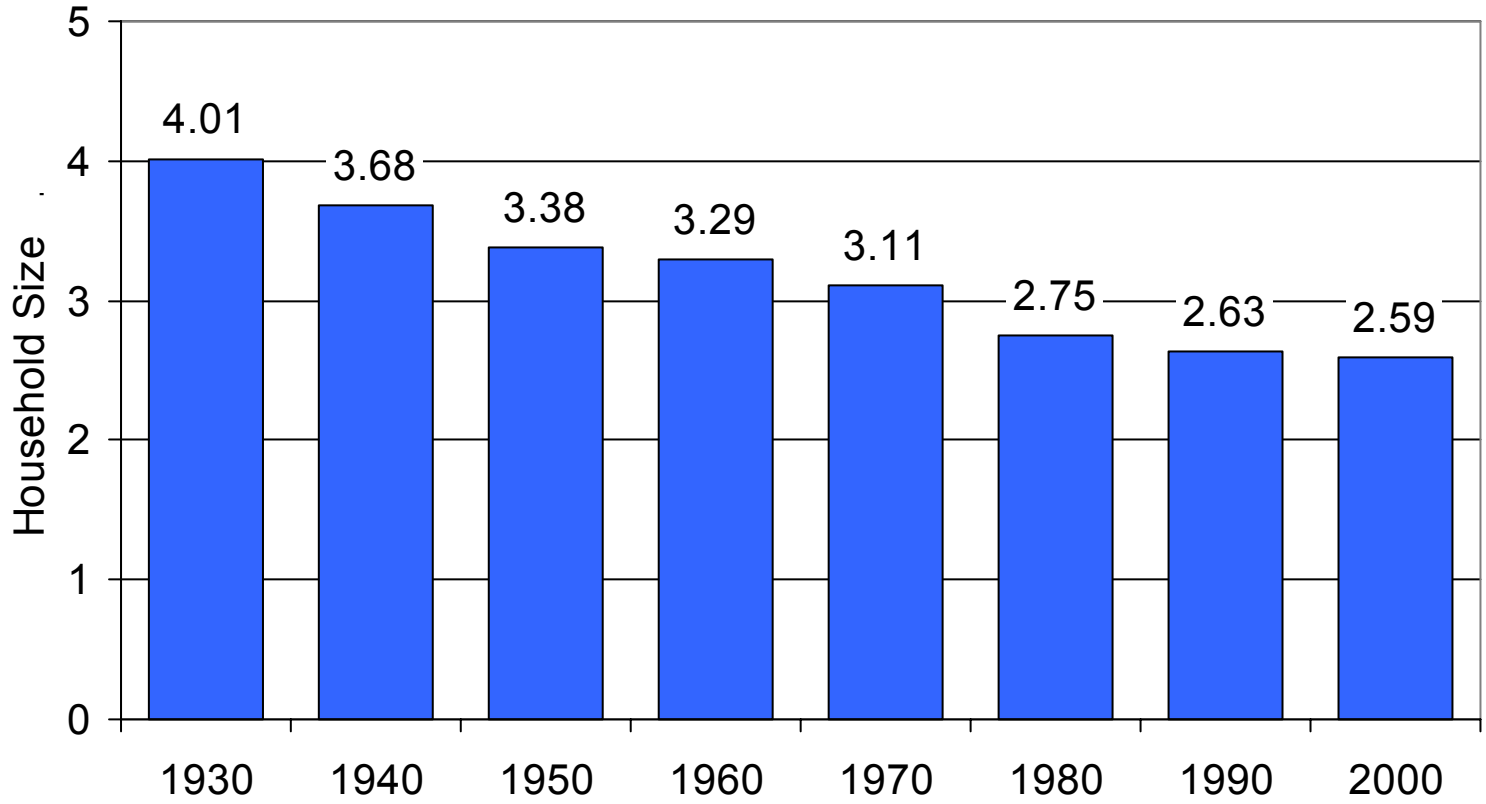


U.S. Population is Concentrated in Peak Travel Age Cohorts



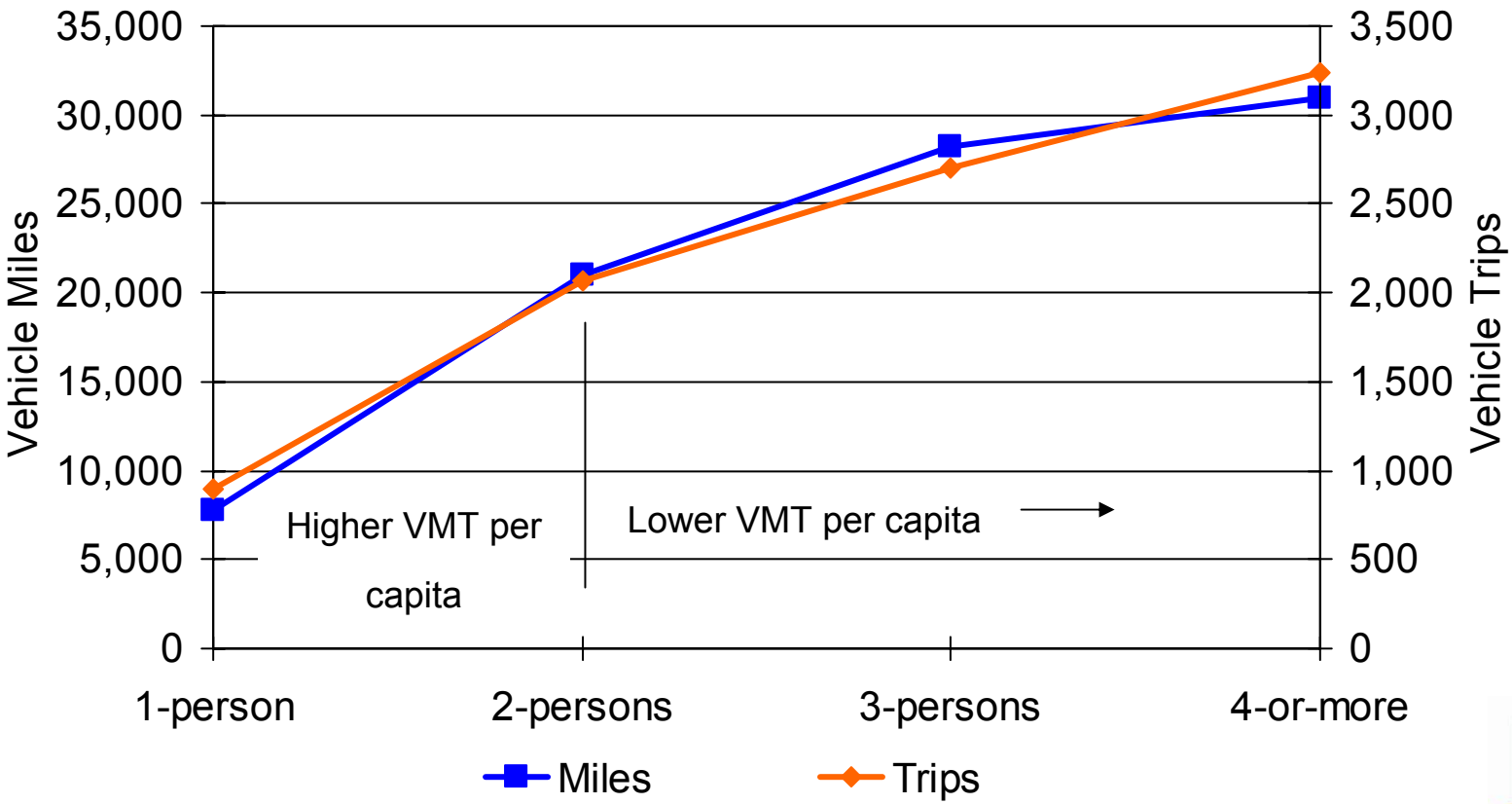
Source: CUTR analysis of NHTS and NPTS and U.S. Census Bureau

