Trips, Chains and Tours-- An Operational Definition

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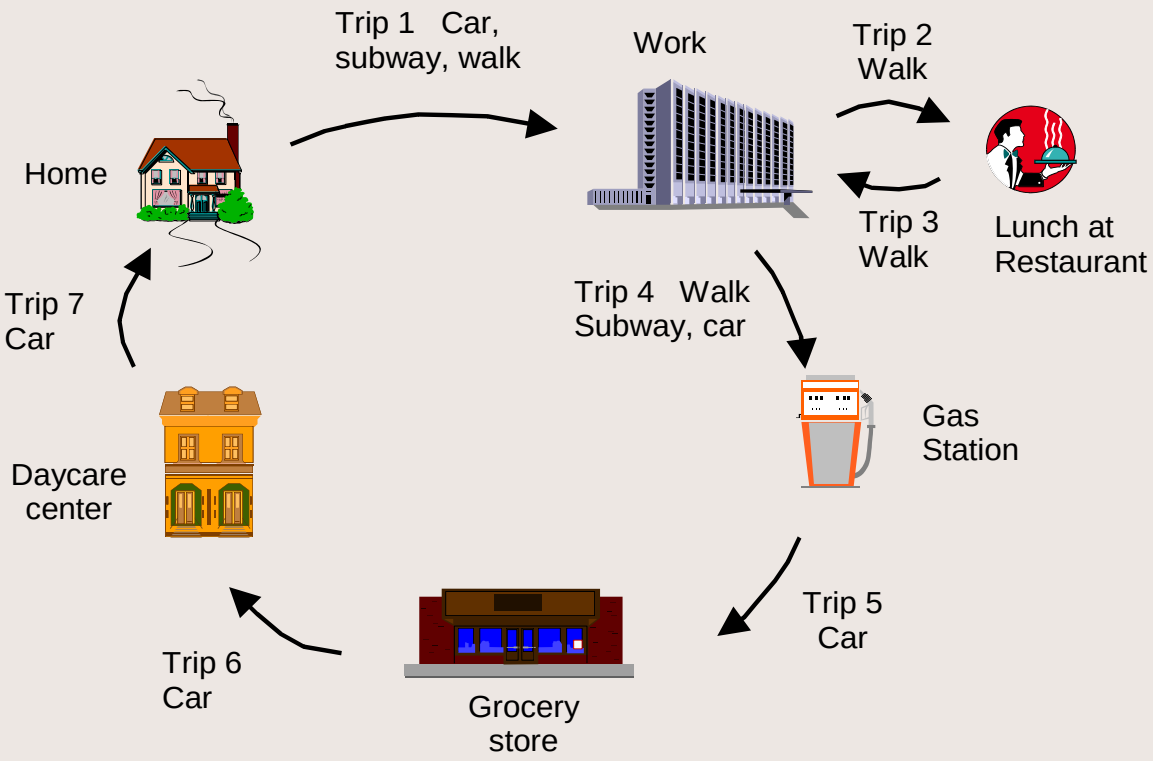
Purpose of the Research:

- Understanding travel behavior
  - Growing understanding that people make travel decisions on multiple destinations
- National and local policy initiatives
  - Air quality attainment/Fuel Use
  - Congestion management: Impact of Flex-Time
- Sustainable measure of trends in commute time and length
  - Census journey-to-work data does not include regular stops
- Trends and growth of non-work travel
  - Weekday vs. weekend travel

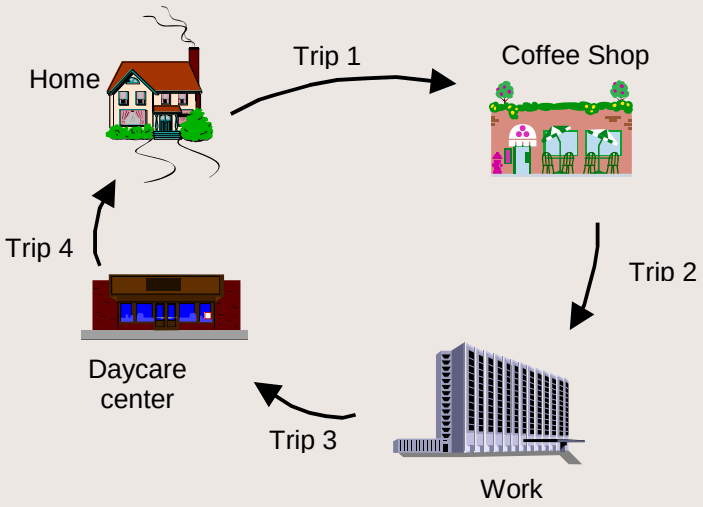
What is a Trip?

In the NPTS data series a trip is defined as “any travel from one address to another by any means”.



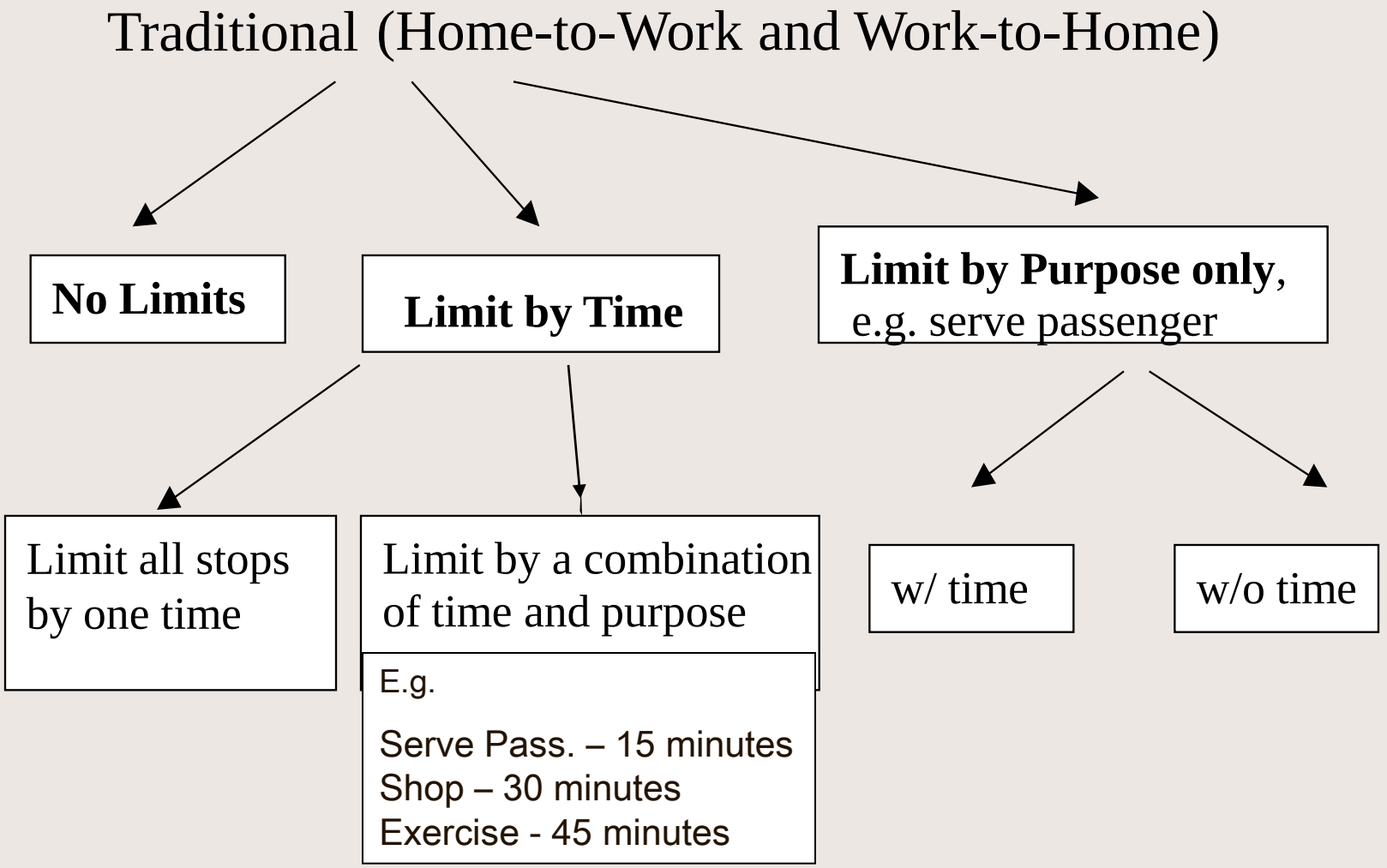
What is a Trip Chain?

Like art, most transportation planners believe they know a trip chain when they see one.

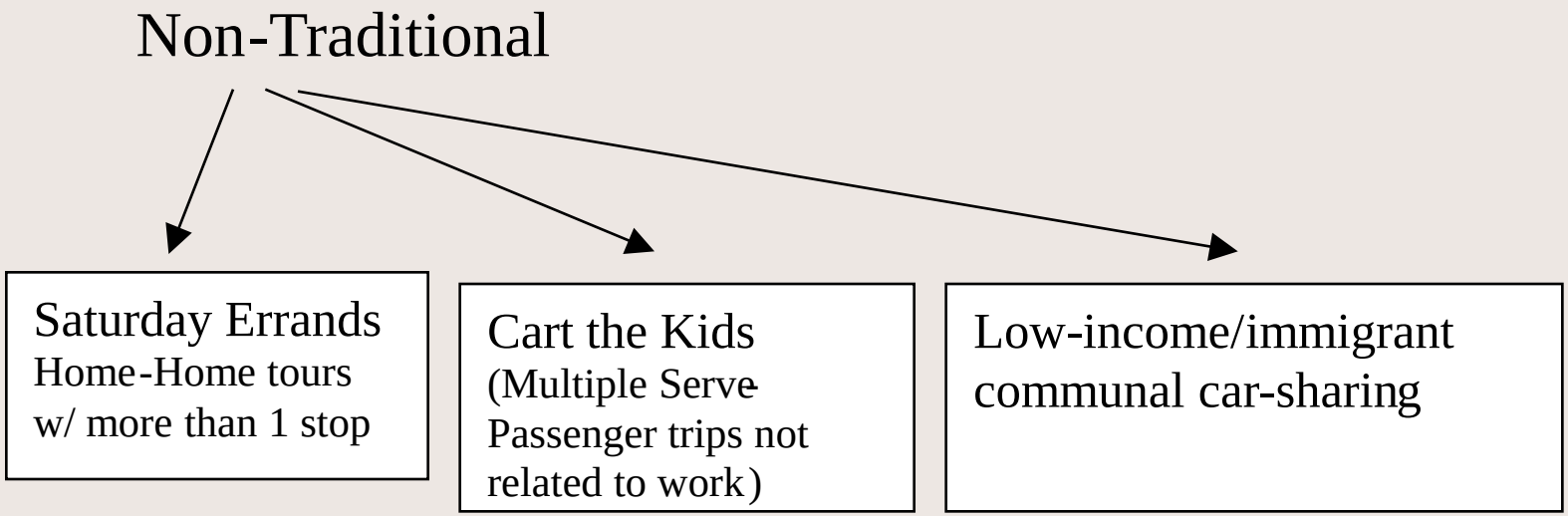


To set the stage for a common definition, FHWA developed definitions and rules to code trip chains for the 1995 NPTS and the 2001 NHTS.

Currently, most planners incorporate some kinds of trip chains:



Tour-based models include more:



A few definitions :

- *Anchor:* A primary or substantial trip destination.
- *Direct Trip*: A description of travel without stops between two anchor destinations, such as a trip from home to work.
- *Chain*: A description of a series of short trips linked together between anchor destinations, such as a trip that leaves home, stops to drop a passenger, and continues to work.
- *Intervening Stop*: The stops along a trip chain.
- *Tour*: The total travel between two anchor destinations, such as home and work, whether direct or with intervening stops. Some models refer to '*complex*' and '*simple*' tours.

The short story:

The entire trip file was “bundled” by anchor type regardless of number or time at intervening stops:

Home-Home	Work-Work
Home-Work	Work-Home

The effect on number and type of stops was analyzed for dwell-times of 30, 60, or 90 minutes or less

A collapsed file was created with 1 record per tour (direct trips and trip chains) with total travel time and miles (POV, transit, walk), number of stops and total dwell-time at all stops, etc.