Average Household Size is Stabilizing, 1930-2000



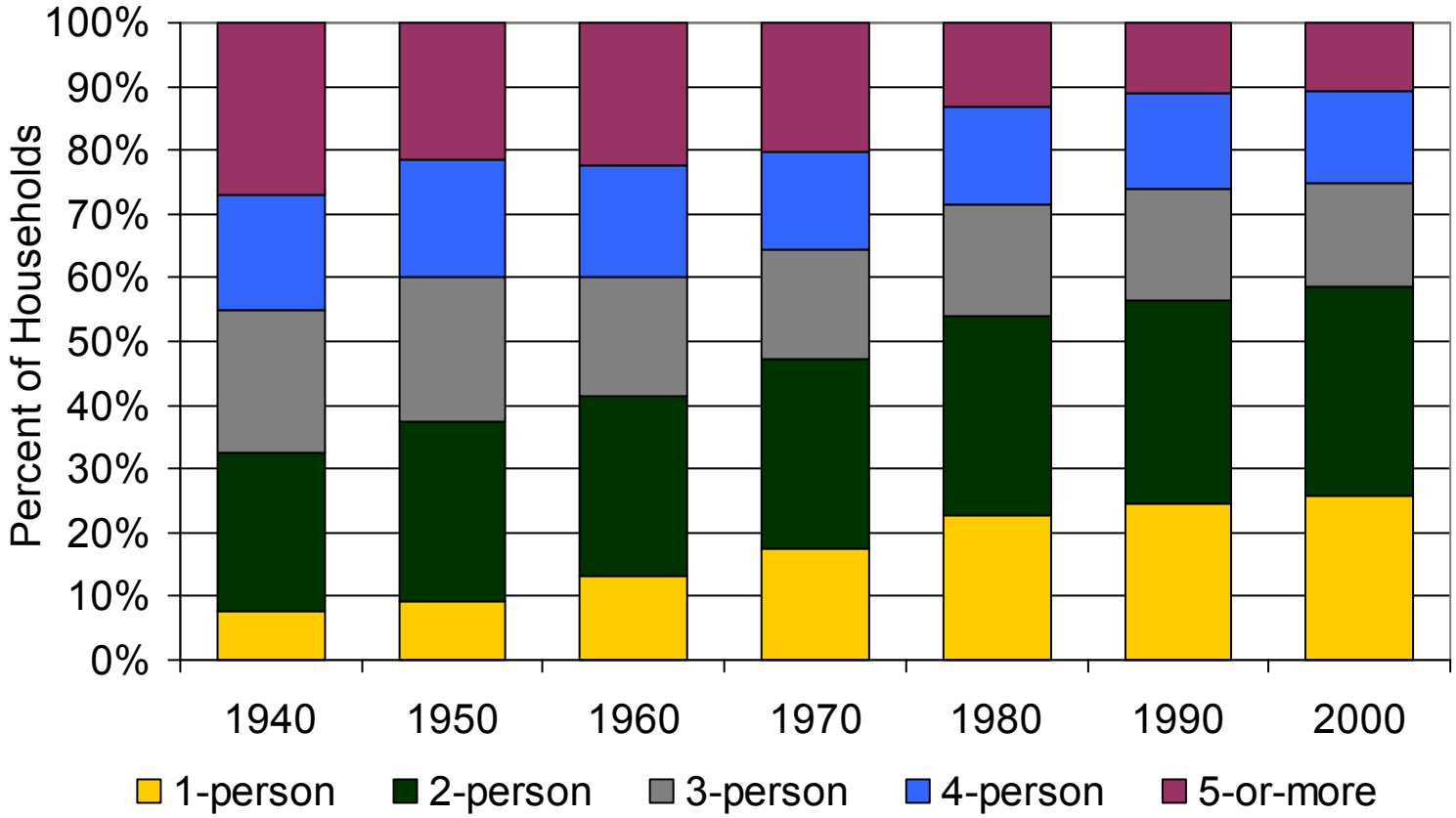
Source: U.S. Census Bureau

Economies of Travel Beyond Two Member Households



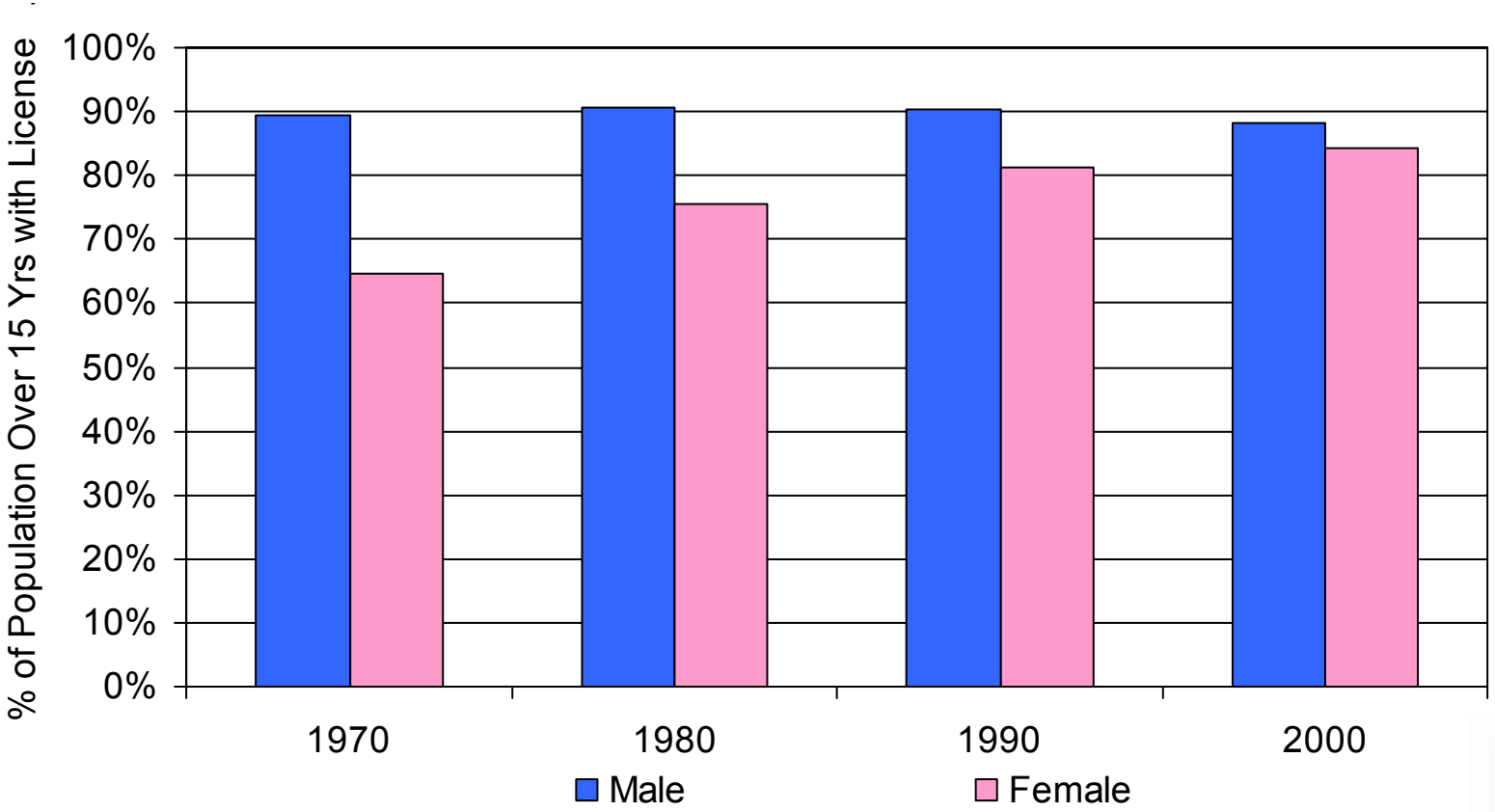
Source: CUTR analysis of NHTS

Households Size May Have Contributed to VMT Growth, 1940-2000



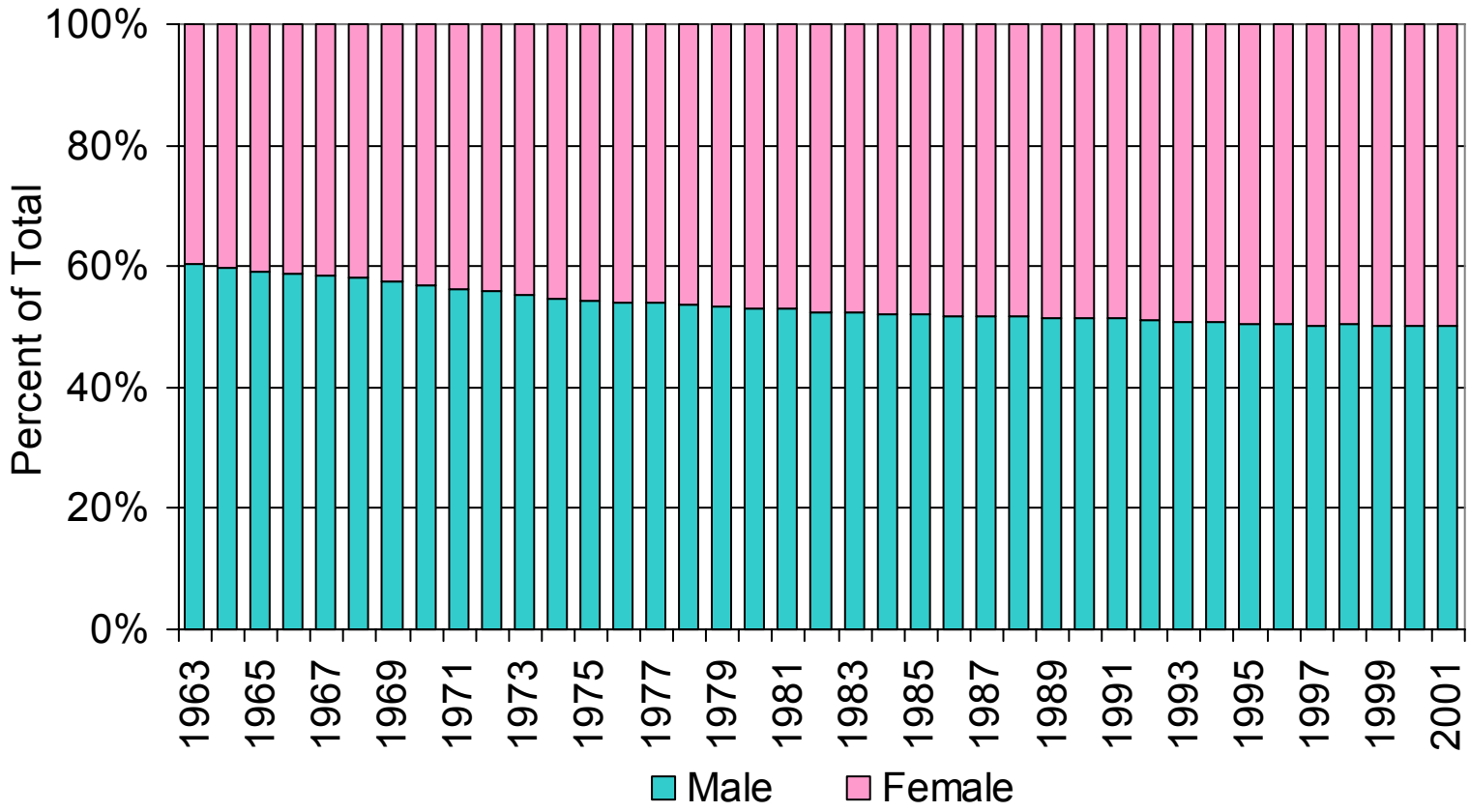
Source: U.S. Census Bureau

Share of Population 16 Years of Age or Older with a Drivers License, 1970-2000



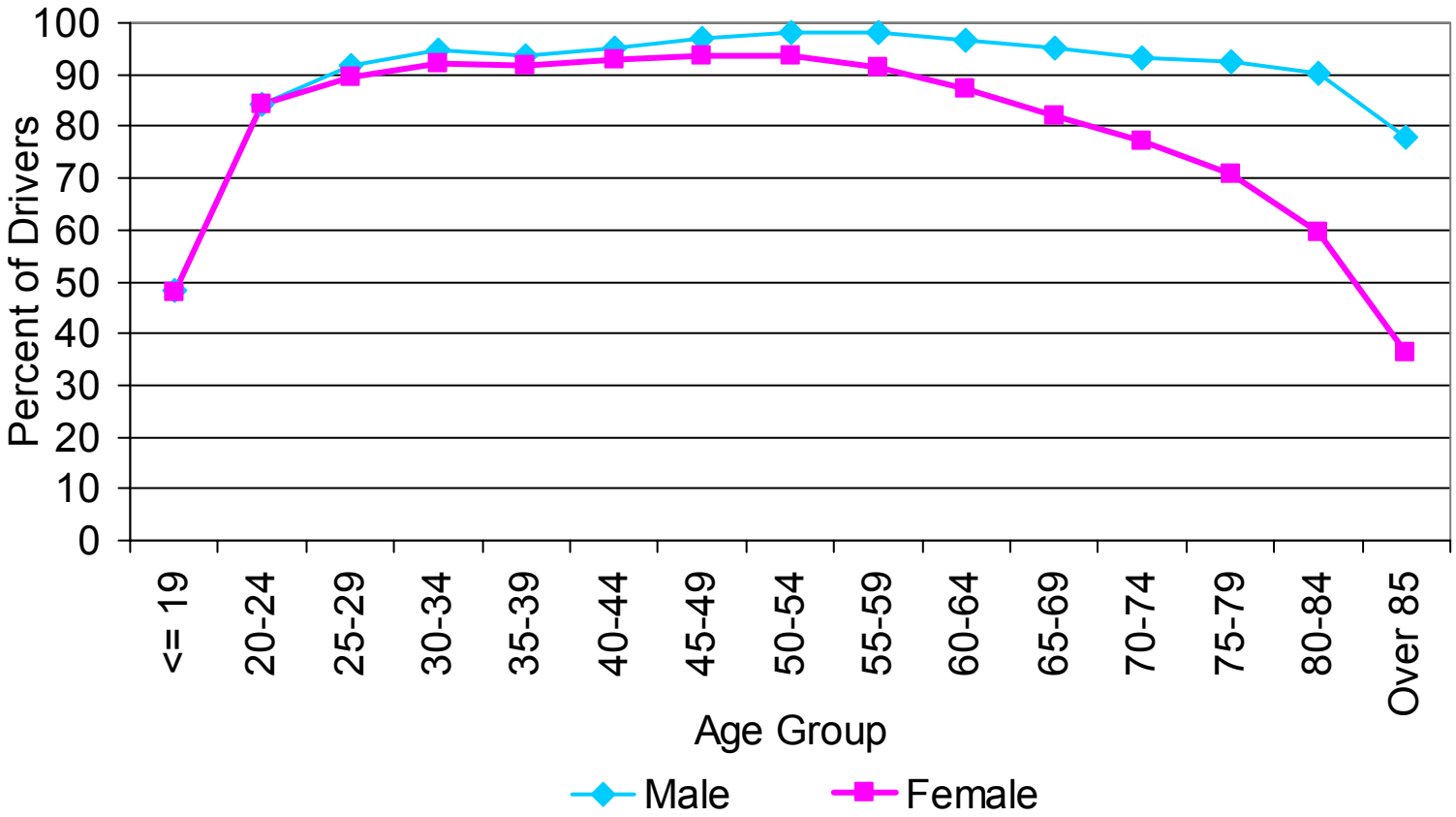
Source: U.S. Department of Transportation, HSS and U.S. Census Bureau

We have reached Gender Equity in Licensed Drivers, 1963-2001



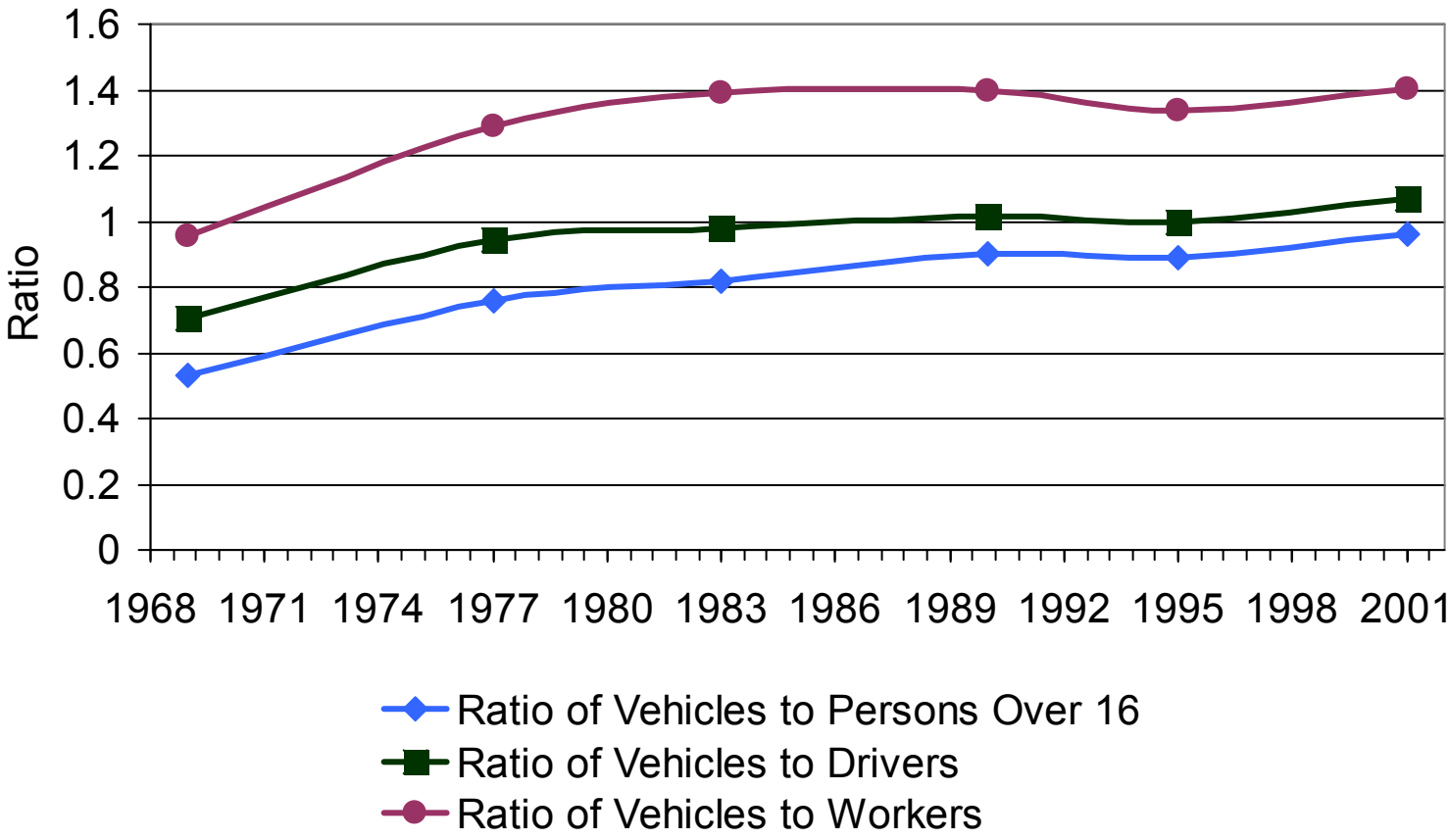
Source: FHWA, Highway Statistics Series

Older Women Less Likely to Drive



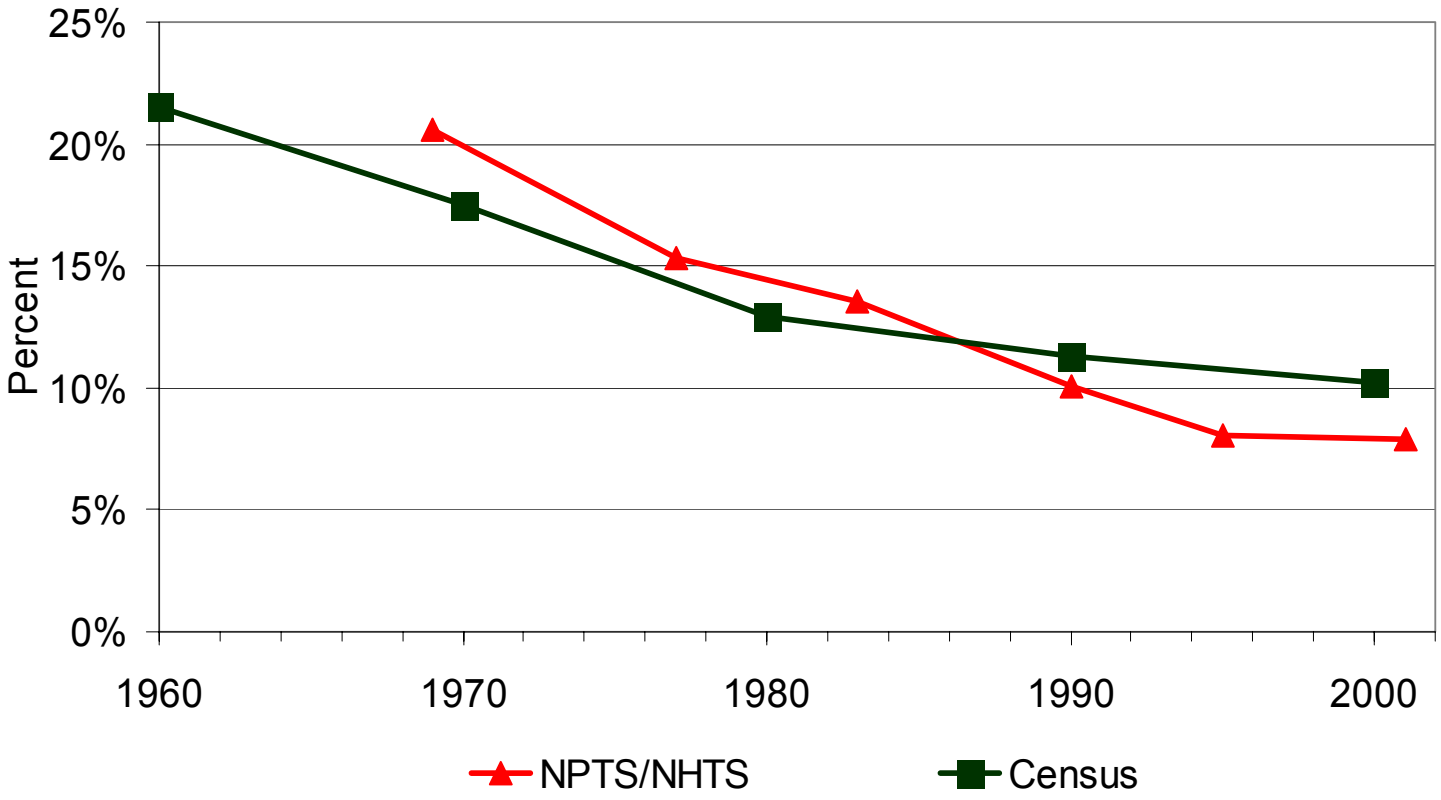
Source: FHWA, Highway Statistics Series, 2000

Vehicle Saturation? Vehicle Gluttony?