The Long Story

Step 1. Creating Tours

- Every traveling person's trips were 'bundled' into tours
- Anchors were Home and Work (other included people who never went Home or to Work)
- No dwell time assumptions were made at this point
- All travelers, regardless of age or mode of travel were included:
    - For example, 31 percent of travelers made a home-work tour, but
    - 58 percent of workers made a home-work tour on Travel Day

Trips by Anchor Type
No Dwell Time Rule
n=641,633 trips

To ➡ / From ⬇	Home	Work	Other
Home	451,761 *70.4%*	59,716 *9.3%*	13,442 *2.1%*
Work	70,113 *10.9%*	21,518 *3.4%*	932 *0.1%*
Other	14,098 *2.2%*	7,865 *1.2%*	2,188 *0.3%*

Tours by Anchor Type
No Dwell Time Rule
n=287,985 tours

To → / From ↓	Home	Work	Other
Home	167,244 *58.1%*	47,640 *16.5%*	6,687 *2.3%*
Work	47,414 *16.5%*	9,817 *3.4%*	414 *0.1%*
Other	4,594 *1.6%*	1,756 *0.6%*	2,419 *0.8%*

Mean Stops by Anchor Type

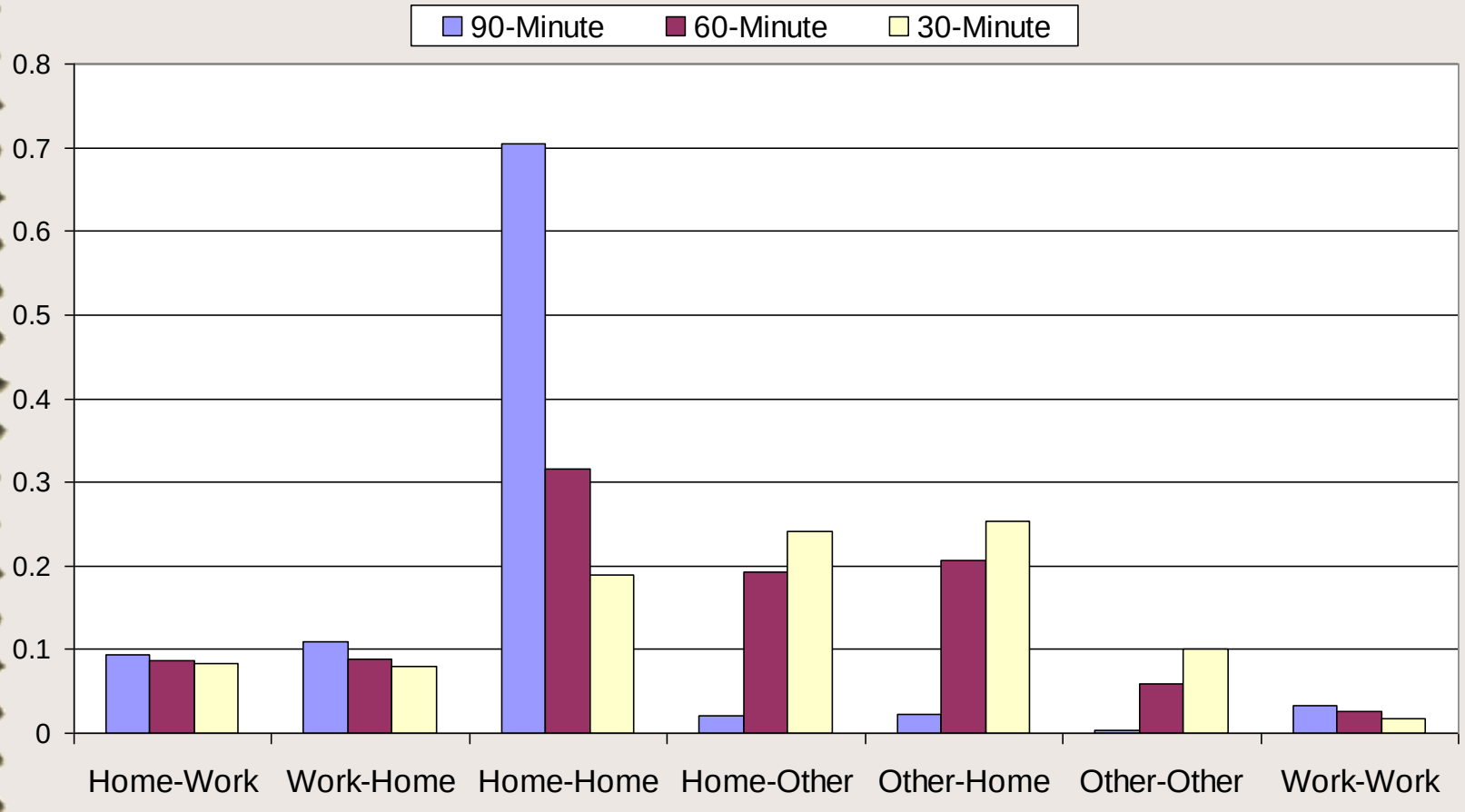
To From	Home	Work	Other
Home	1.7	0.25	1.01
Work	0.48	1.19	1.25
Other	2.07	0.25	2.25

Step 2. Effect of Dwell Time Rules

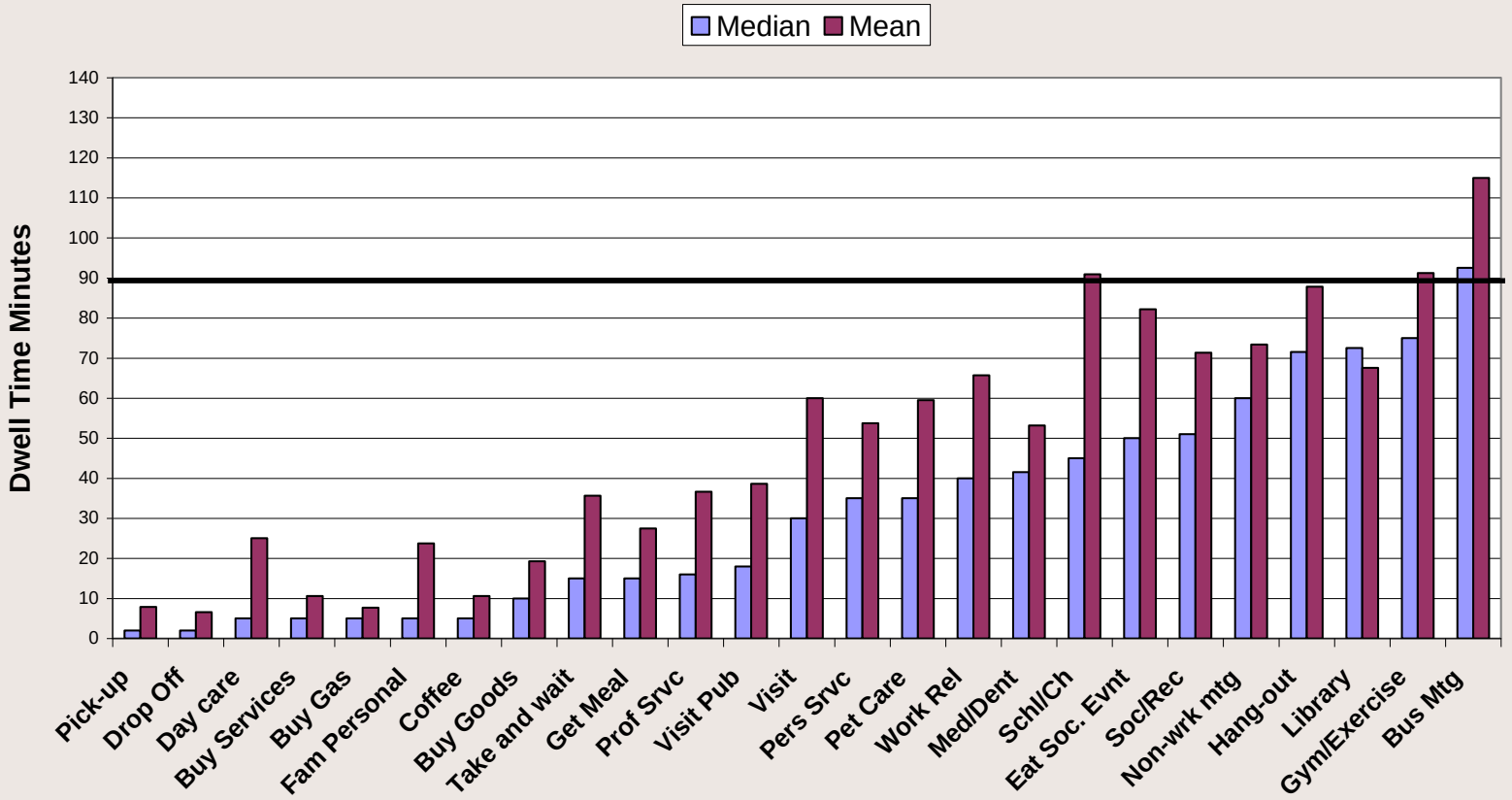
1. 90 minutes and less,
2. 60 minutes and less, and
3. 30 minutes and less.

Stepping down the time limits moves more trips into "Other" Tour Types

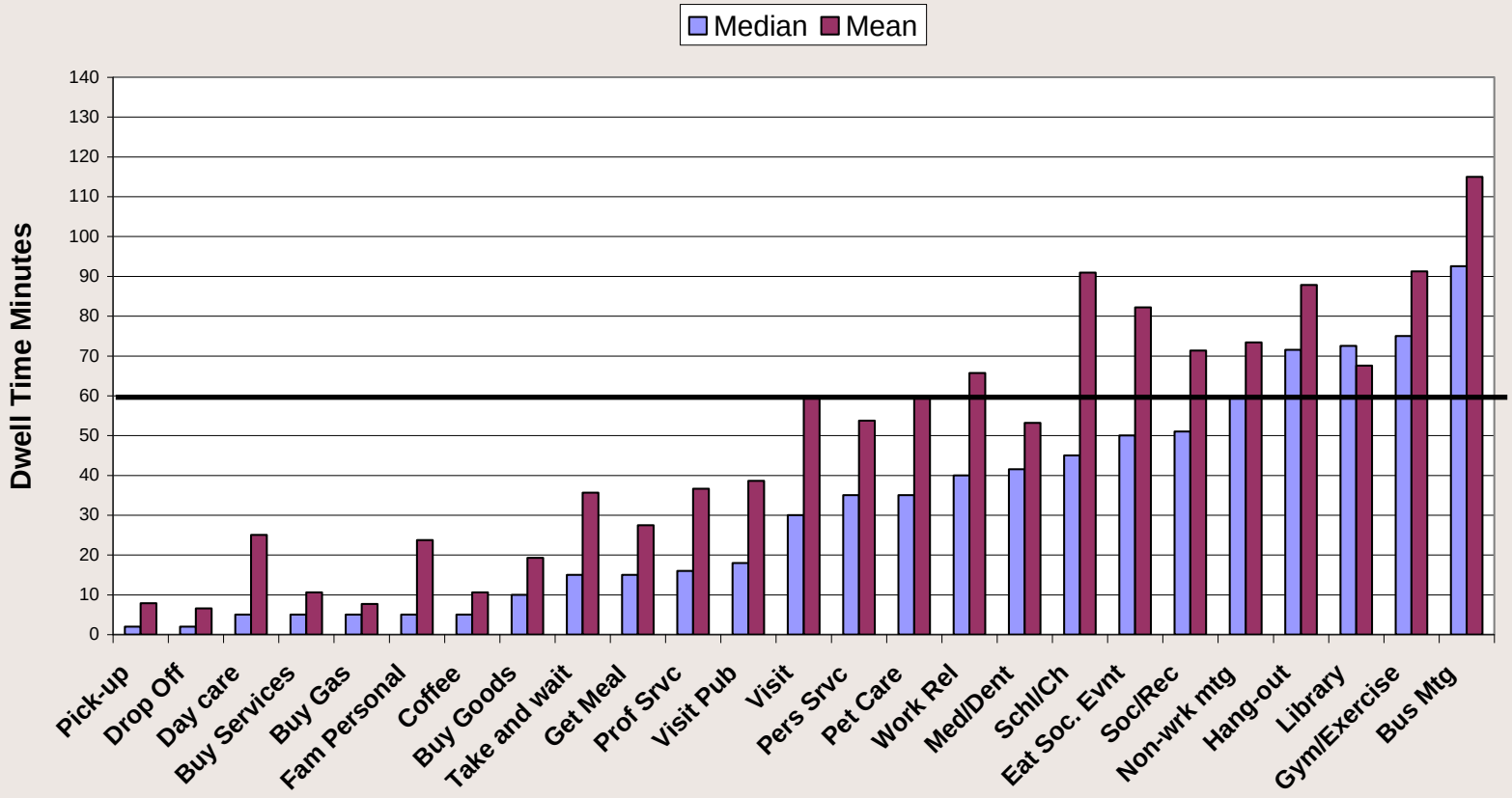
Effect of Dwell-Time Limits on Tours by Type



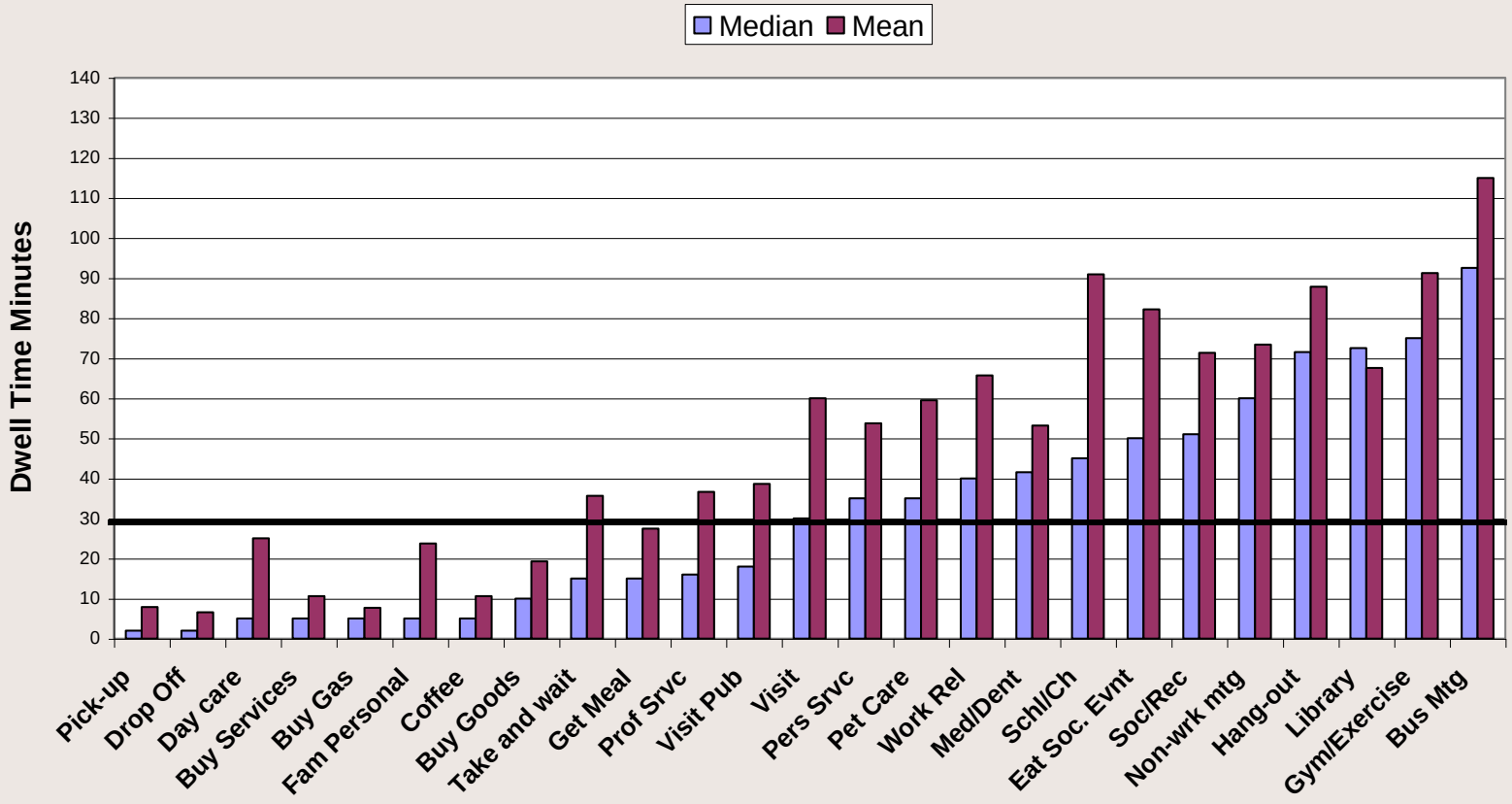
90-Minute Dwell Time at Stops – Home to Work Tours



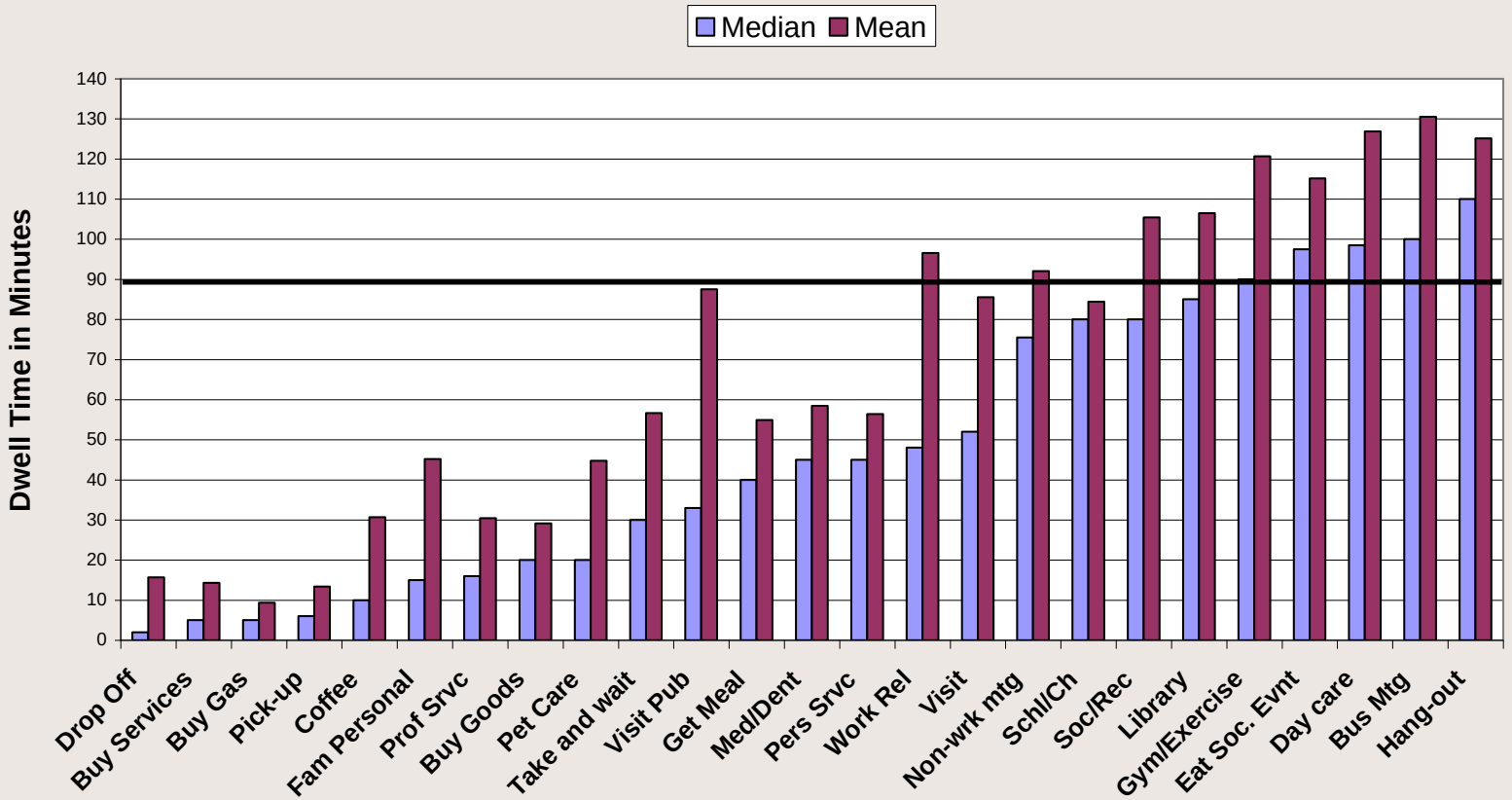
60-Minute Dwell Time at Stops – Home to Work Tours



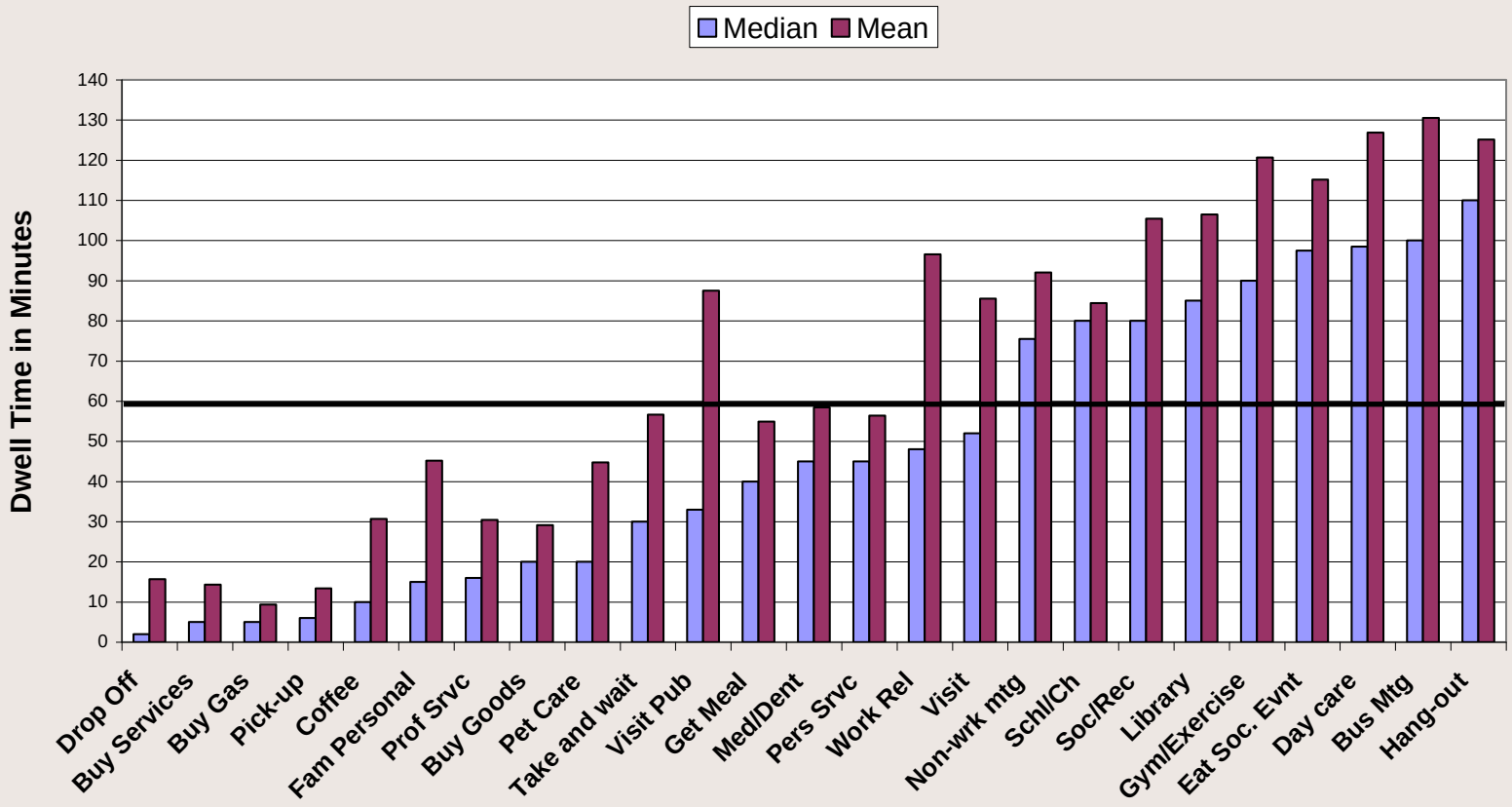
30 Minute Dwell Time at Stops – Home to Work Tours



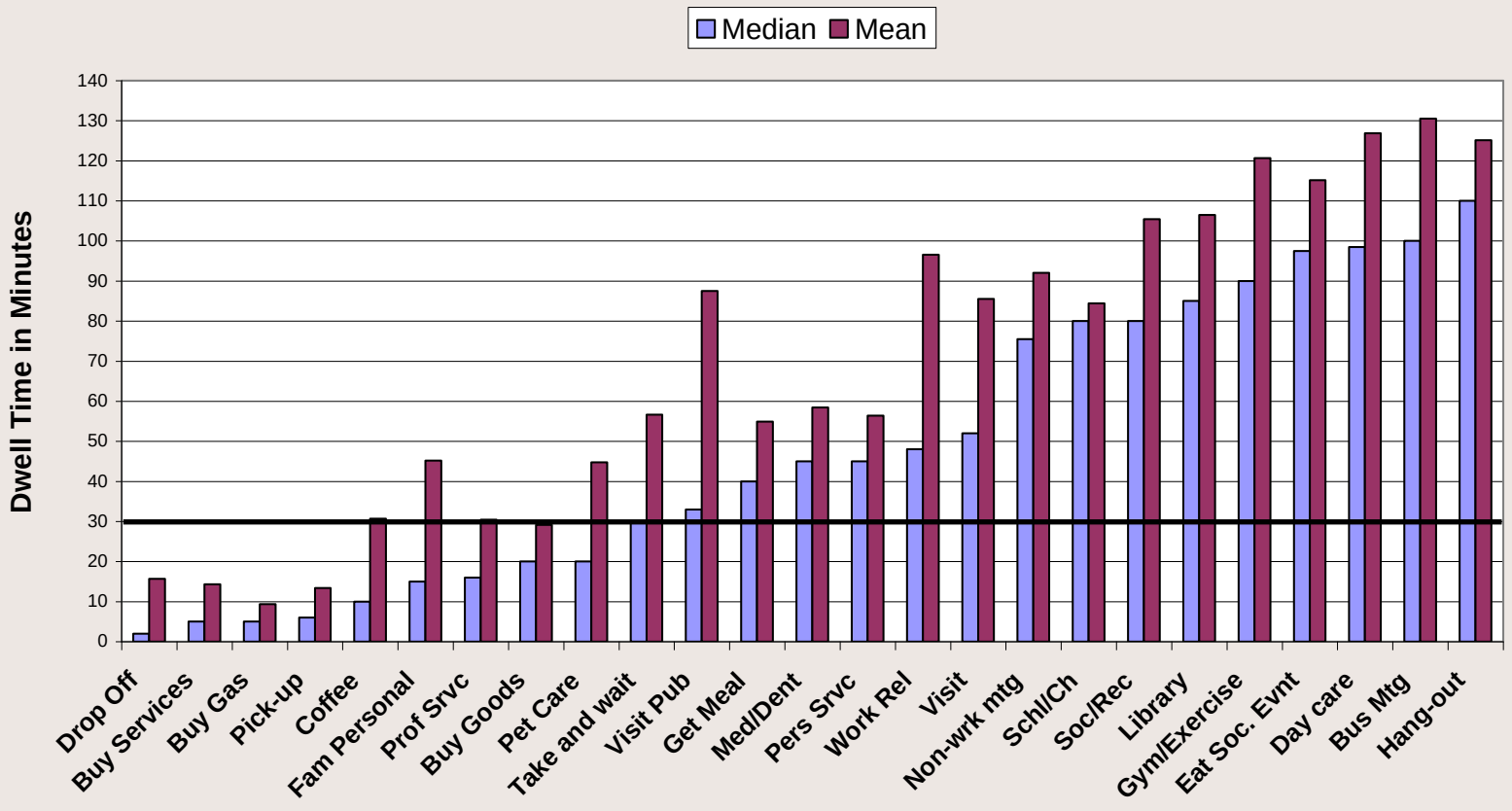
90 Minute Dwell Time at Stops – Work to Home Tours



60 Minute Dwell Time at Stops – Work to Home Tours



30 Minute Dwell Time at Stops – Work to Home Tours



Resulting number and percent of trips within tours (30-minute dwell-time rule):

To ➡ / From ⬇	Home	Work	Other
Home	121,546 *18.9%*	53,492 *8.3%*	154,425 *24.1%*
Work	51,064 *8.0%*	11,638 *1.8%*	13,571 *2.1%*
Other	162,060 *25.3%*	9,497 *1.5%*	64,340 *10.0%*