Source: FHWA, Highway Statistics Series

Declining Zero-Vehicle Households



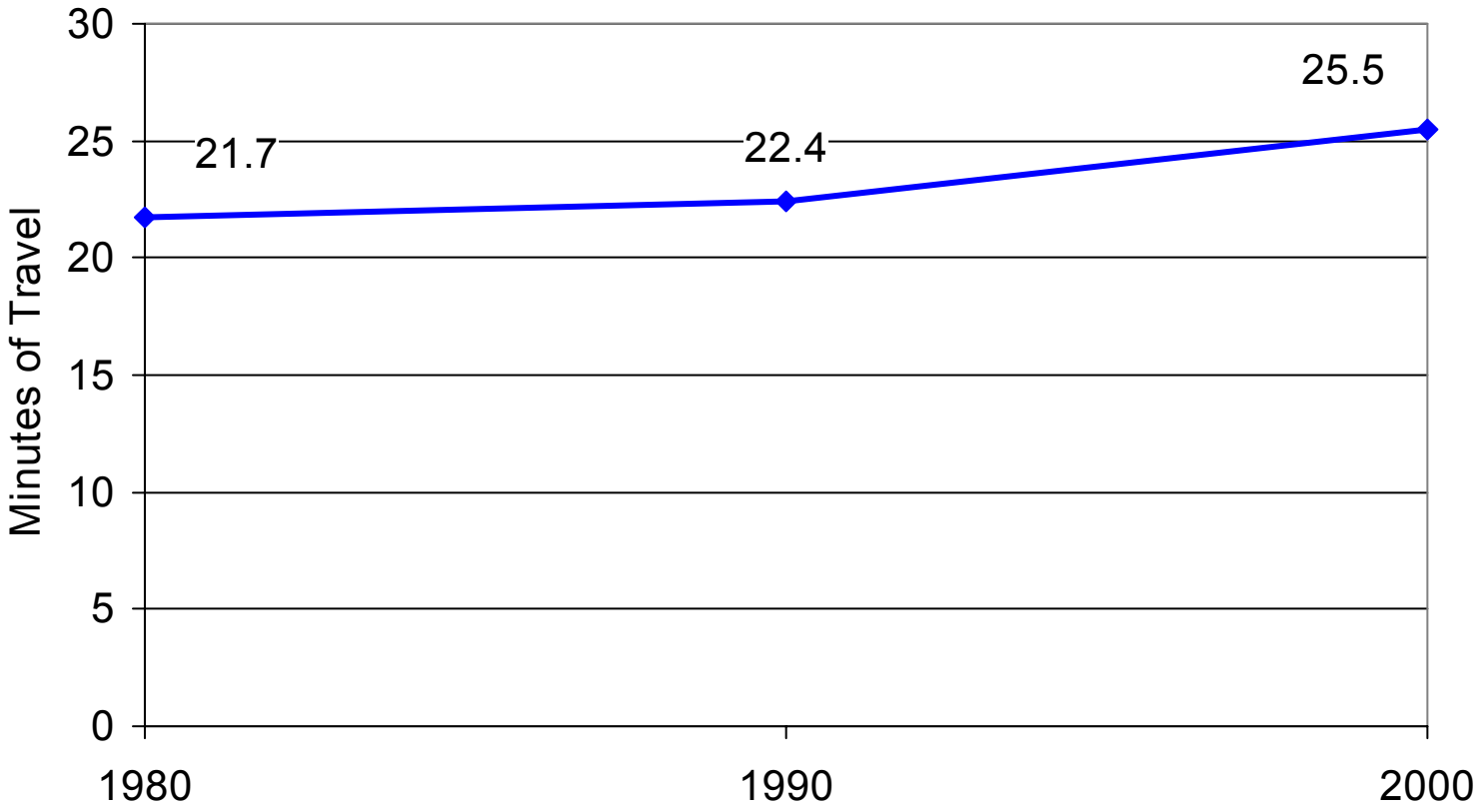
Source: CUTR analysis of NHTS and NPTS and U.S. Census Bureau

Percent Teen Auto "Ownership"

Age	Teens with Auto Available (percent)					
	1999			2003		
	New	Used	Total	New	Used	Total
16-17	1	14	15	9	36	45
18-19	5	12	17	11	47	58

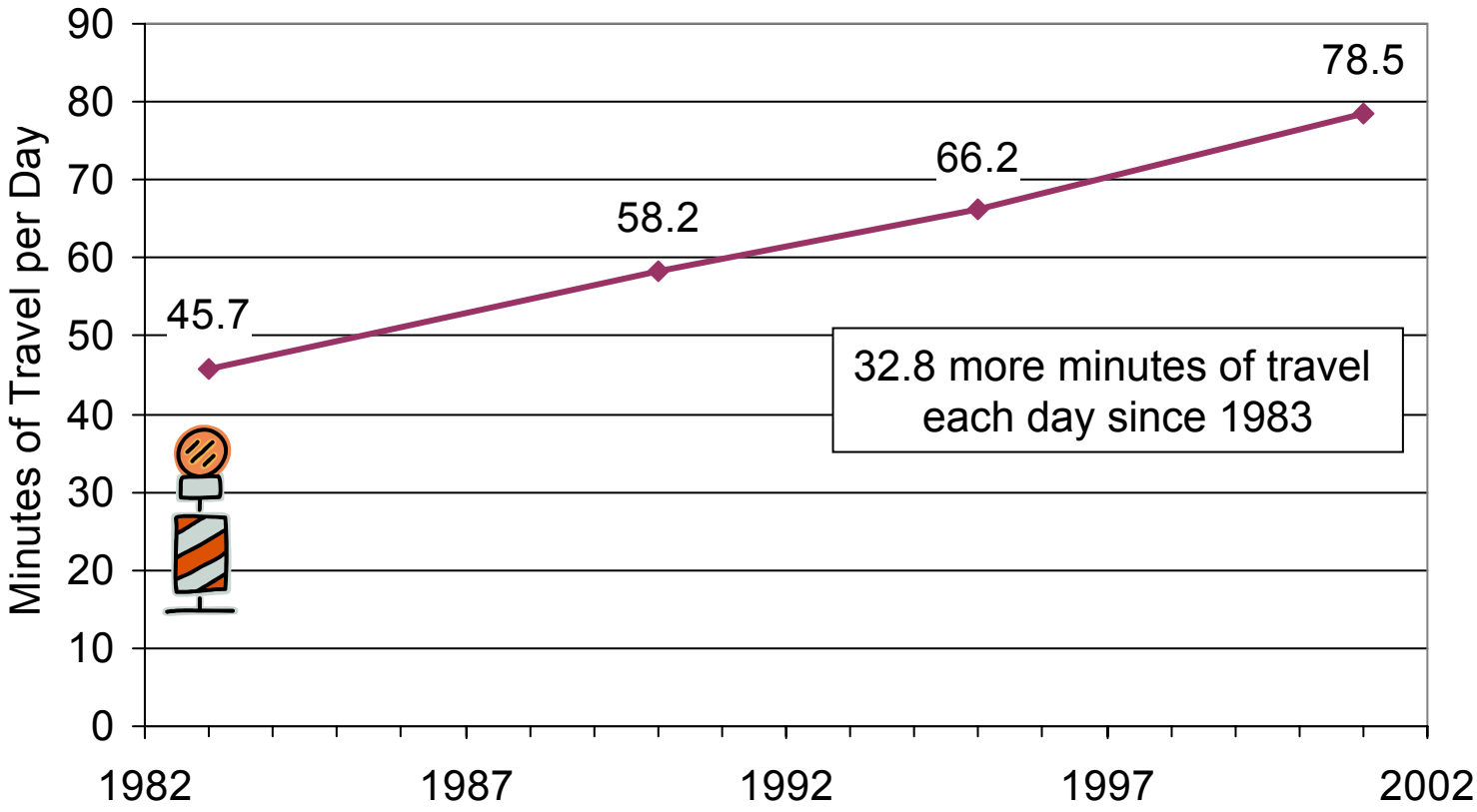
Source: Teenage Research Unlimited, Associated Press, September 14, 2003.

Commute Times Are Growing



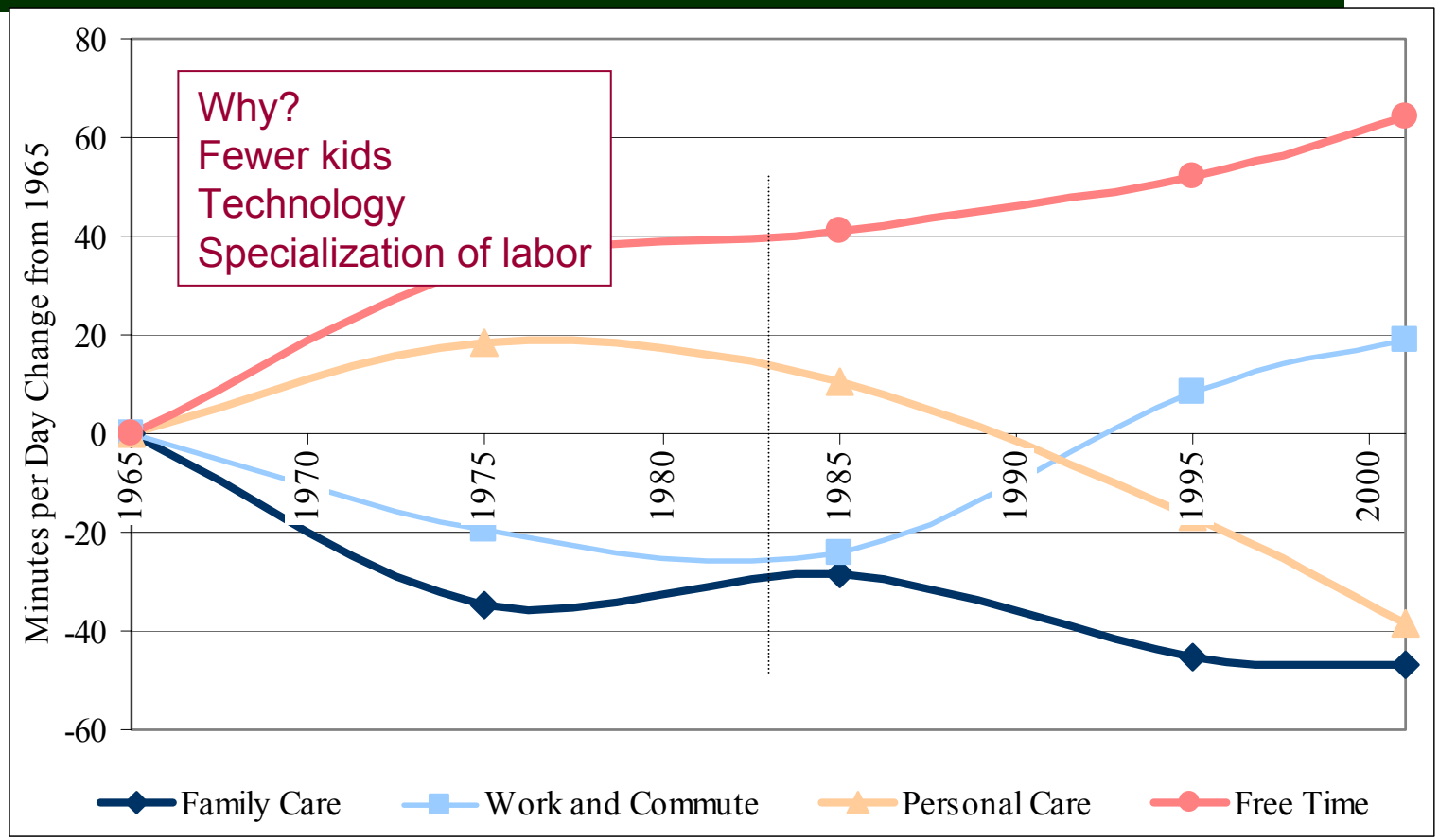
Source: CTPP 2000 and prior

Travel Time Budgets Have Grown 1.8 Minutes per Day per Person per Year



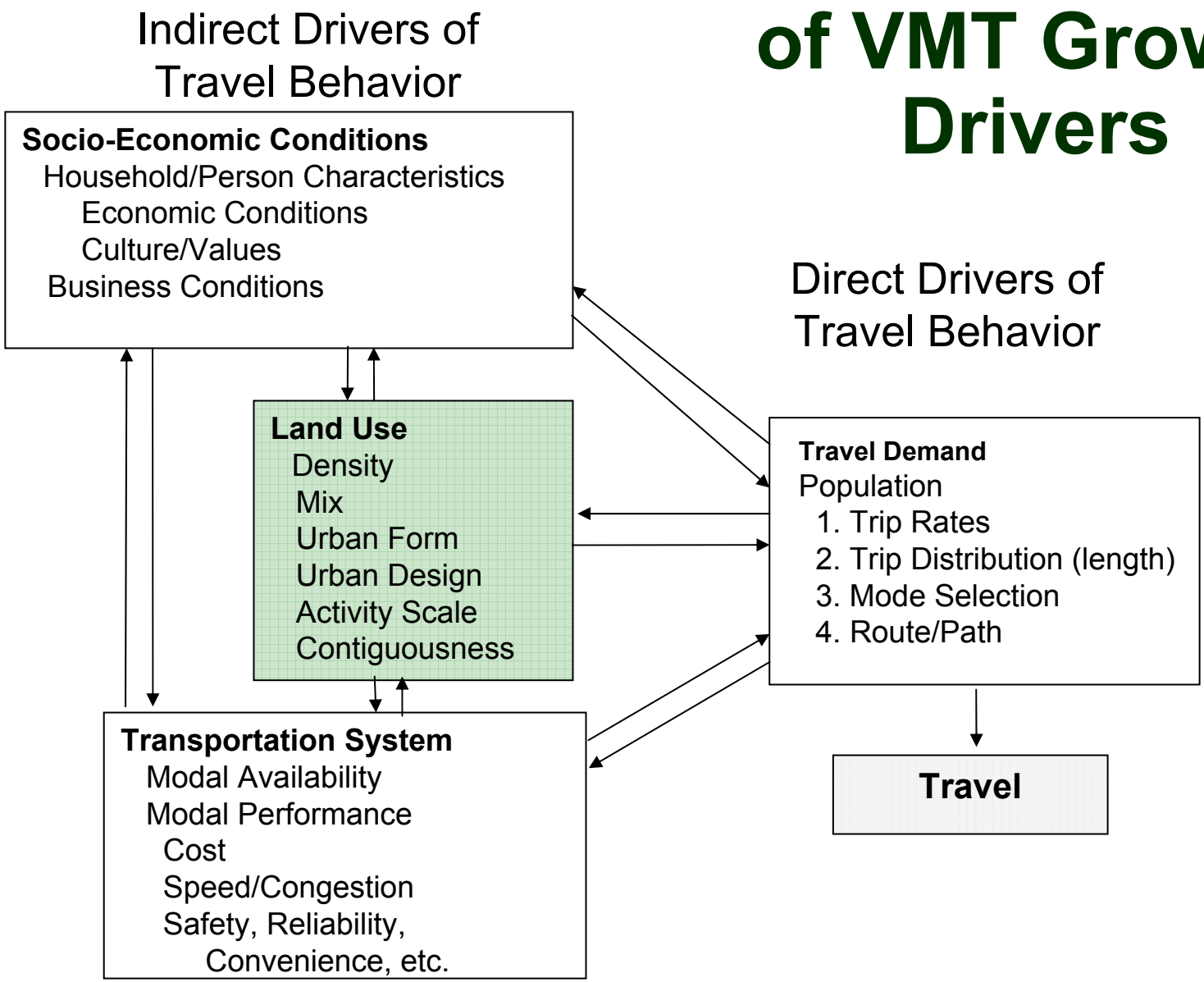
Source: CUTR analysis of NHTS and NPTS

Change of Time Spent by Major Time Use Category from 1965 (Minutes per Day)



Source: *Americans' Use of Time Project cited in Robinson, 1999 and 1998-2001 Time Diary Studies*

Conceptual Model of VMT Growth Drivers



How Does Land Use influence Travel?