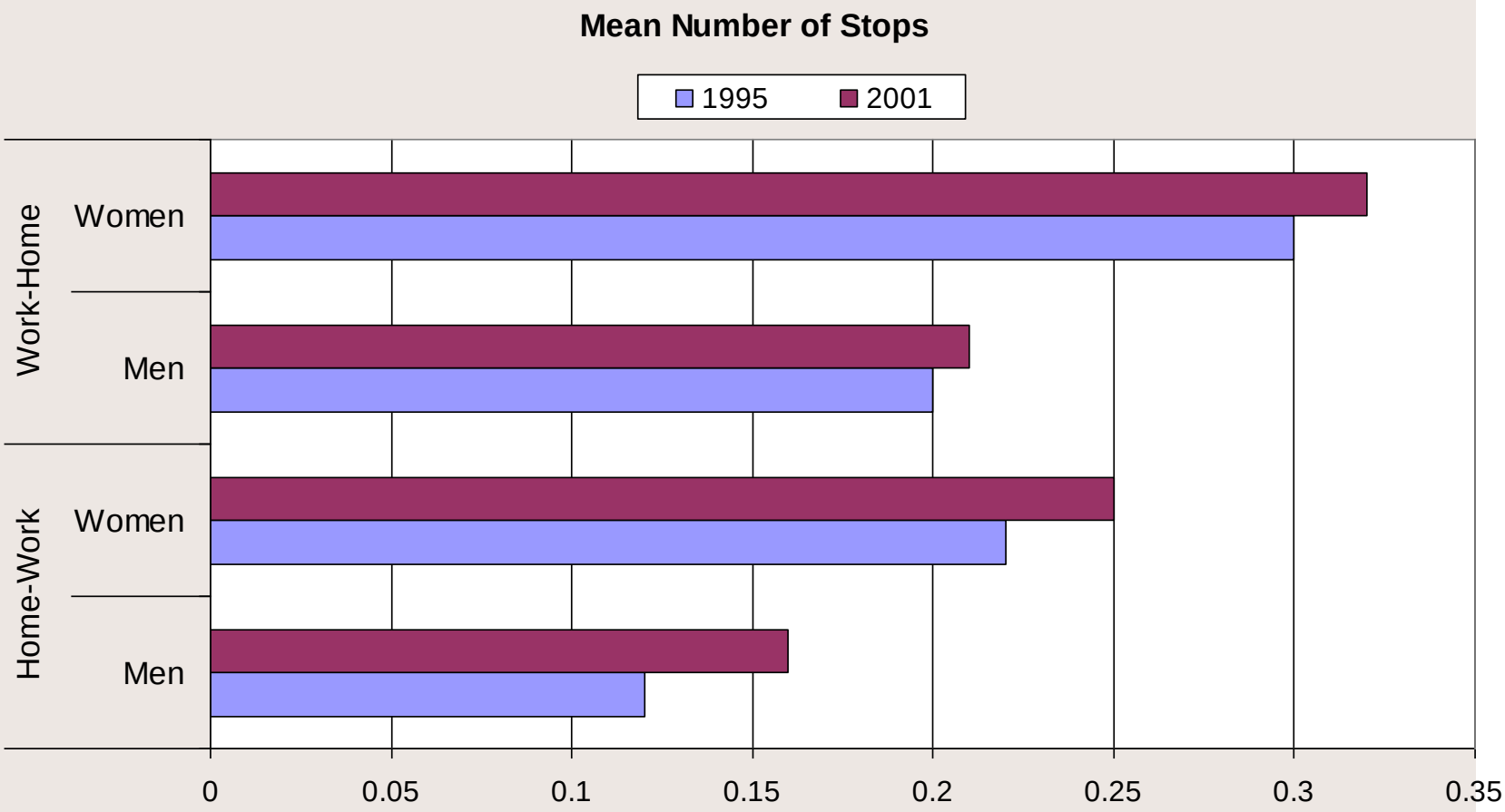
Step 3. Analyzing Trip Tours with 30 Minutes Dwell Time

- Examine the trends for work travel: How many workers trip chain? Is trip chaining increasing?
- What are the characteristics of workers who trip chain? How are they different from people who make direct trips?
- Why do people stop on their way to work? Is it different on the way home?
- How does tour-level analysis compare with previous assignment of miles to purposes? Have we improved our estimates?

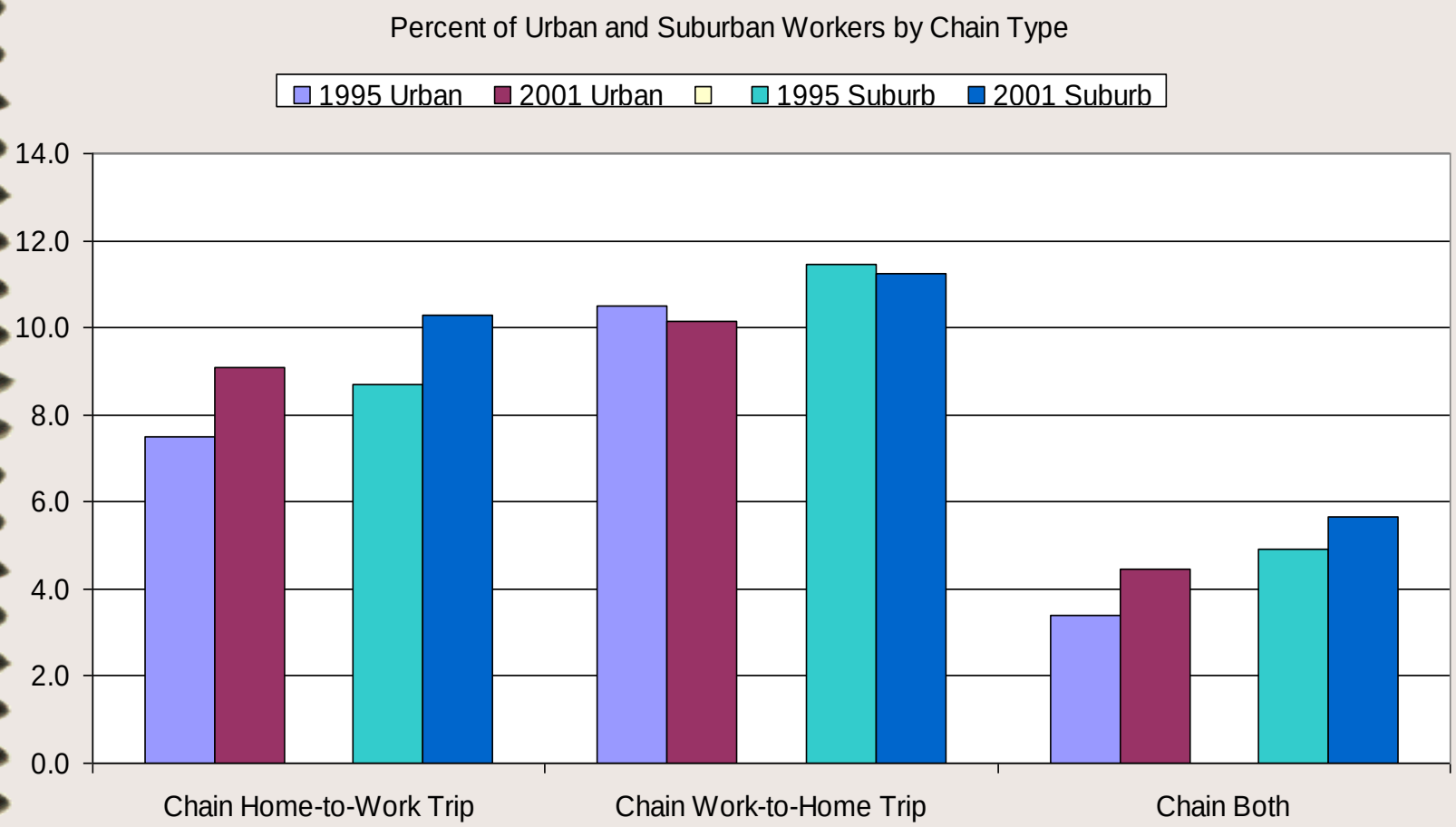
Trends in the weekday commuting

	1995	2001	Numeric Change 1995-2001	Percent Change 1995 - 2001
Number of Weekday Workers	68,760,000	68,990,000	230,000	0.33%
Did Not Chain	31,290,000	31,660,000	370,000	1.18%
Chained Work Trips	17,276,045	18,842,670	1,566,625	9.07%
Chain Home-to-Work Trip Only	5,929,237	7,158,844	1,229,607	**20.74%**
Chain Work-to-Home Trip Only	7,762,956	7,659,436	-103,520	-1.33%
Chain Both	3,583,852	4,024,390	440,538	**12.29%**

Not just the incidence but the number of stops is increasing…

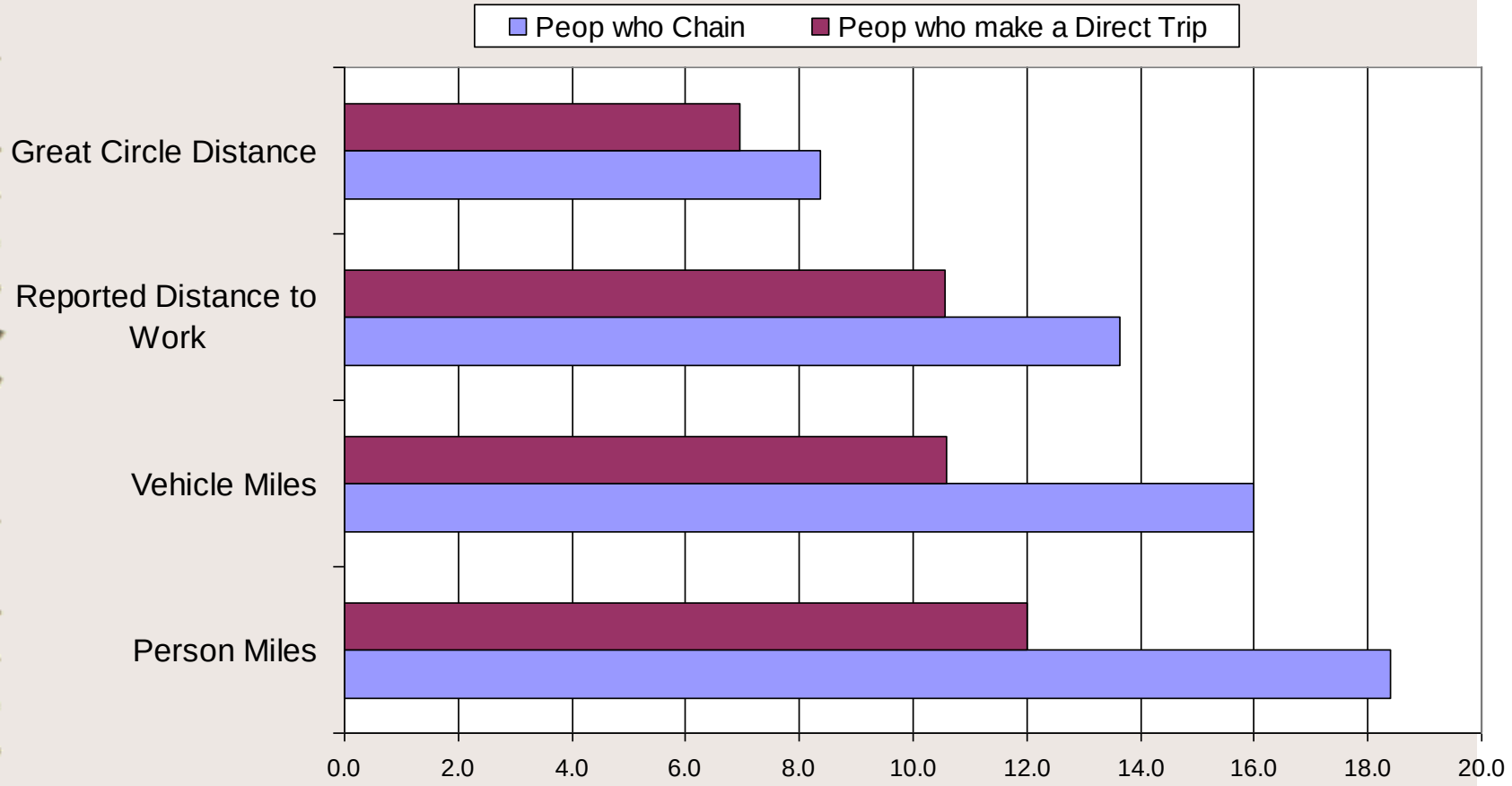


We do see some difference by area type…

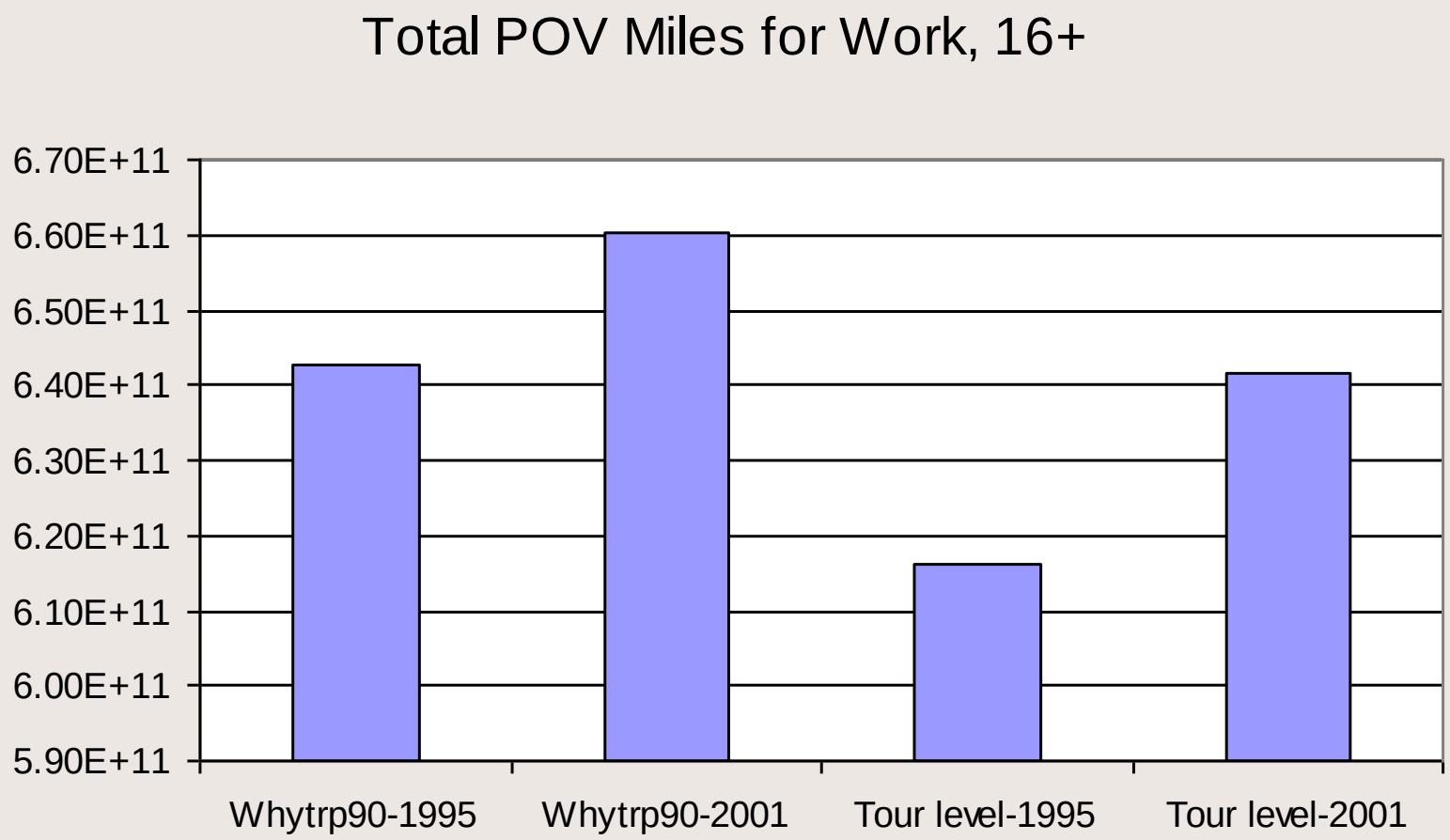


Workers who make direct trips live closer than those who chain…

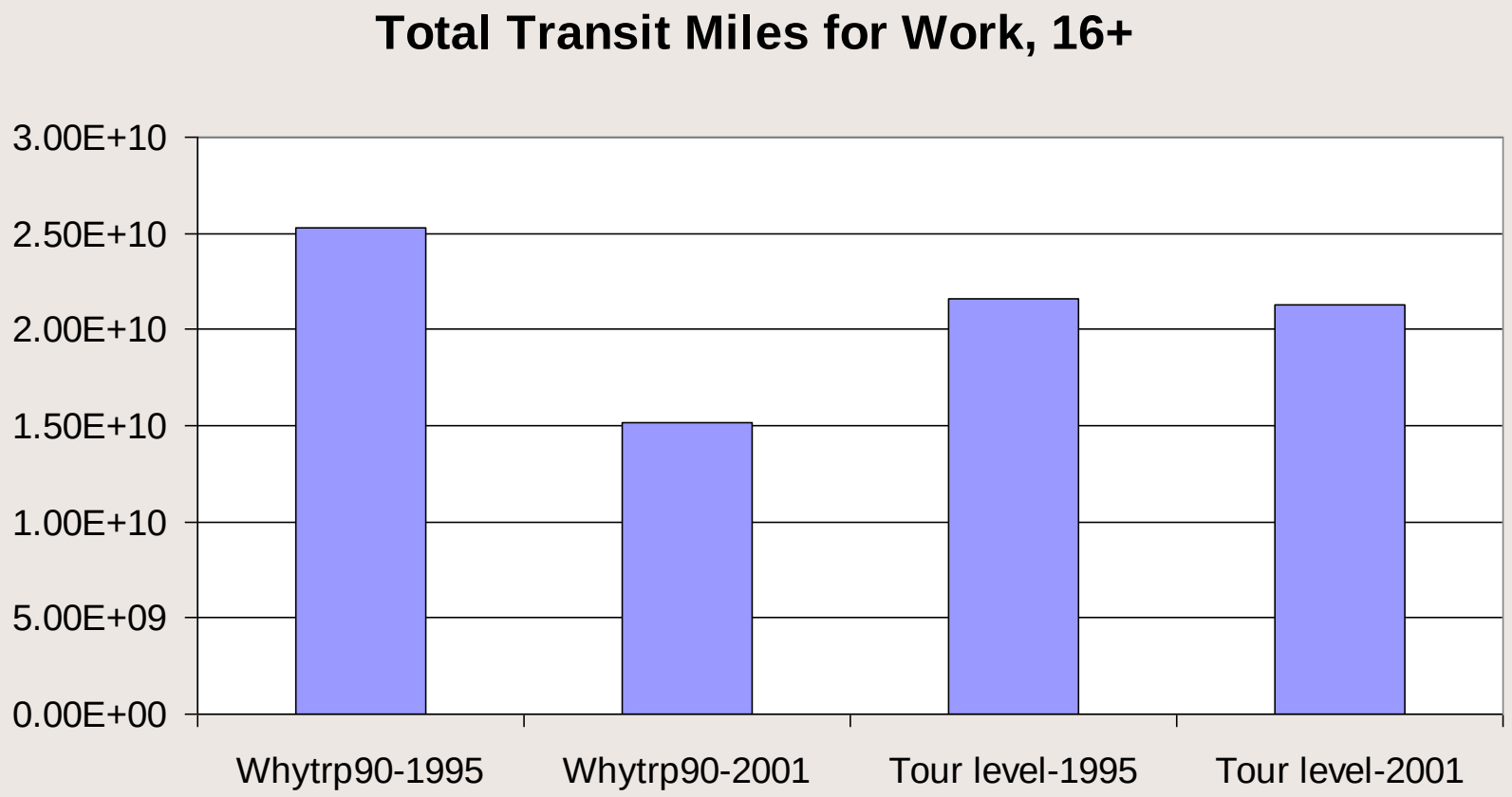
(or are people who live farther from work more likely to chain trips during commuting?)



Tour-level analysis captures fewer POV miles overall than previous coding strategies (whytrp90)…



However, transit miles are captured better…

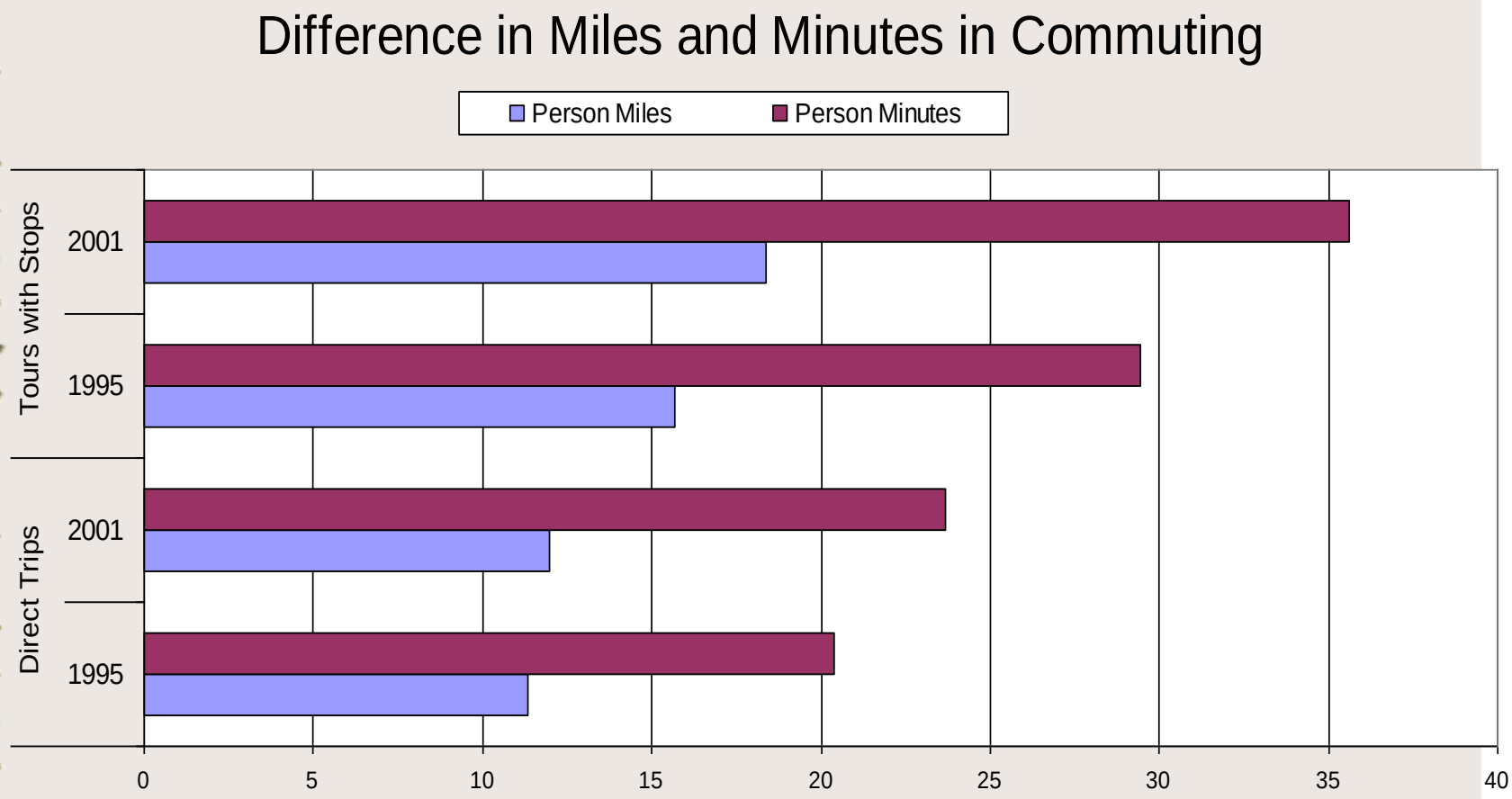


And walk miles about the same…

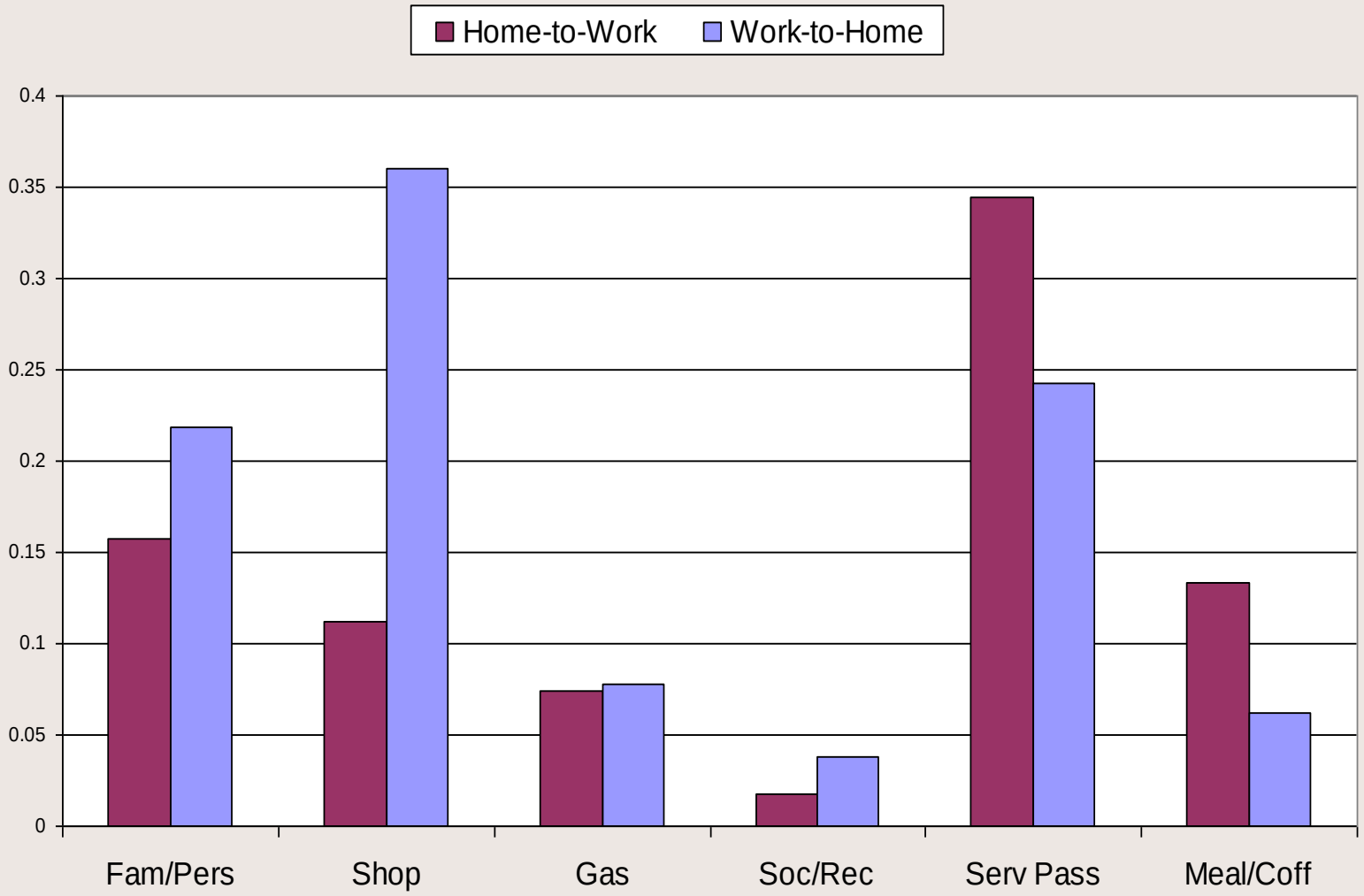
The effect of trip-chaining on travel mode needs further research…