Land Use Traits
- Density
- Mix
- Urban Form
- Urban Design
- Activity Scale
- Contiguousness

Travel Demand	Impact of "Better" Land Use	Impact on VMT
Trip Rates	Greater accessibility will tend to encourage trip making	↑
Trip Distribution (length)	Greater accessibility will tend to reduce trip length	↓
Route/Path	Greater accessibility will tend to produce shorter trips	↓
Mode Choice	Greater accessibility and density enables competitive alternative modes	↓

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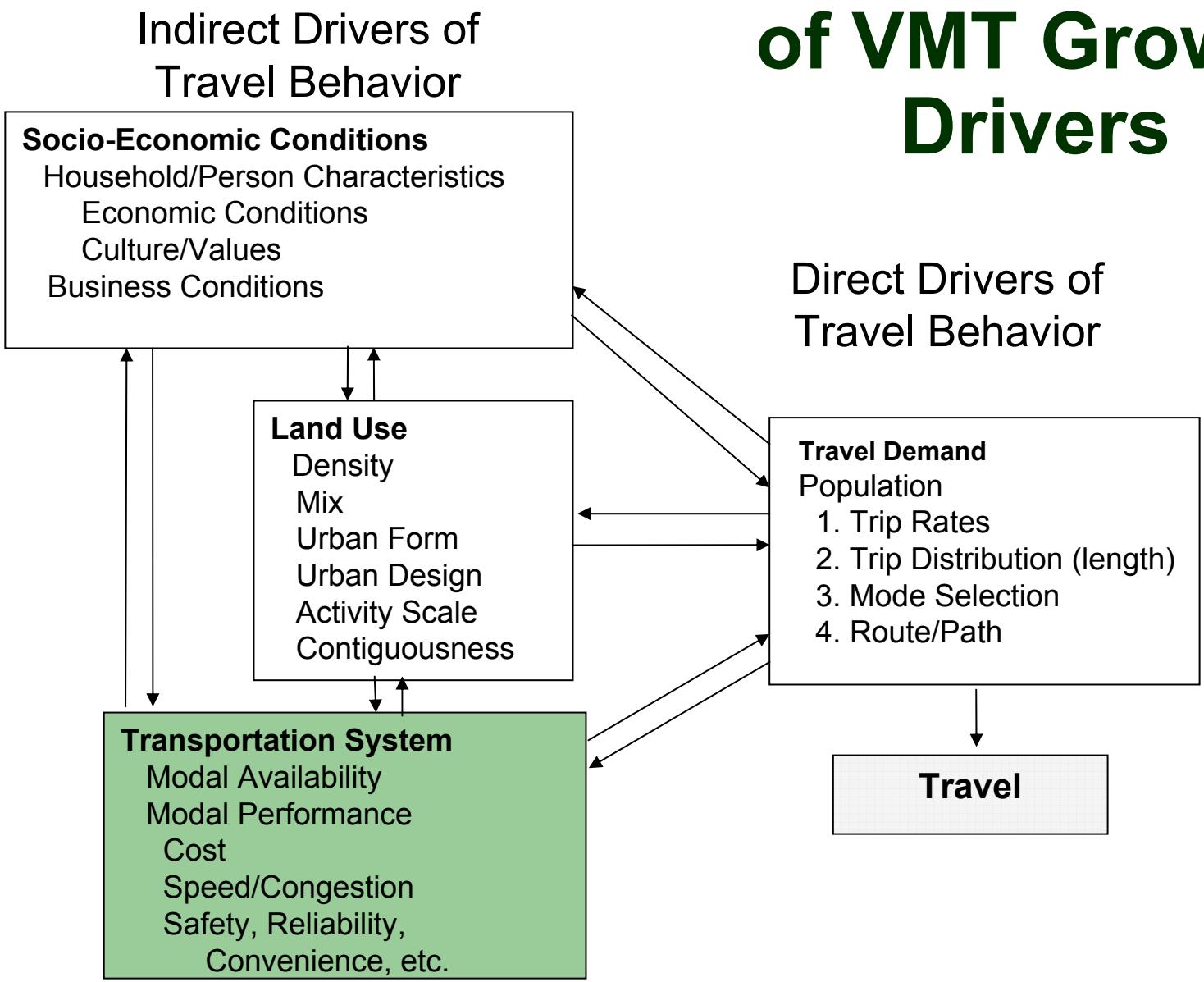
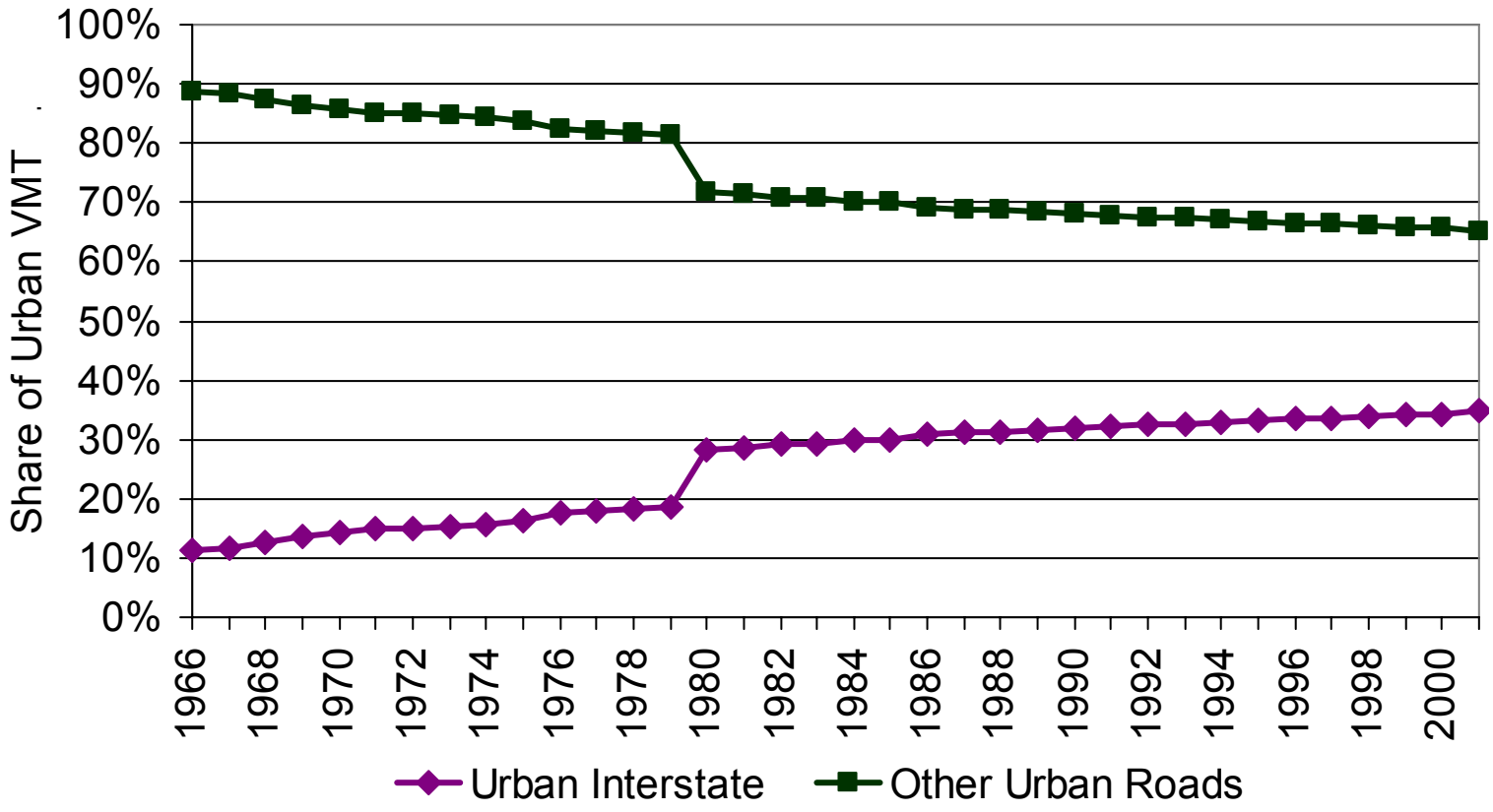
Conceptual Model of VMT Growth Drivers