	POV	Transit	Walk/Bike	Other
Direct Trip	83.7	6.3	2.9	7.1
Home-Work Chain	88.1	3.4	1.1	7.5
Work-Home Chain	87.9	3.7	1.9	6.6
Chain Both Directions	90.7	3.5	0.6	5.2
Other	86.1	4.0	2.2	7.7

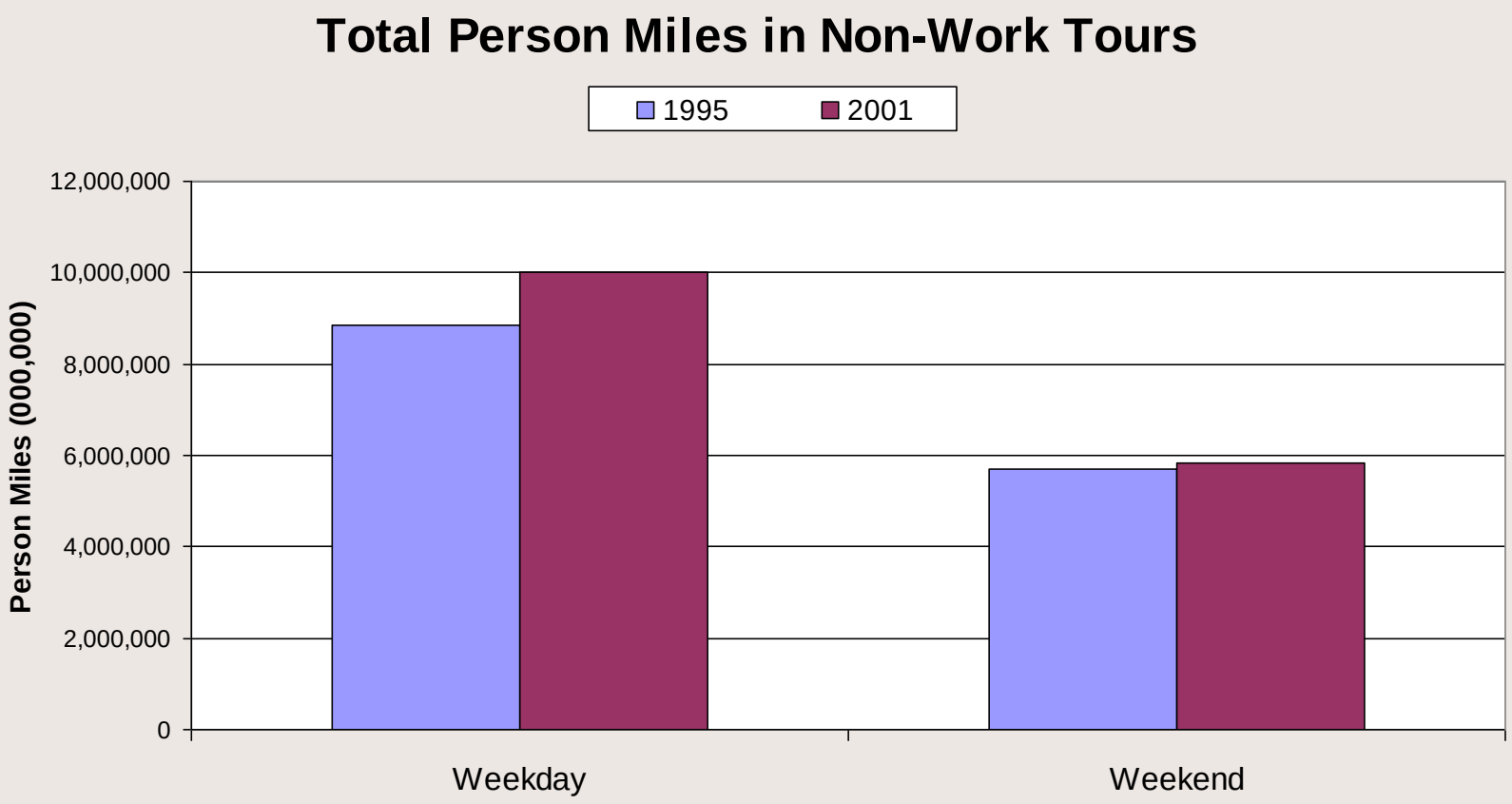
We can measure the changes in miles and minutes of travel to work separately from the trends in chaining…



And look at the purpose of incidental stops during the commute by tour type (weekday work tours)



Non-work tour analysis is still in research infancy…



Conclusions

- This operational definition allows comparison of travel behavior over time and between areas, especially as a consistent measure of commute miles and minutes.
- Trip chaining is a growing phenomenon, especially in the commute *to* work, perhaps related to greater distances between home and work.
  - Research into the trends in job/residence location, especially for 2-worker families, would be illuminating.
- Home-based tours show surprising growth on weekdays, and women make a greater percent of home-based tours than men.
  - Further research into non-work travel is needed.
- Files are available for researchers and planners – let us know what you discover!

Trip Chaining Differences Between Men and Women

1995-2001 NPTS/NHTS data series

Nancy McGuckin, Travel Behavior Analyst
and
Yuki Nakamoto, SAS Programmer

Research on Women's Issues in Transportation
Chicago, Illinois Nov. 18-20

Women…

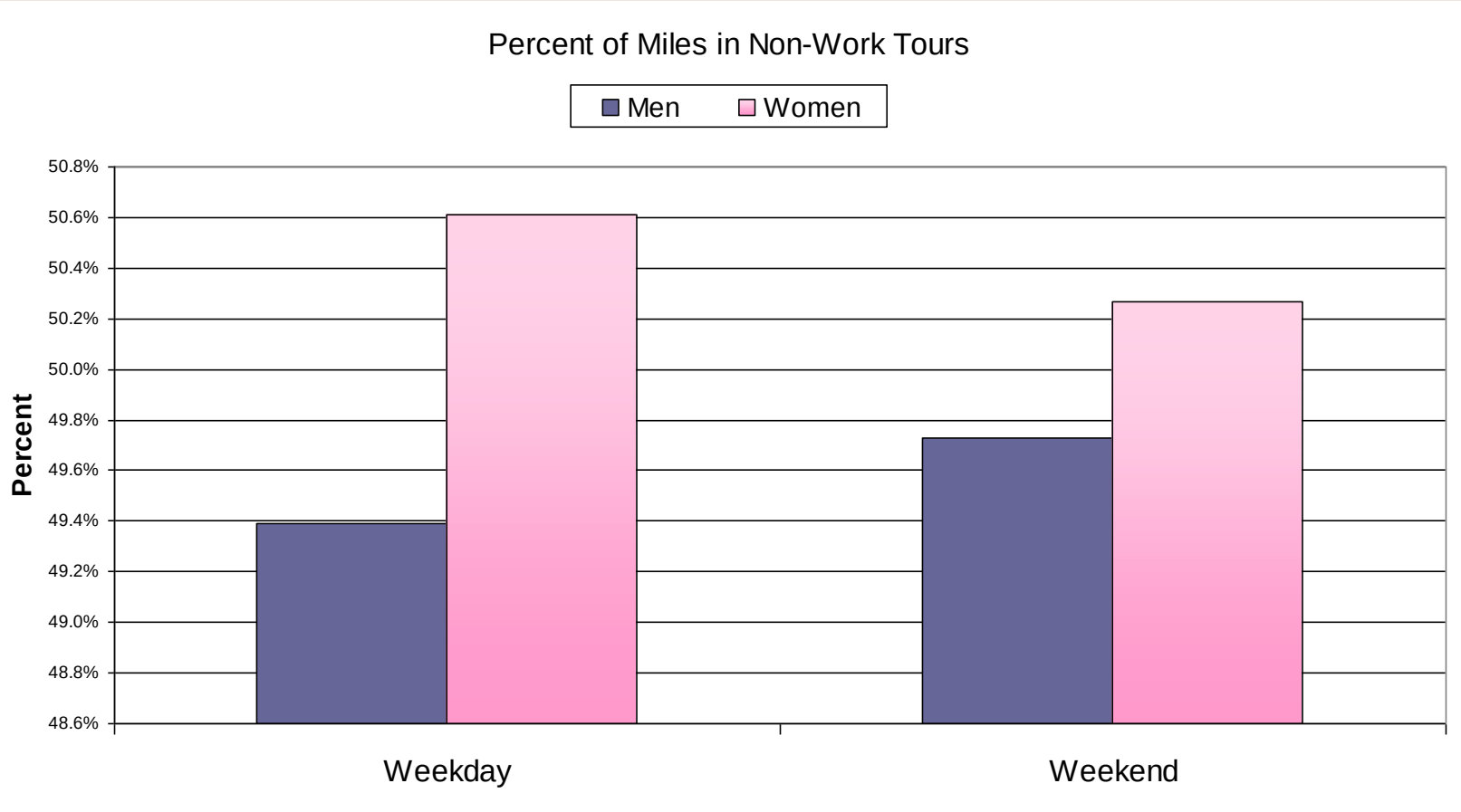
- Of working age travel more of their miles in non-work tours than men
- Work nearly 3 miles closer to home than men, regardless of occupation
- Pick-up and/or drop-off children on their way to and from work, even in 2-worker families
- Chain other trips into their commutes more often than men, and this varies by race/ethnicity and purpose of the stops

Men…

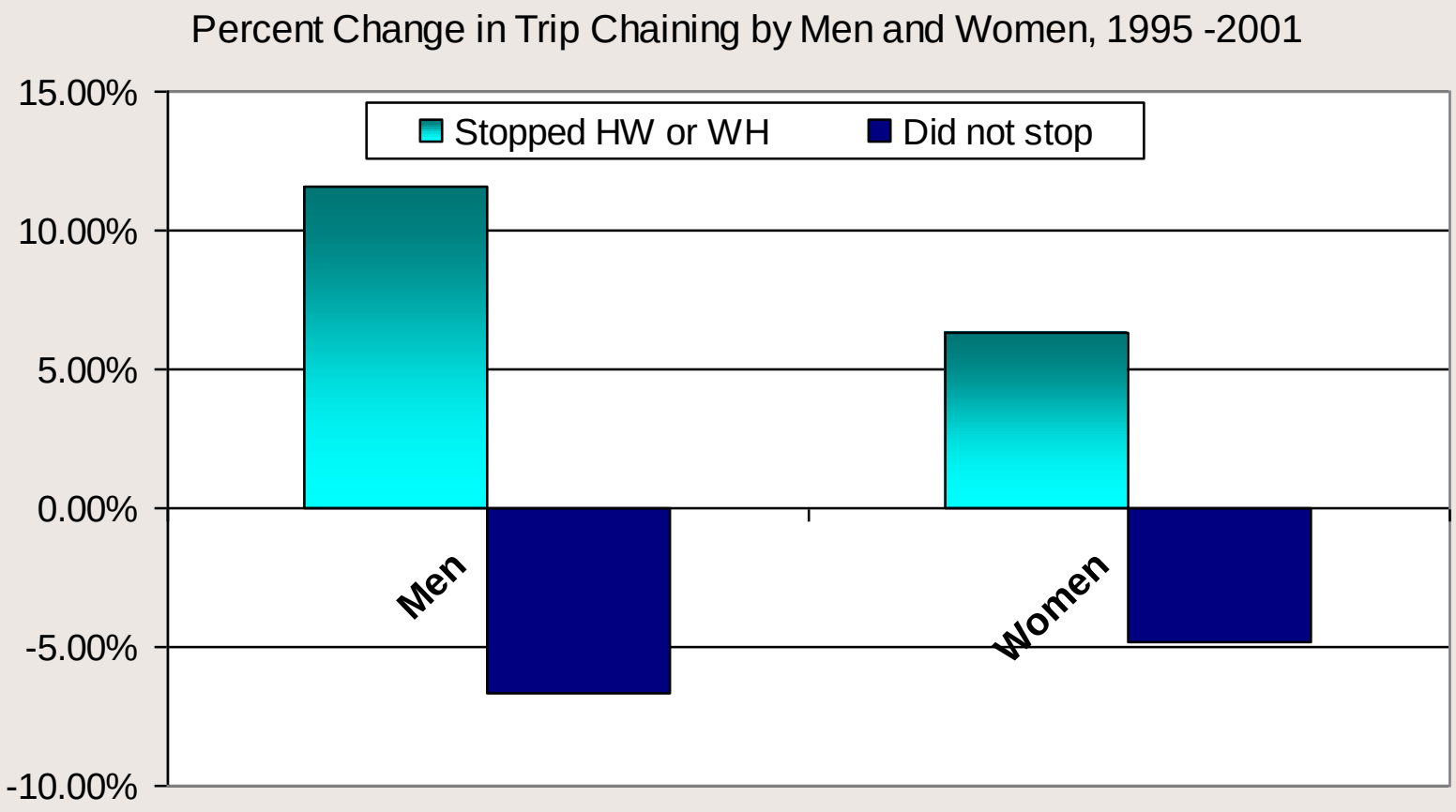
- Have increased their trip chaining in commute tours almost twice women's increase since 1995 (11.6 vs. 6.3 percent change)
- Who are in families with 2 adults and small children have increased trip chaining more than other groups
- Who trip chain have added stops in the home-to-work direction

P.S. There's a surprise ending

Overall, women (16-65 years old) travel more in non-work tours than men:

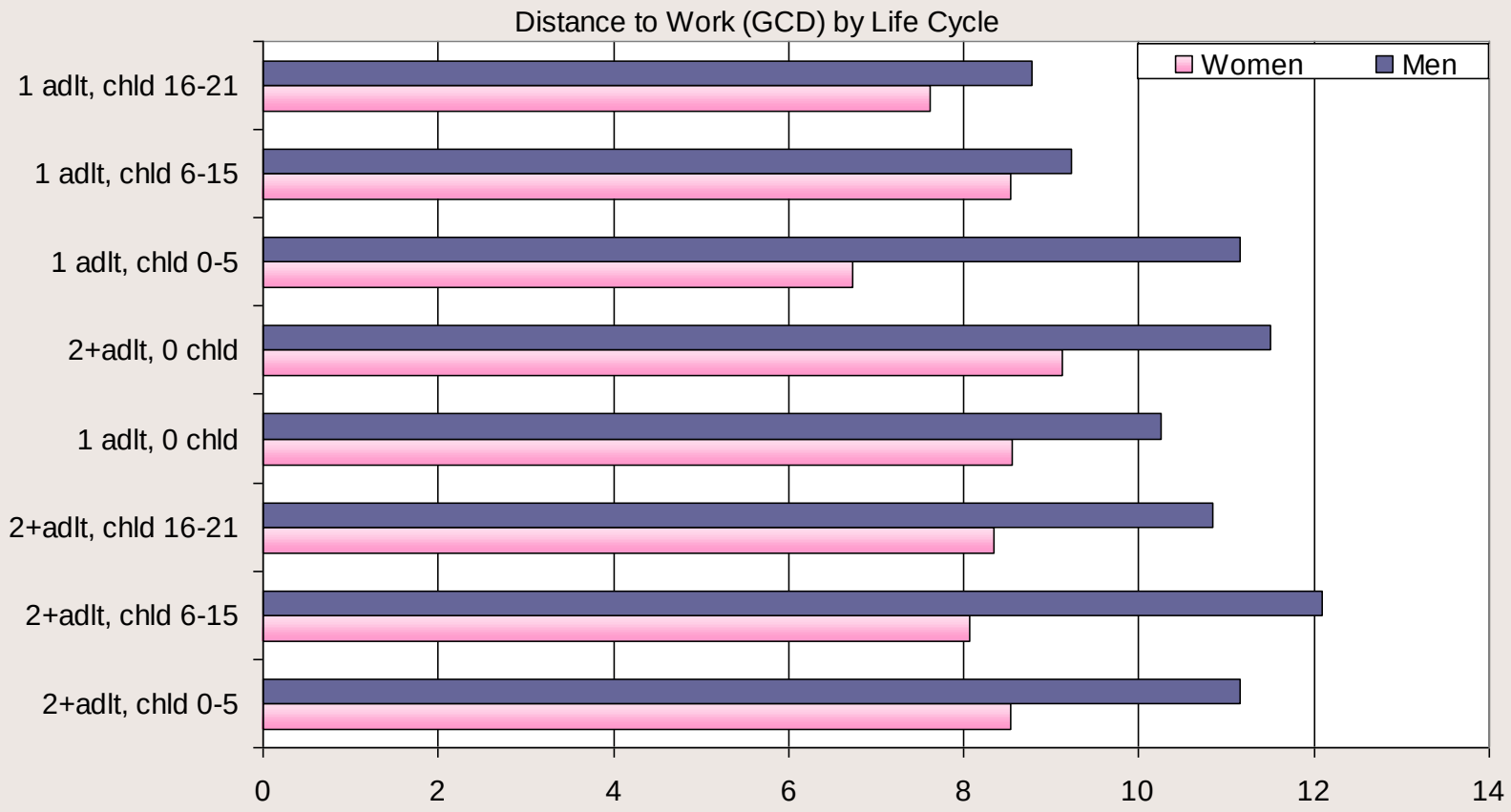


Men have increased trip chaining in commute tours at nearly twice the pace of women since 1995…

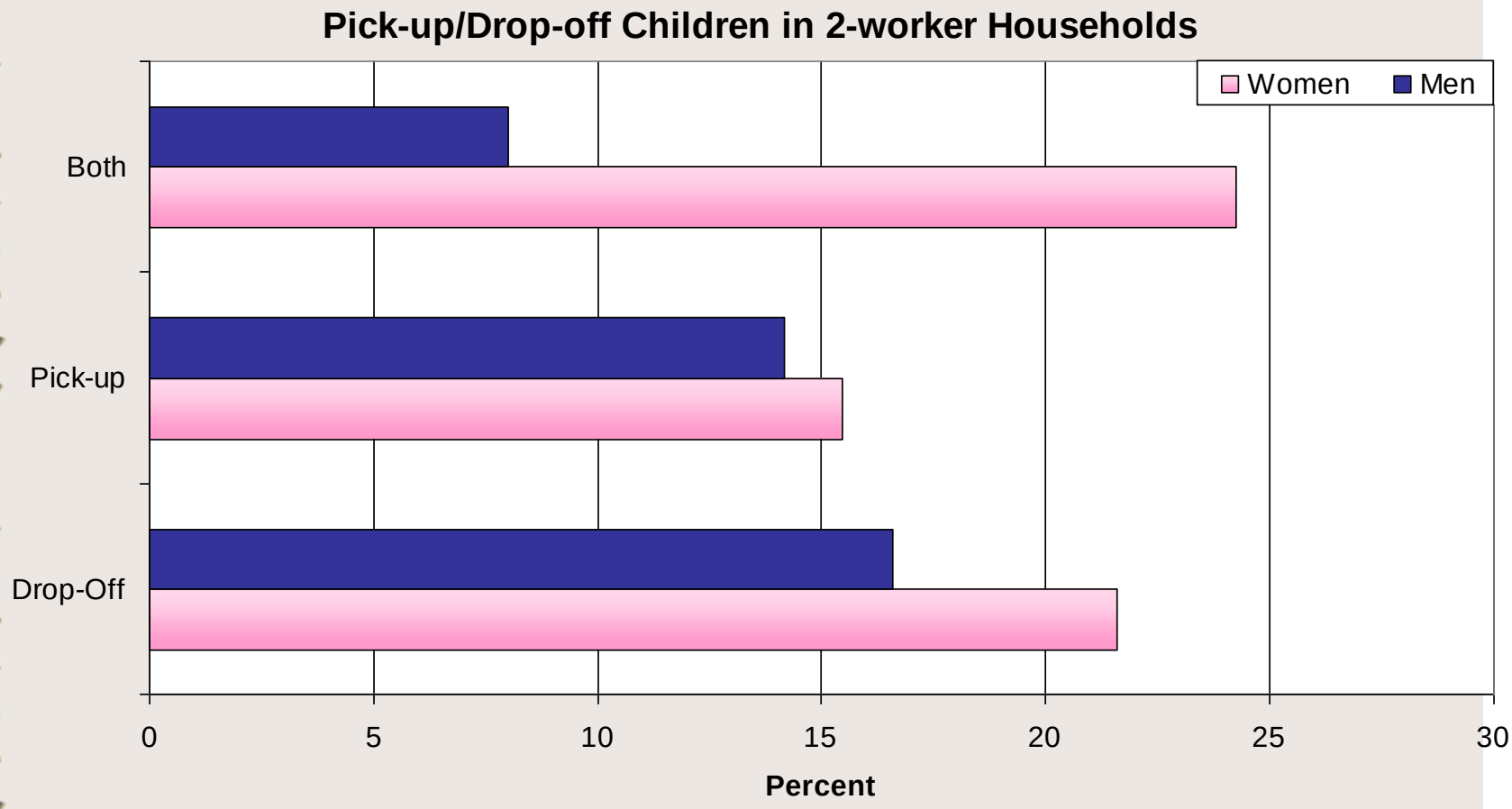


No matter what occupation, women work closer to home…

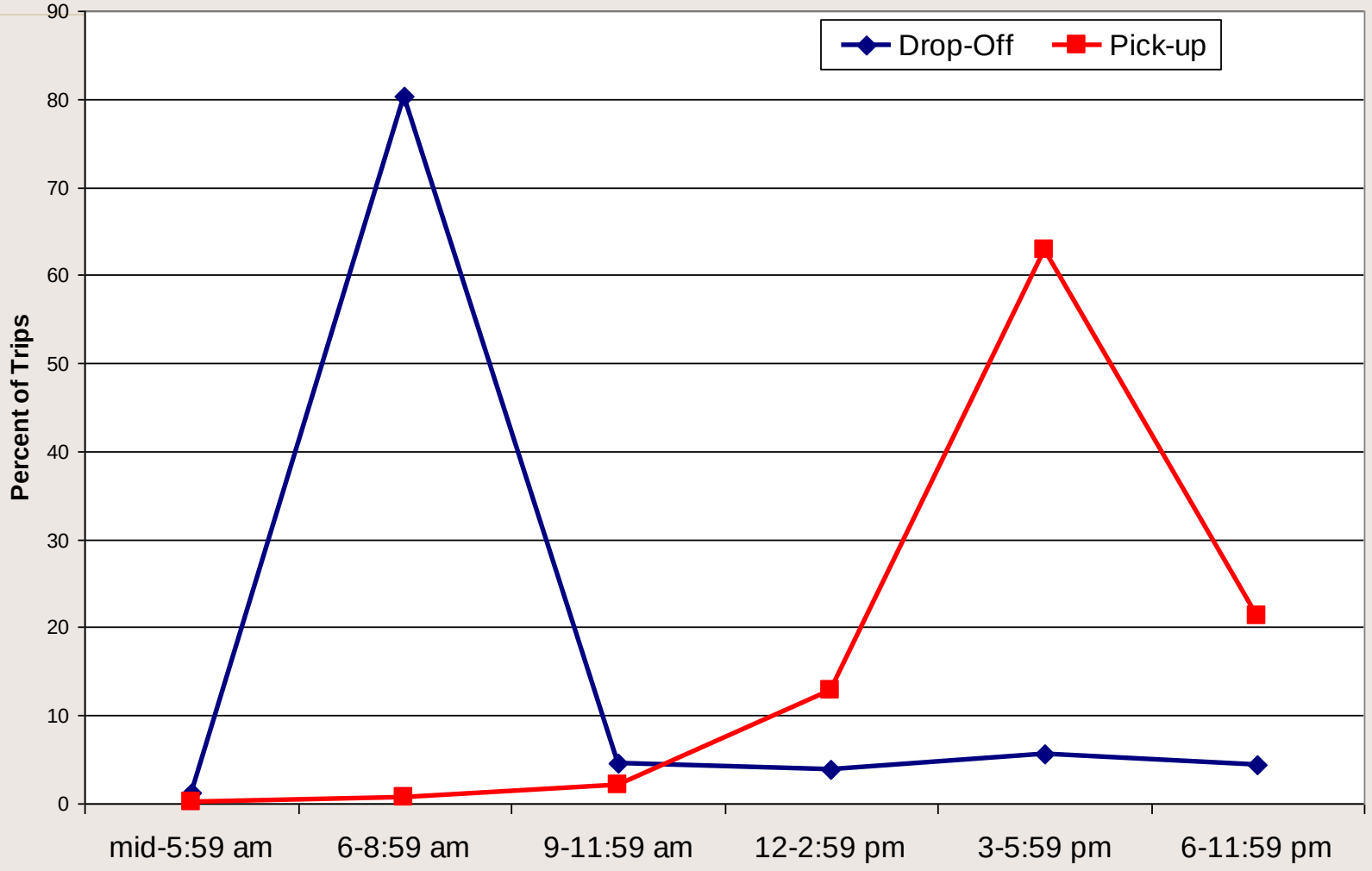
Women with children work closer to home than their male counterparts…