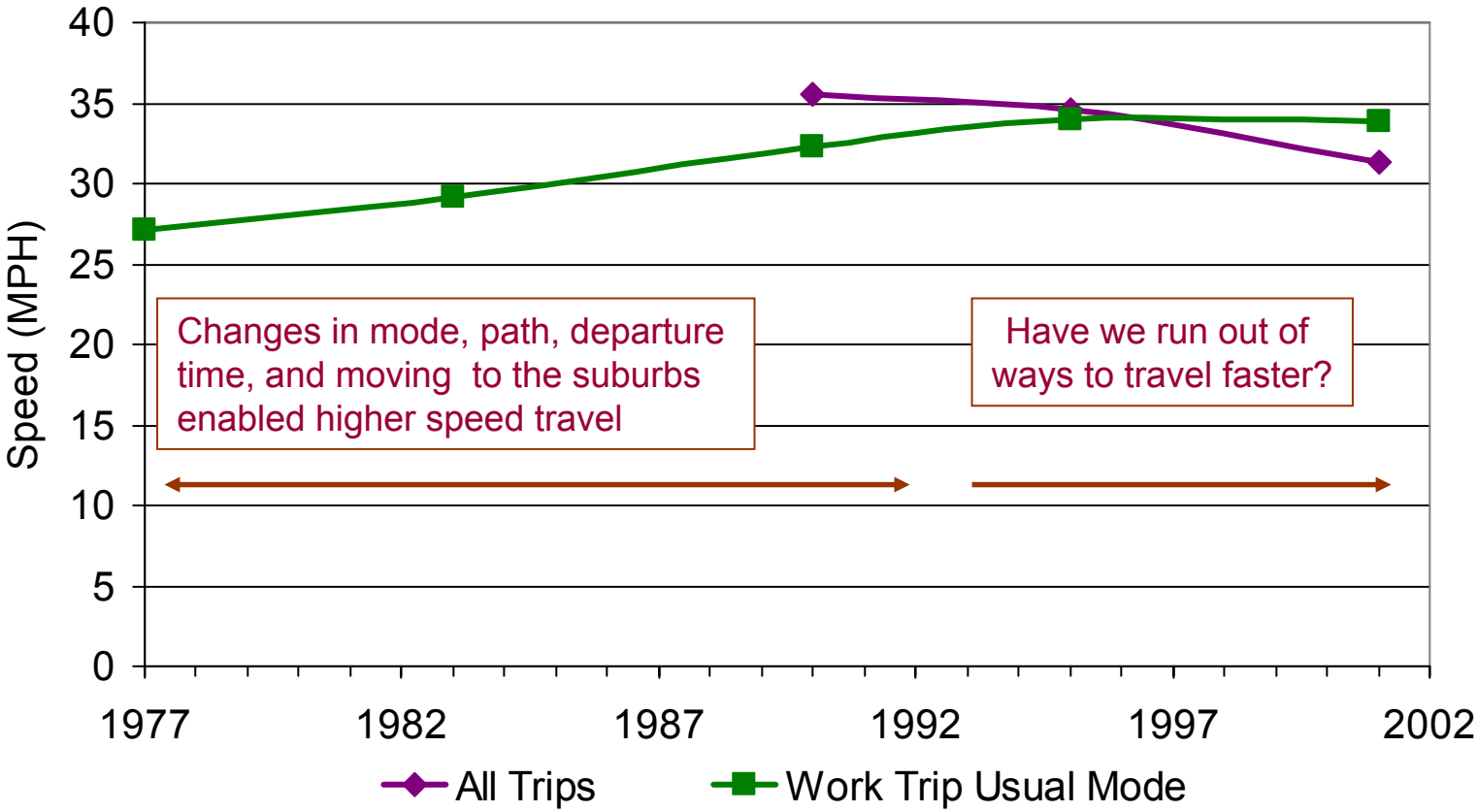


Share of Urban VMT by Road Type, 1966-2001



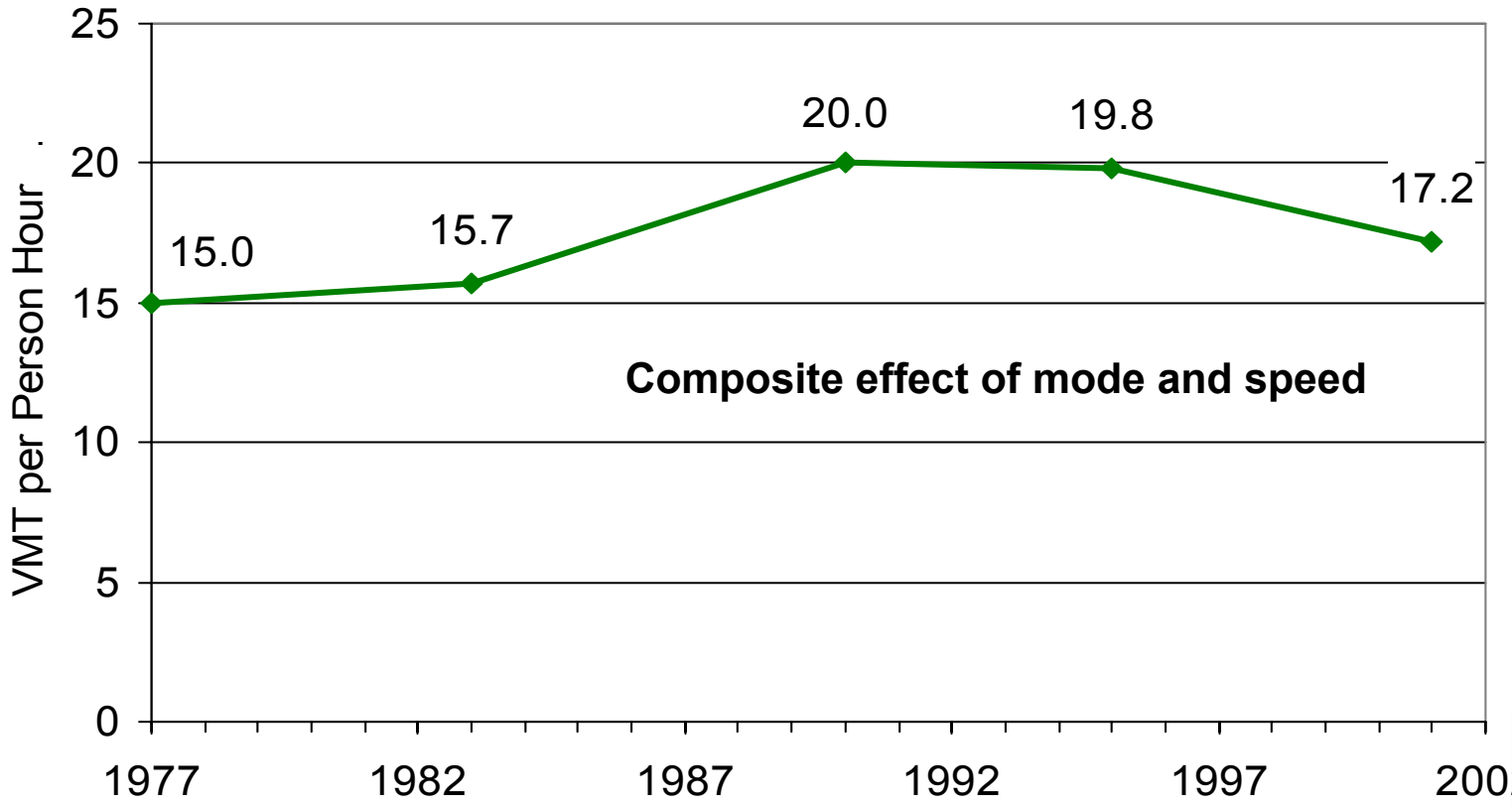
Source: FHWA (Note: Urban Interstate share after 1980 includes Other Urban Freeways and Expressways)

NHTS/NPTS Data Suggest Travel Speeds are Now Slowing



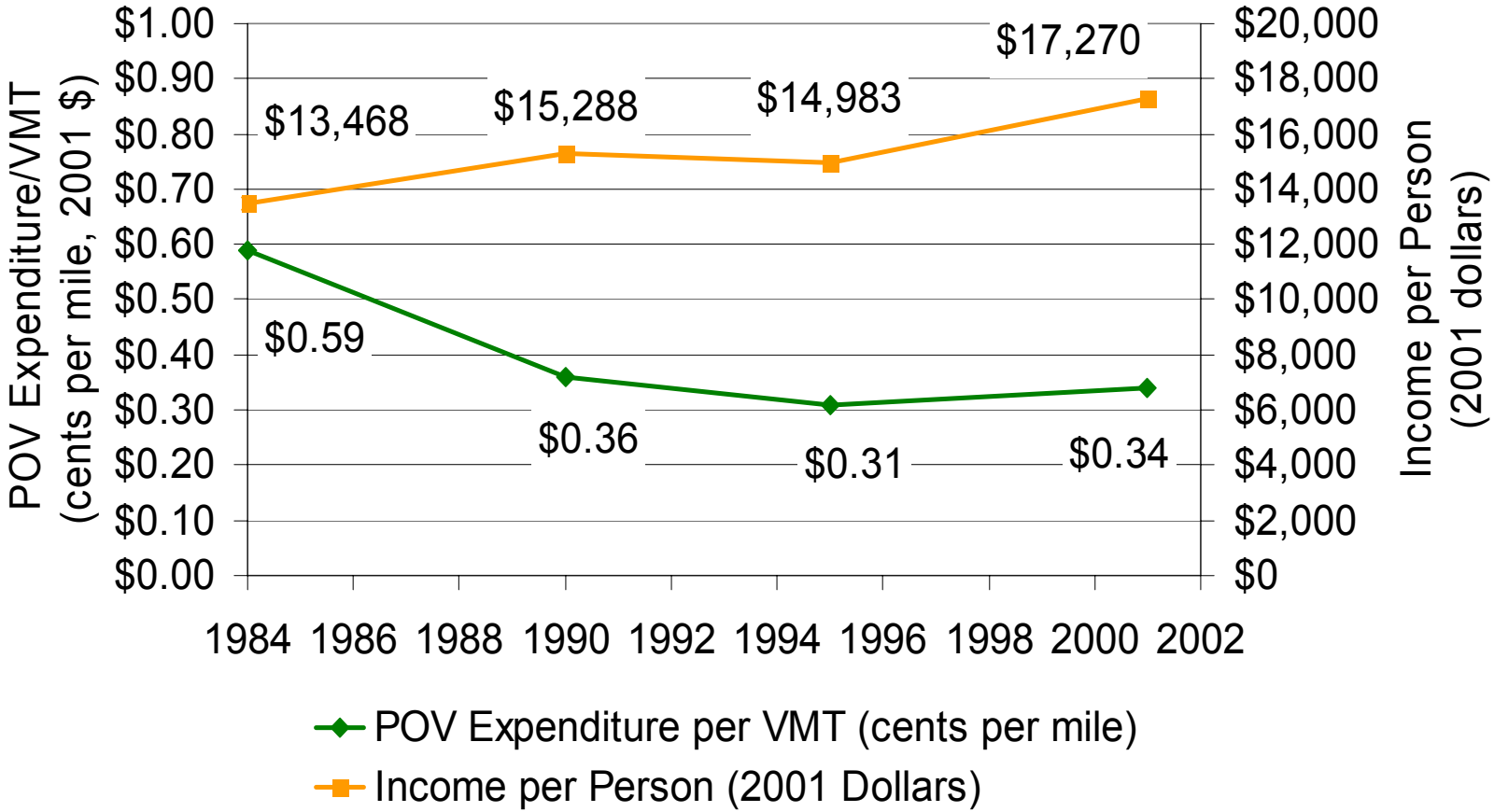
Source: CUTR analysis of NHTS and NPTS

VMT per Person Hour Spent in Travel is Declining



Source: CUTR analysis of NHTS and NPTS

Are Income and Travel Cost Driving VMT Growth?



Source: CUTR analysis of NHTS, BLS

Conceptual Model of VMT Growth Drivers

Indirect Drivers of Travel Behavior

Socio-Economic Conditions
- Household/Person Characteristics
- Economic Conditions
- Culture/Values
- Business Conditions

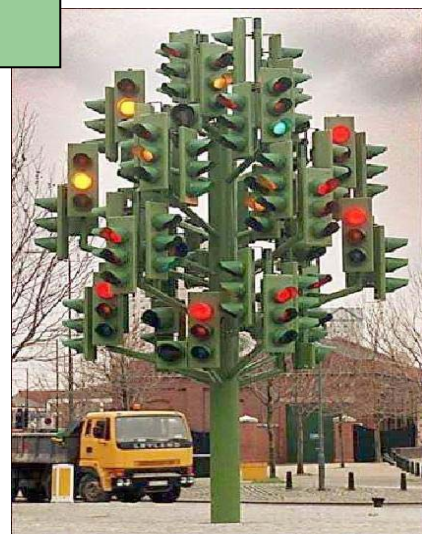
Land Use
- Density
- Mix
- Urban Form
- Urban Design
- Activity Scale
- Contiguousness

Transportation System
- Modal Availability
- Modal Performance
  - Cost
  - Speed/Congestion
  - Safety, Reliability, Convenience, etc.

Direct Drivers of Travel Behavior

Travel Demand
Population
1. Trip Rates
2. Trip Distribution (length)
3. Mode Selection
4. Route/Path

Travel



VMT Growth Estimation Equations

Trip Generation Trip Length Mode

1. $$\text{Population} \times \frac{\text{Person Trips}}{\text{Person}} \times \frac{\text{Person Miles}}{\text{Person Trips}} \times \frac{\text{Vehicle Miles}}{\text{Person Miles}} \equiv \text{Vehicle Miles}$$

Travel Time Budget Travel Speed

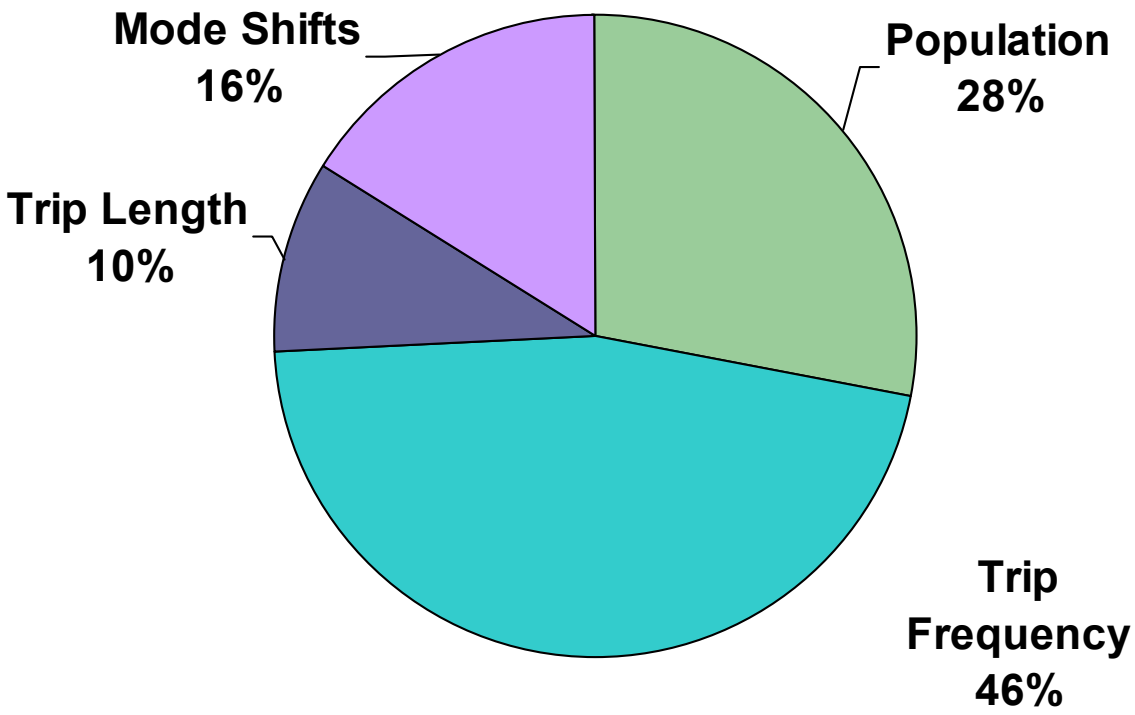
2. $$\text{Population} \times \frac{\text{Person Hours of Travel}}{\text{Person}} \times \frac{\text{Vehicle Miles}}{\text{Person Hours of Travel}} \equiv \text{Vehicle Miles}$$

Key Indicators, 1977 to 2001

	1977	2001	% Change 1977-2001
All Persons (000)	213,141	277,208	+30.1%
HH VT (000,000)	108,826	234,994	+115.9%
HH VMT (000,000)	907,603	2,281,863	+151.4%
Person Trips (000,000)	211,778	410,969	+94.1%
PMT (000,000)	1,879,215	4,026,158	+114.3%
PT/P/Year (trip rate)	994	1,483	+49.2%
PMT/PT (trip length)	8.874	9.797	+10.4%
VMT/PM (mode)	0.483	0.567	+17.4%

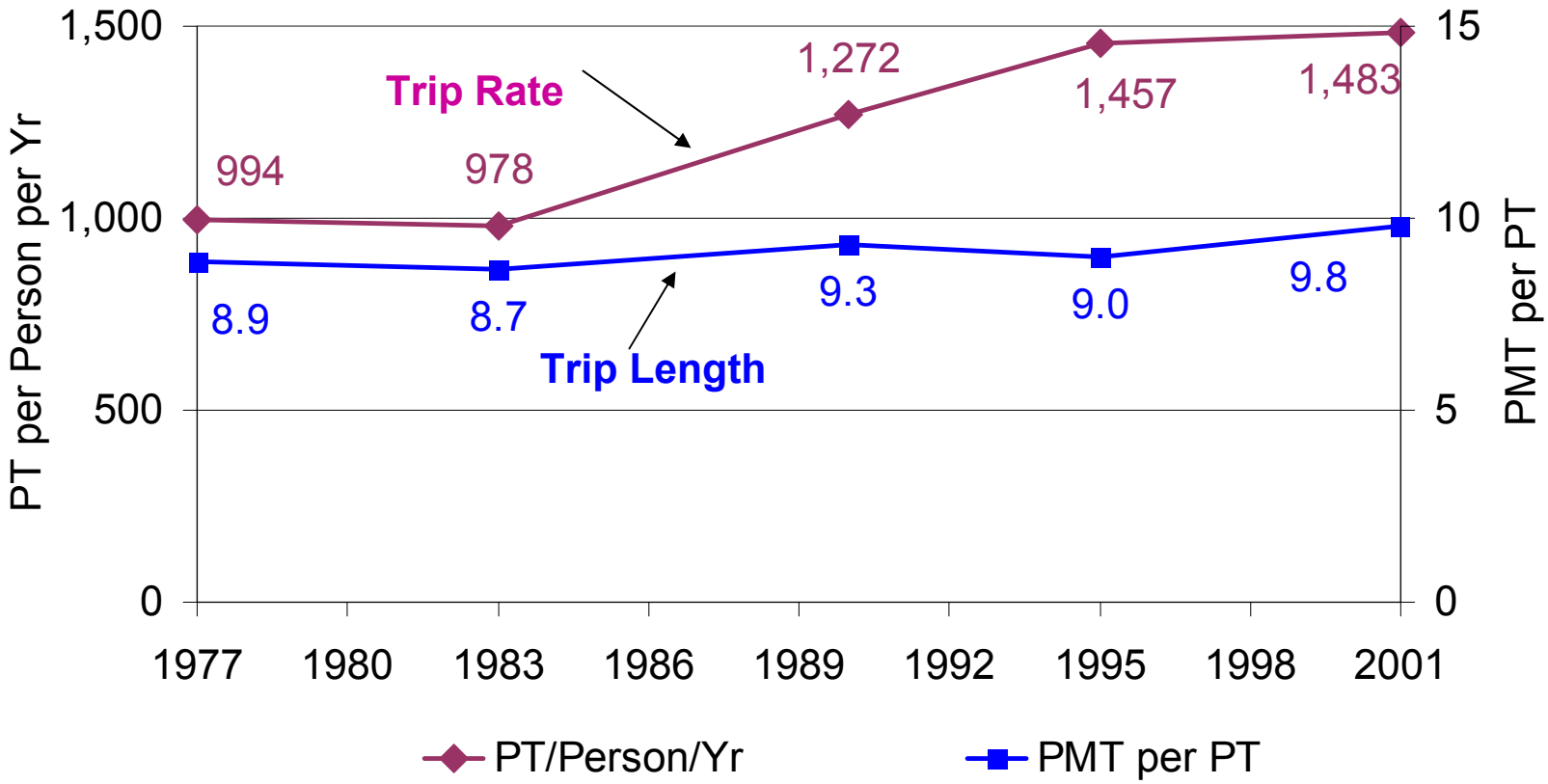
Source: CUTR analysis of NHTS and NPTS

Factors Contributing to US VMT Growth 1977-2001



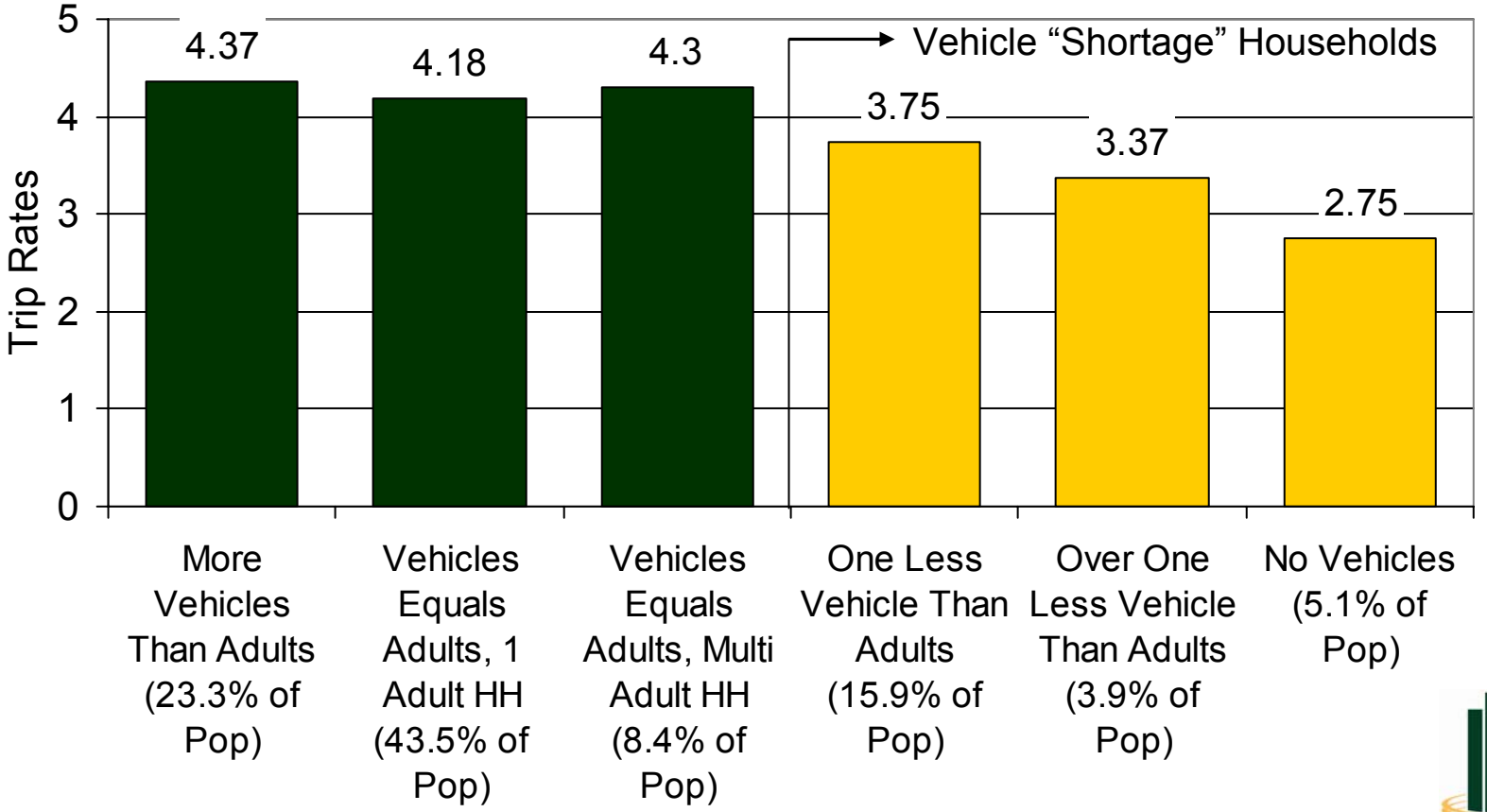
Source: CUTR analysis of NHTS and NPTS

Person Trips per Person per Year and PMT per Person Trip



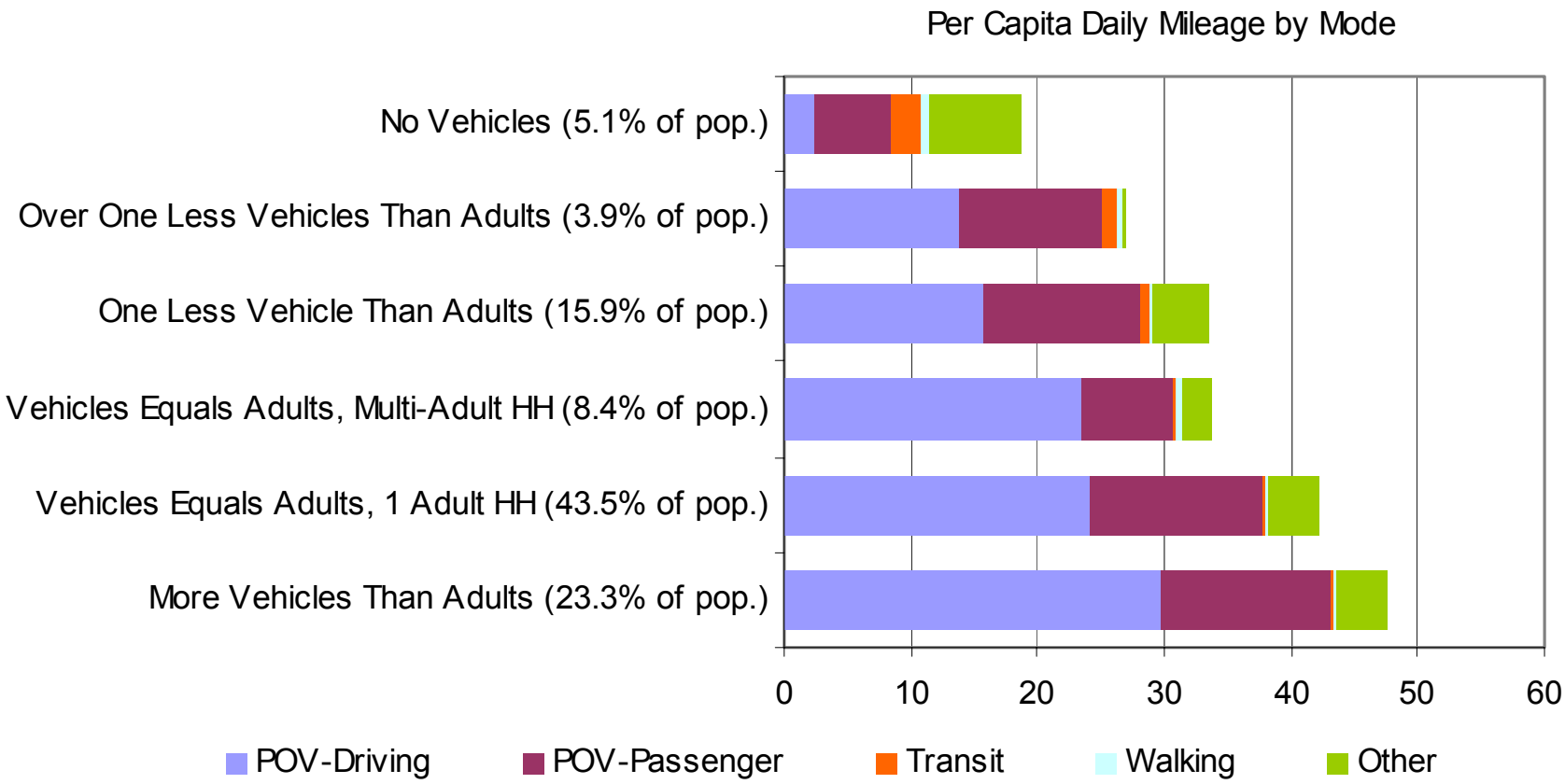
Source: CUTR analysis of NHTS and NPTS

Daily Person Trip Rates by Vehicle Availability, 2001



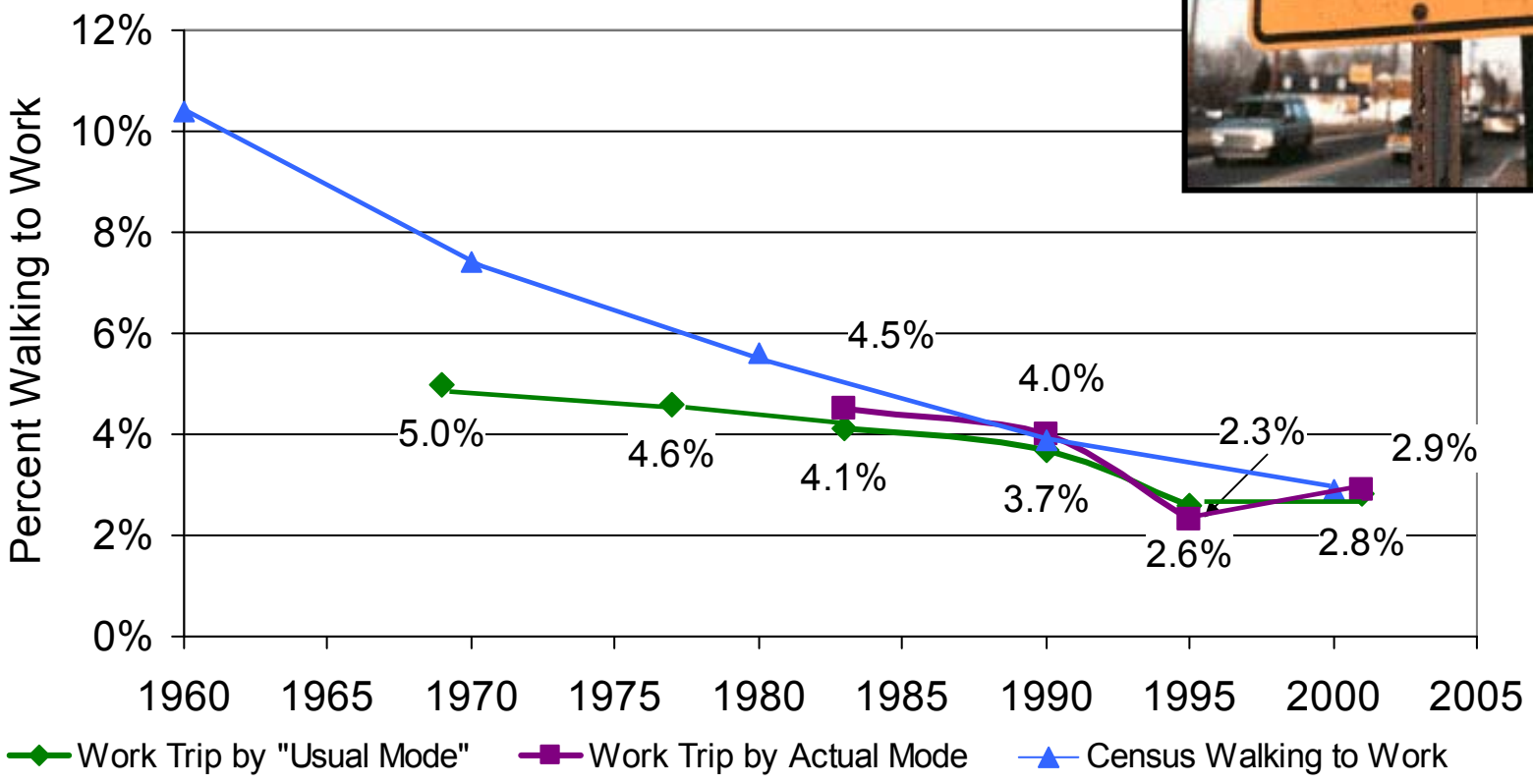
Source: CUTR analysis of NHTS

Daily Mileage by Vehicle Availability and Mode, 2001



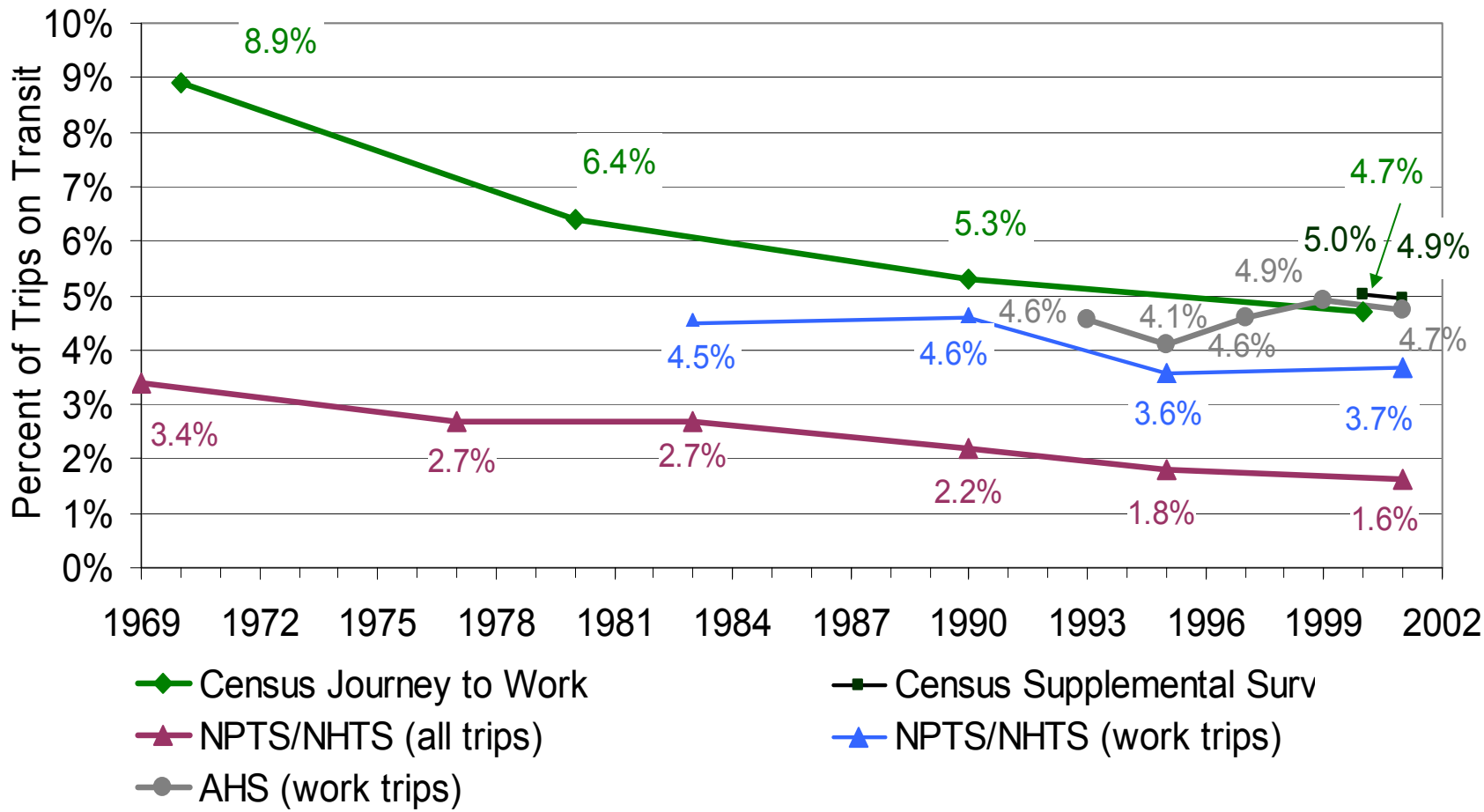
Source: CUTR analysis of NHTS

Declining Walk Shares

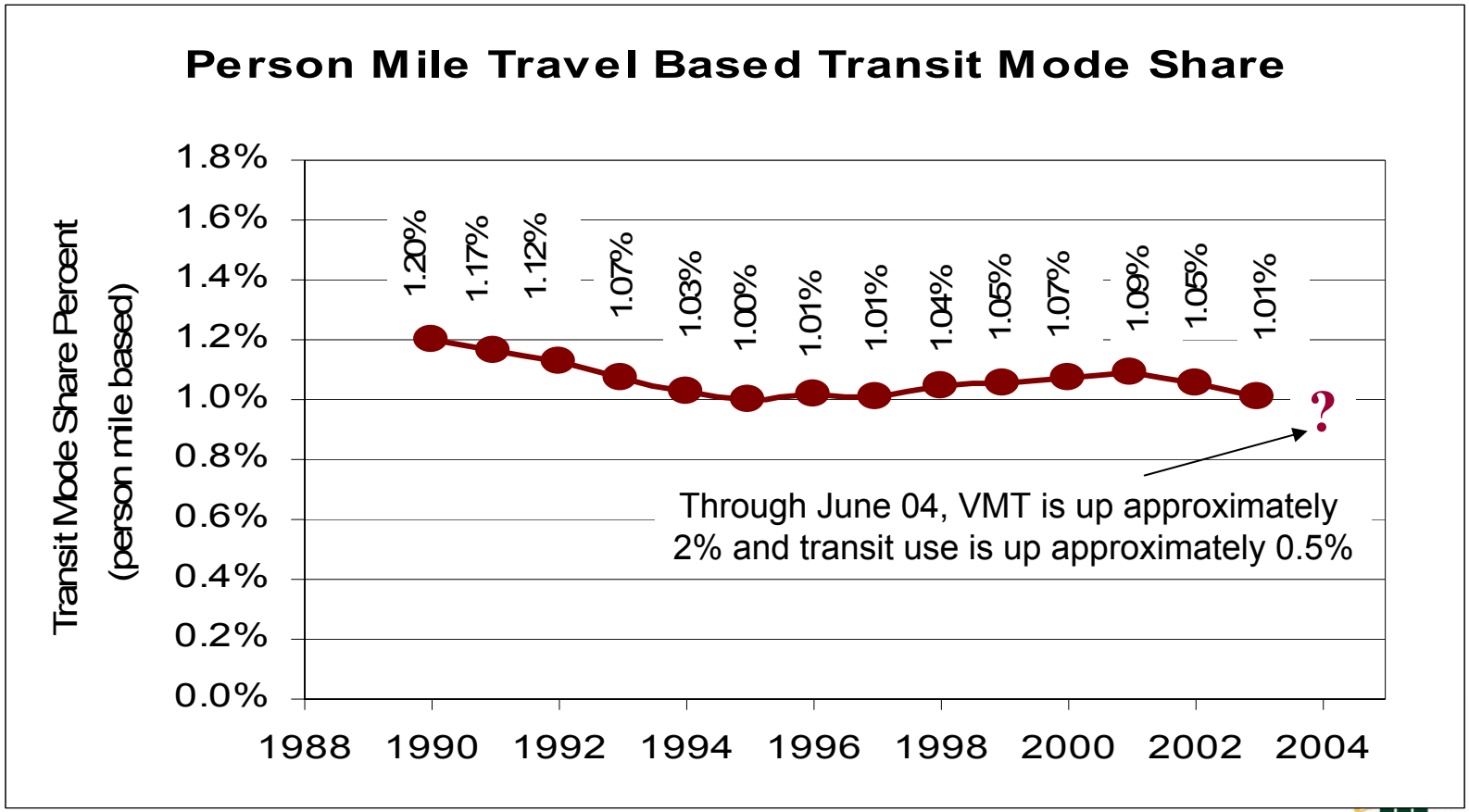


Source: CUTR analysis of NHTS and NPTS, U.S. Census Bureau

Ending the Decline in Transit Mode Share – Survey Data

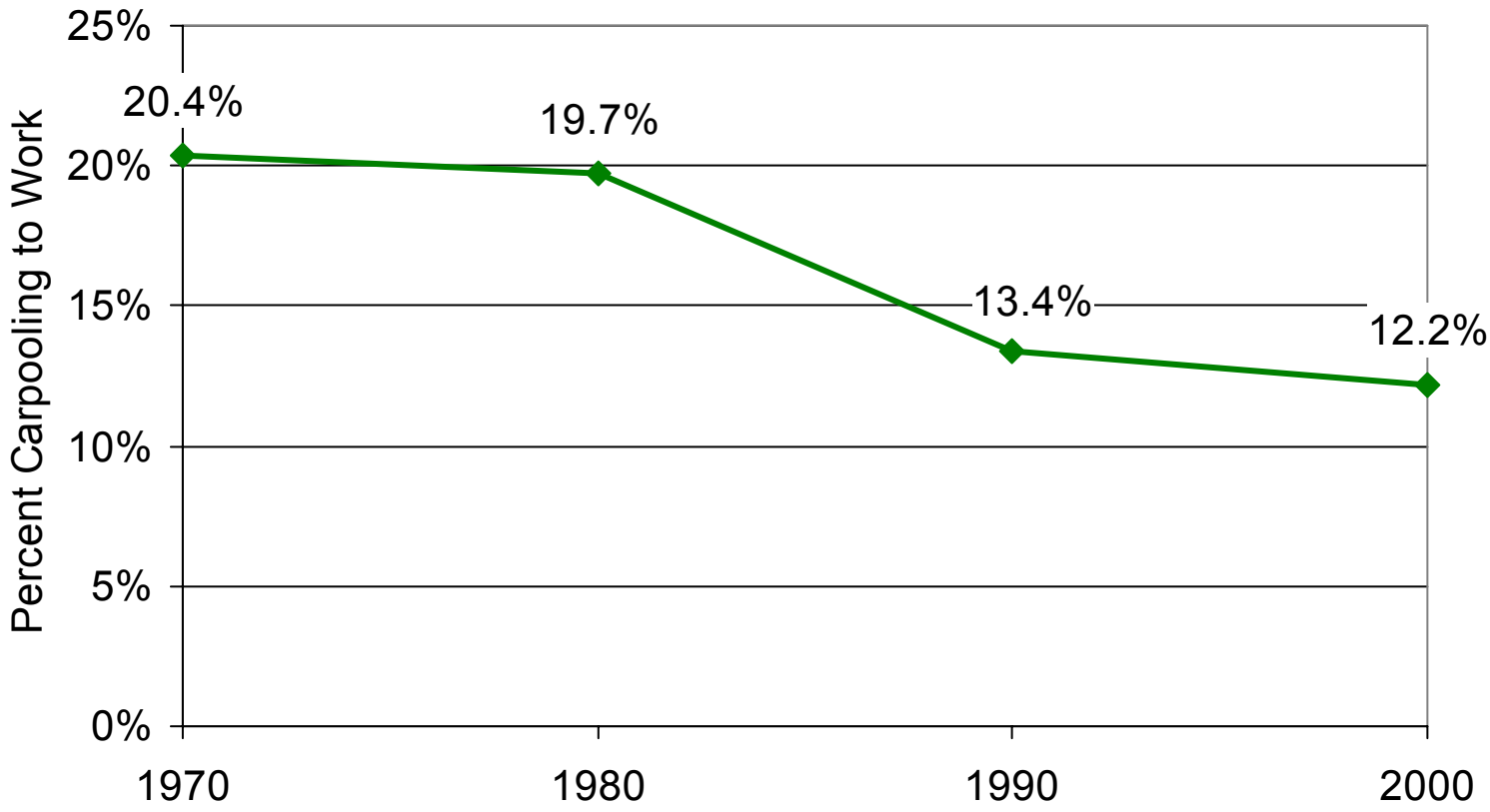


Transit Share in Person Miles – Empirical Data



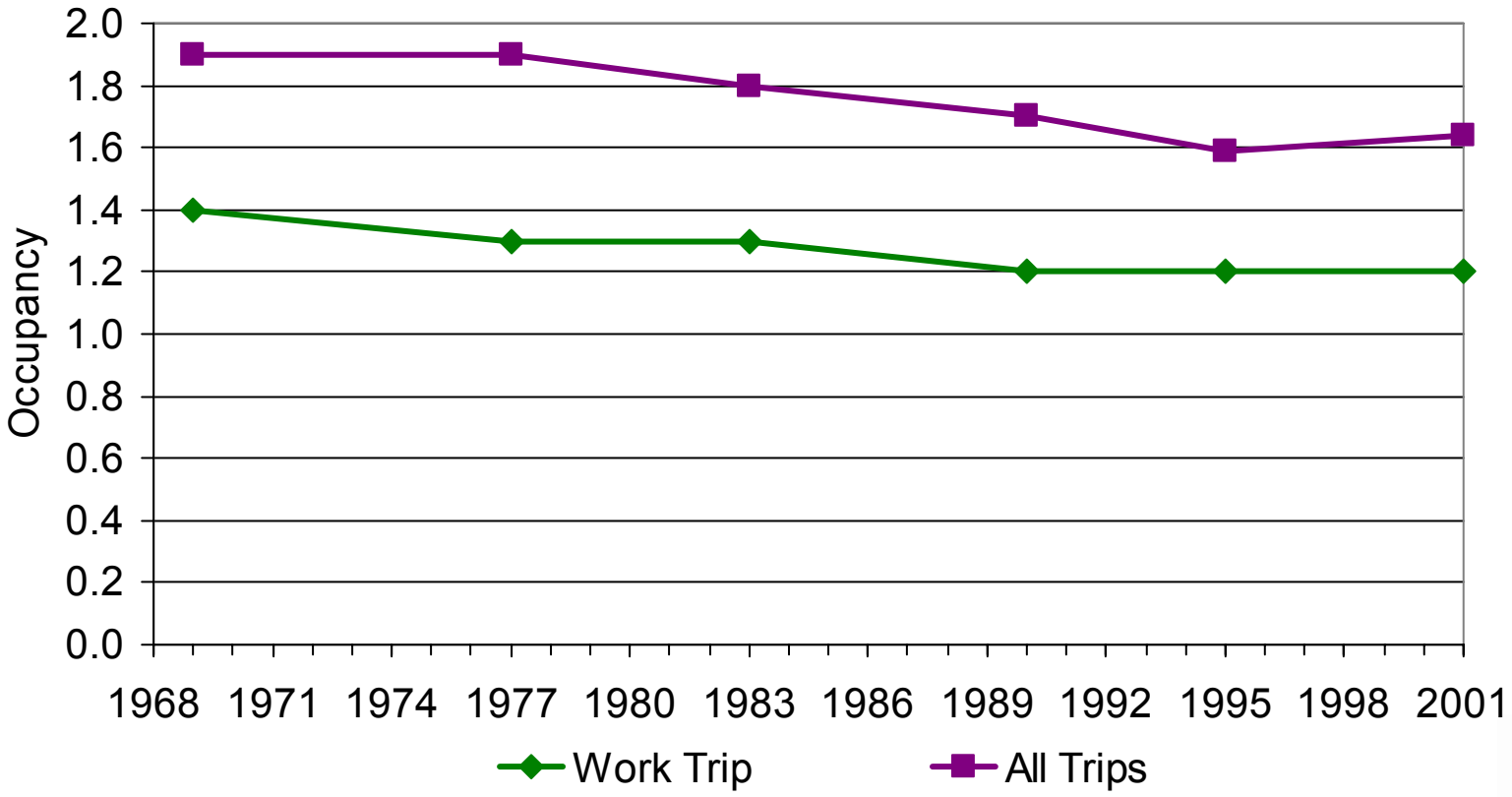
Source: CUTR analysis of NHTS, NPTS, FHWA, and APTA data

Census Work Trips Carpooling Mode Share



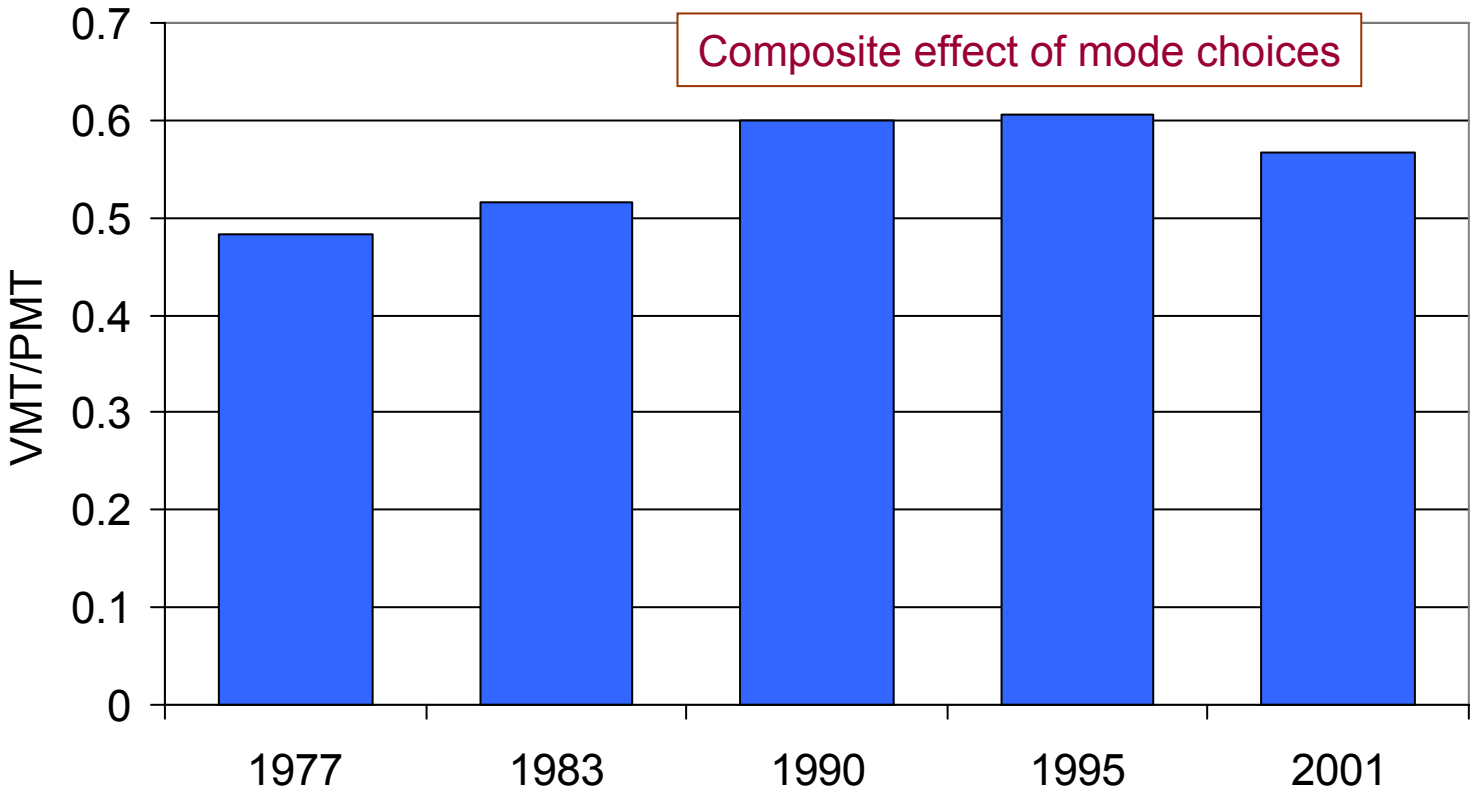
Source: U.S. Census Bureau

Stabilizing Vehicle Occupancies – NHTS and NPTS



Source: CUTR analysis of NHTS and NPTS

Slowing Vehicle Miles of Travel Per Person Mile of Travel



Source: CUTR analysis of NHTS and NPTS

So What Does this Mean in Terms of VMT?

VMT Growth Estimation Equations

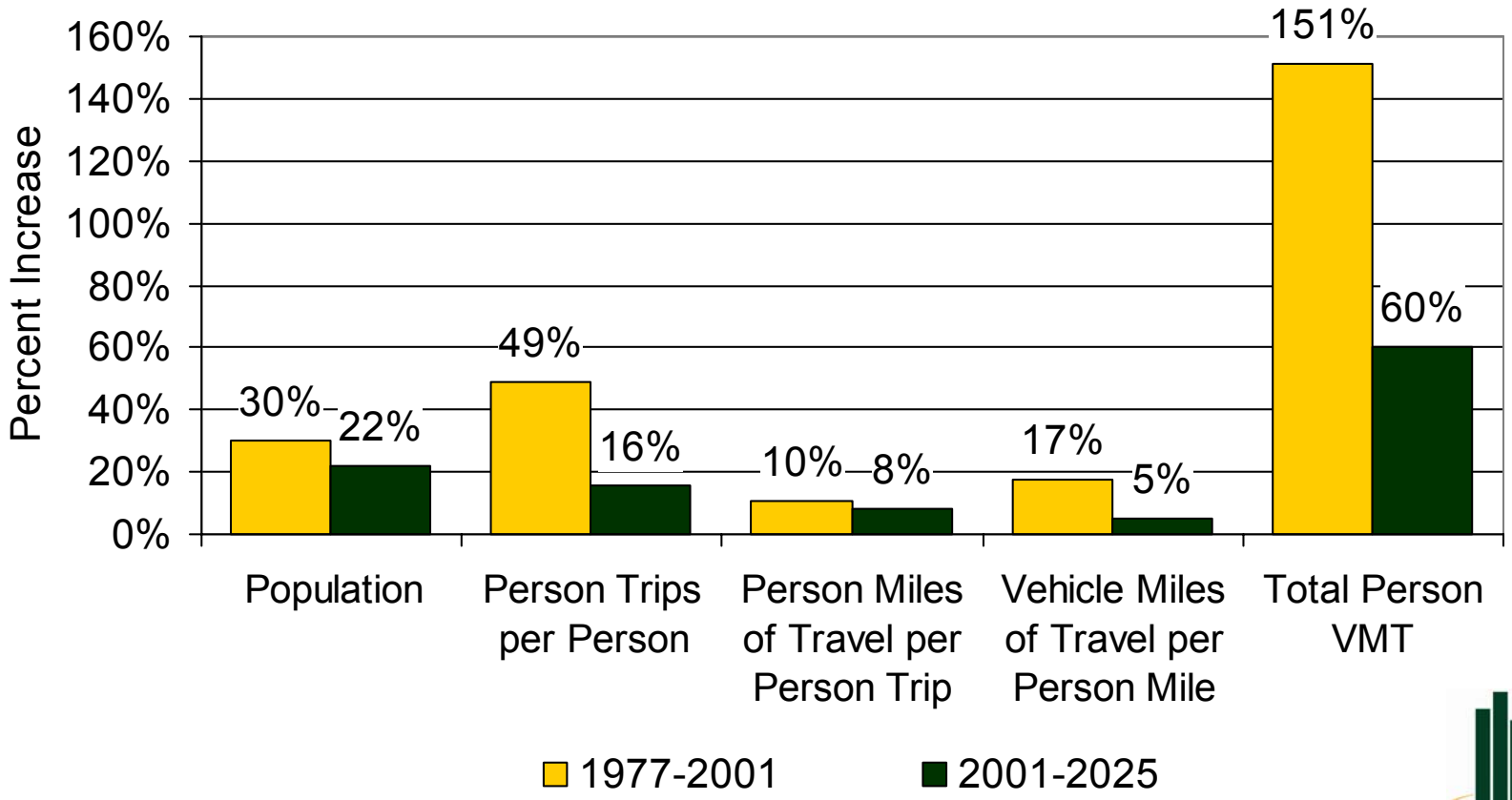
Trip Generation Trip Length Mode

$$1.\ \text{Population} \times \frac{\text{Person Trips}}{\text{Person}} \times \frac{\text{Person Miles}}{\text{Person Trips}} \times \frac{\text{Vehicle Miles}}{\text{Person Miles}} \equiv \text{Vehicle Miles}$$

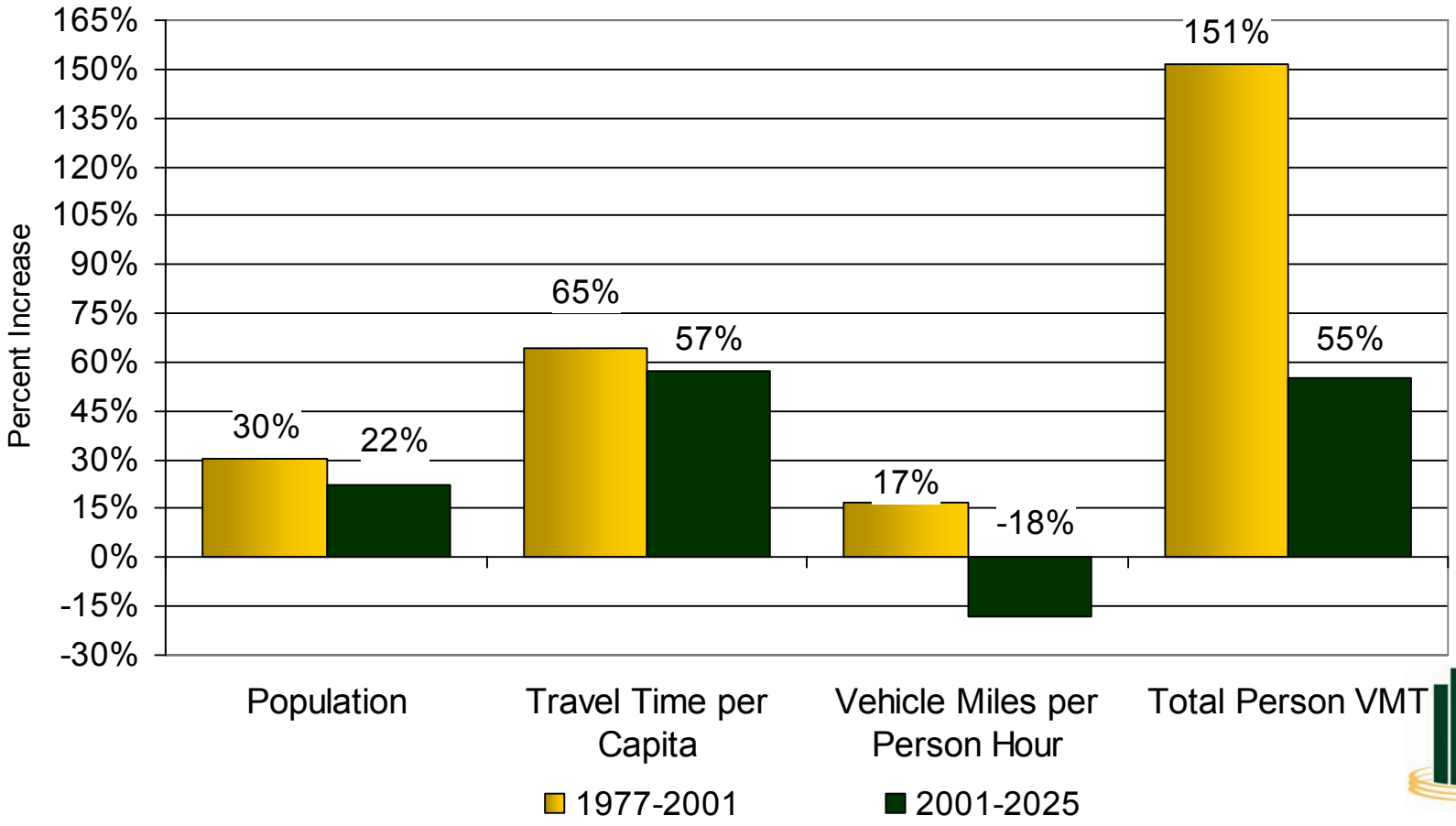
Travel Time Budget Travel Speed

$$2.\ \text{Population} \times \frac{\text{Person Hours of Travel}}{\text{Person}} \times \frac{\text{Vehicle Miles}}{\text{Person Hours of Travel}} \equiv \text{Vehicle Miles}$$

VMT Growth Scenario 1



VMT Growth Scenario 2



Future VMT Growth

- *Vehicle Miles Traveled 2001* – 2.08% per year (to 2020)
- Scenario One – 1.98% per year (to 2025)
- Scenario Two – 1.90% per year (to 2025)

Observations

- The moderation of several historic trends may have significant impacts in terms of future VMT demand as well as on other aspects of travel behavior.

Socio-Economic Conditions

- Average Household Size
- Women Labor Force Participation Rates
- Women Share of Licensed Drivers
- Share of Zero Vehicle Households

Transportation System

- Travel Speed

Travel Trends

- Mode Share of Public Transportation
- Vehicle Occupancies
- Mode Share for Walk, Bike
- Perhaps trip rates

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Observations (Transportation Supply)

Increases in system capacity (supply) compared to demand growth remains uncertain.

- What will federal, state and local willingness to increase spending be?
- Will there be the public will to tolerate the impacts of transportation system expansion?
- What role will toll facilities play?
- What increase in transit supply and use will occur?
- What capacity benefits will be realized by ITS?

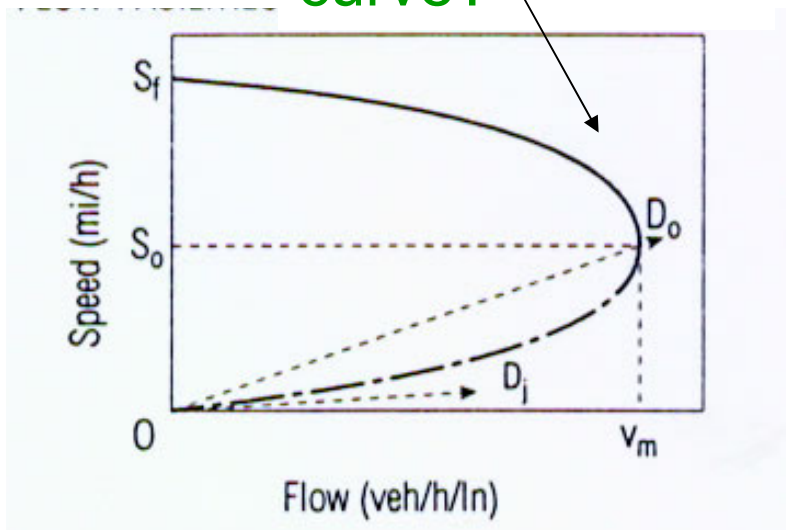
Observations (travel behaviors)

The dynamic response of our system subject to growing demand is not well understood.

How will people adapt?

- Communications substitution
- Temporal shifts in demand
- Location shifts to avoid congestion
- “Fragileness” of our system

Where are we on this HCM curve?



Observations & Speculations

The growth in trip making and travel time budgets poses the greatest risk to moderating travel demand.

- Historic causal variables of income, car ownership and worker status are no longer the dominant drivers of trip making (we no longer know how to forecast trip generation growth?)
- Multi-tasking moderates the reluctance to travel:
  - Eating in car
  - Cell phone use
- Activities are shifting from inside to outside of home:
  - Specialization of labor (eating out, hired services)
  - Socialization (for working Americans the social relationships have moved from the front porch or back yard to the workplace break room)
  - Parenting (more organized youth activities and lessons)
  - Specialization of services (GP Dr. > specialist > lab > scanning center)
- Land use changes will not impact the trip making

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Observations

- Uncertainties include:
  - Energy costs and traveler reactions
  - The extend to which development trends change toward smart growth (retrofit versus new town)
  - The extent to which housing affordability encourage housing dispersion
  - Whether activity scale continues to influence travel (mega churches, schools, and stores, create longer trips and different social relationships)
  - What will the VMT trends for truck travel be?
  - What will the VMT trends for long distance travel be?
  - Can/will peak spreading continue?

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Socio Demographic Research Questions

- How are older American travel rates likely to change over time?
- Of zero vehicle households what share are by choice, what share have income constraints, what share have mental or physical health or legal constraints?
- Under what conditions do multi-person households result in some economy of travel?
- What happened to the concept of a travel time budget? Are we multitasking in our cars?

Transportation System Performance Research Questions

- Has the increase in congestion occurred so fast as to preclude location decision making from naturally adjusting to intolerable travel times?
- Have we really reached the point where average daily travel speeds are declining?
- To what extent is real income and travel cost, versus time a constraint on additional travel?

Trip Generation, Distribution and Mode Choice Research Questions

- Will trip making levels increase?
- Will trip lengths continue to grow or accelerate?
- Is transit growth inevitable?
- Will walk see a revival as a functional travel mode?
- Will auto occupancies stop declining?

What Will Happen Next?

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