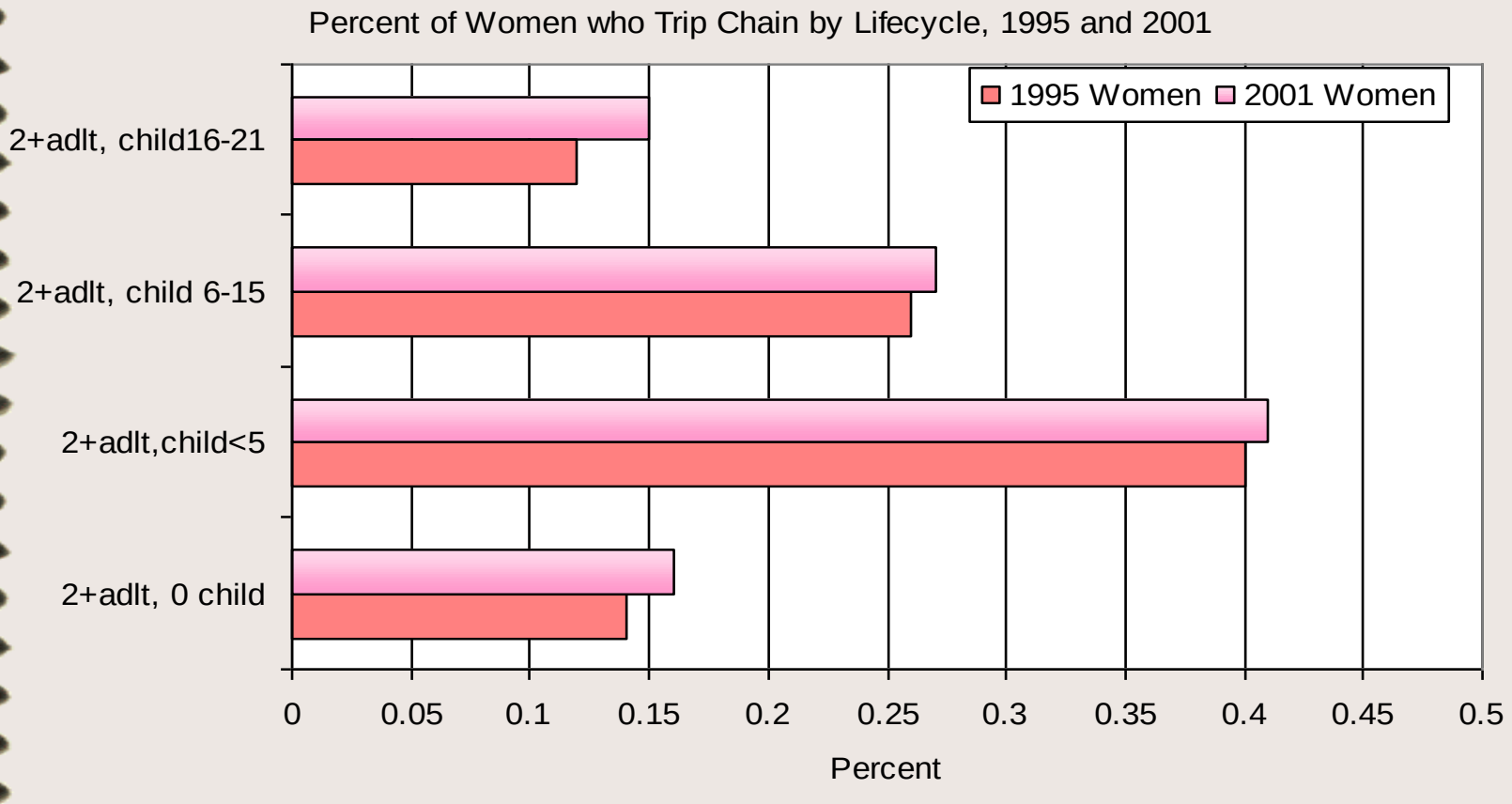
Maybe because even in 2-worker families, women are more likely to pick-up/drop off kids at school…



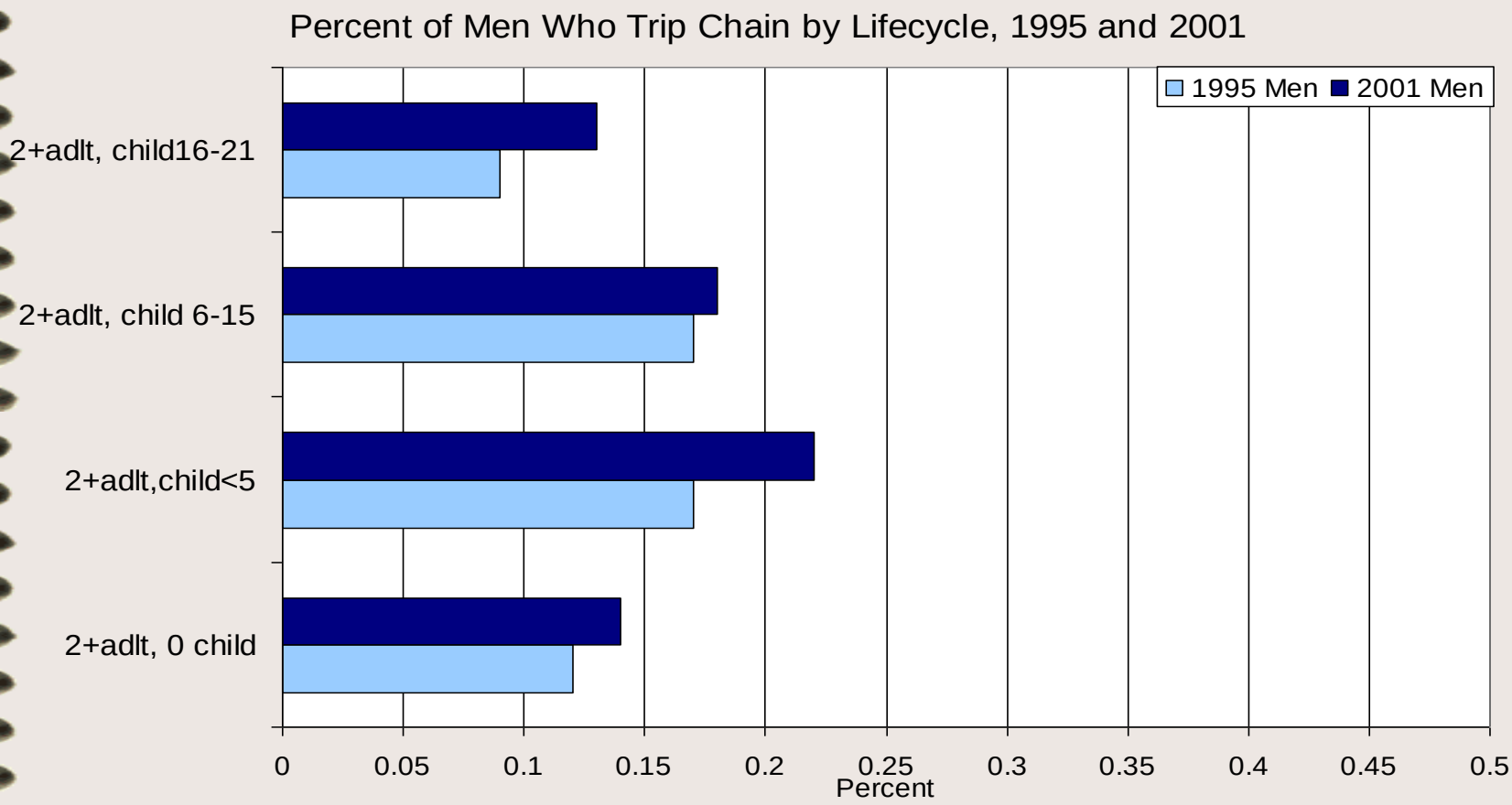
And they have to be on time…



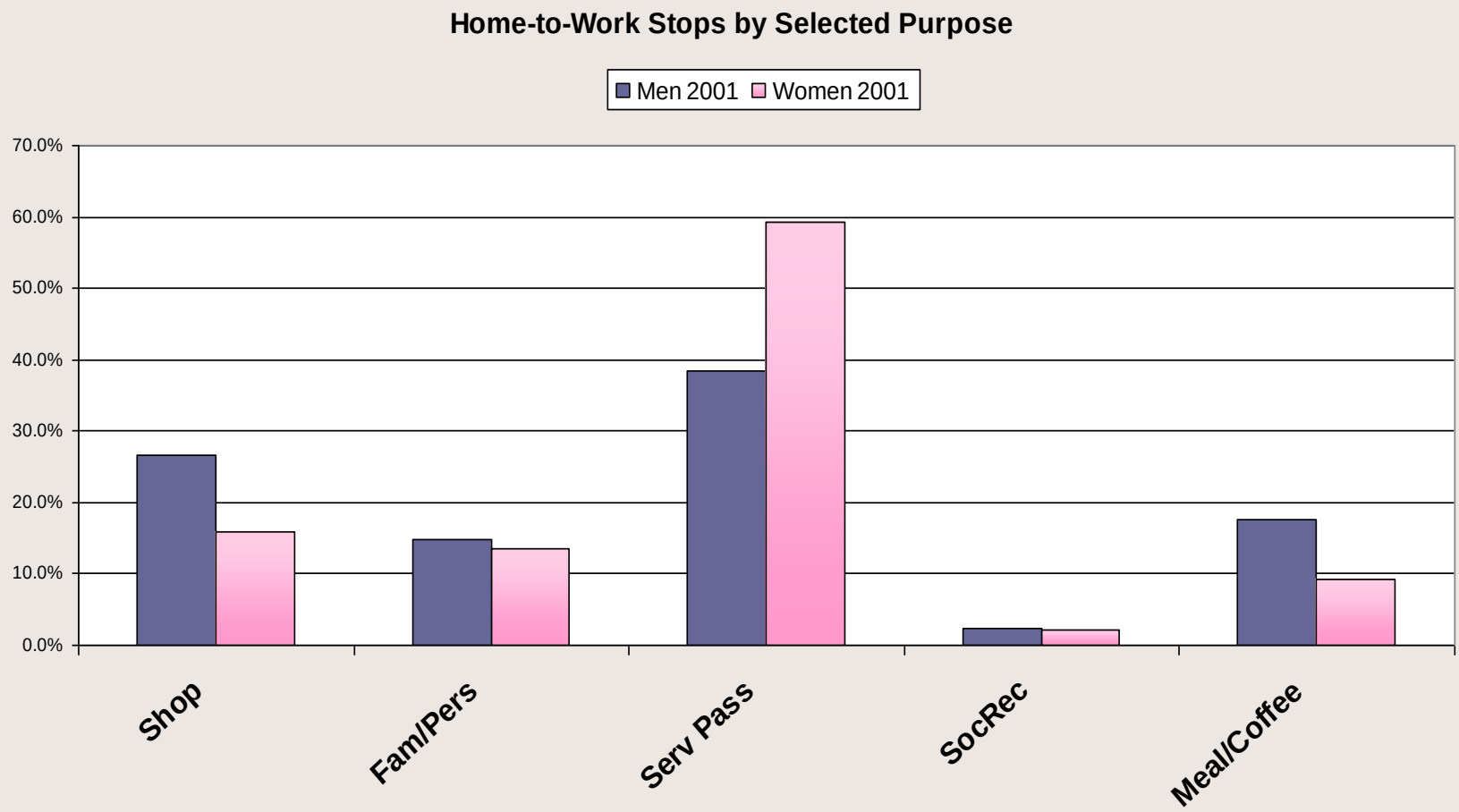
Women in 2-adult families have increased there trip chaining…



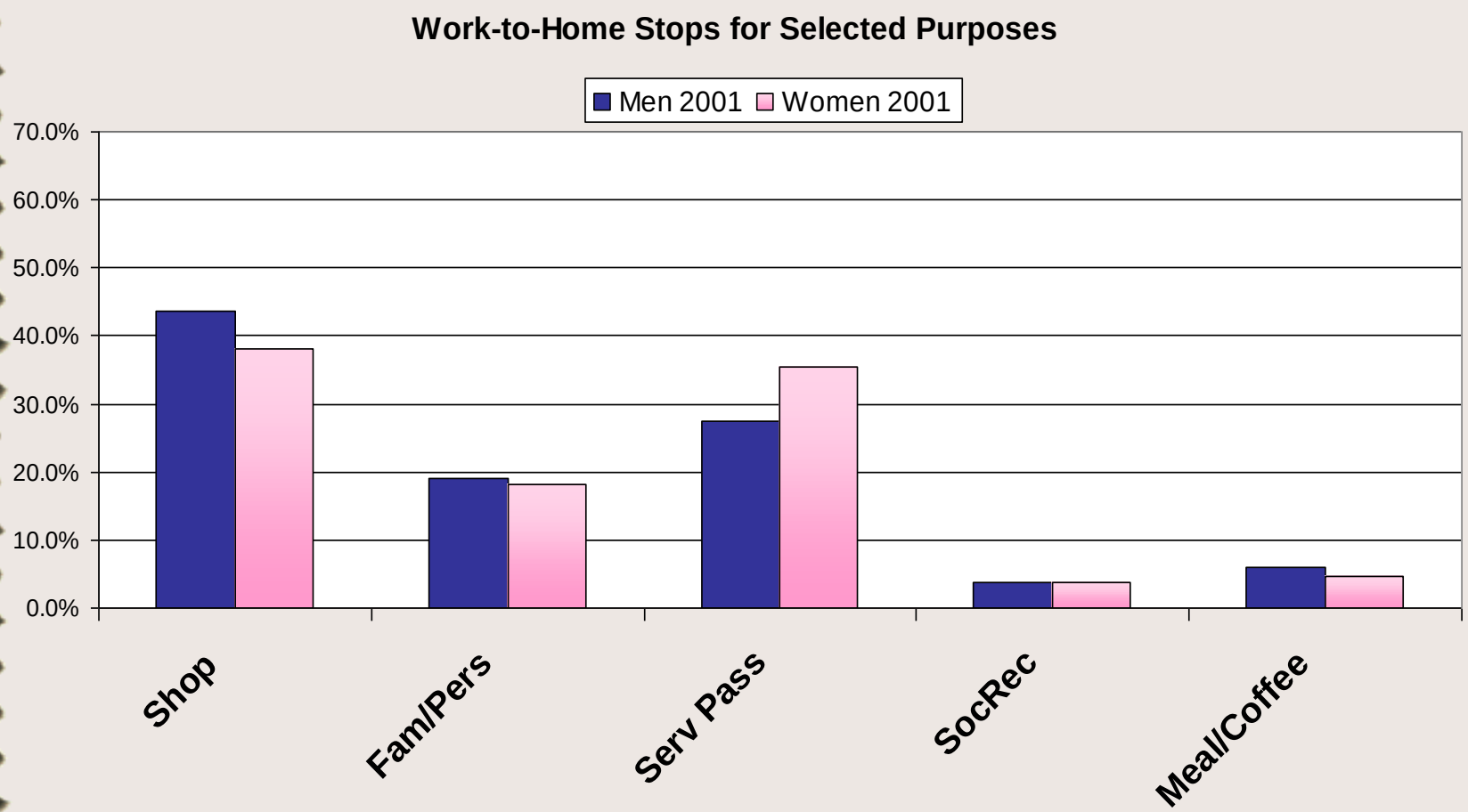
But men have increased more, esp. in families with small children…



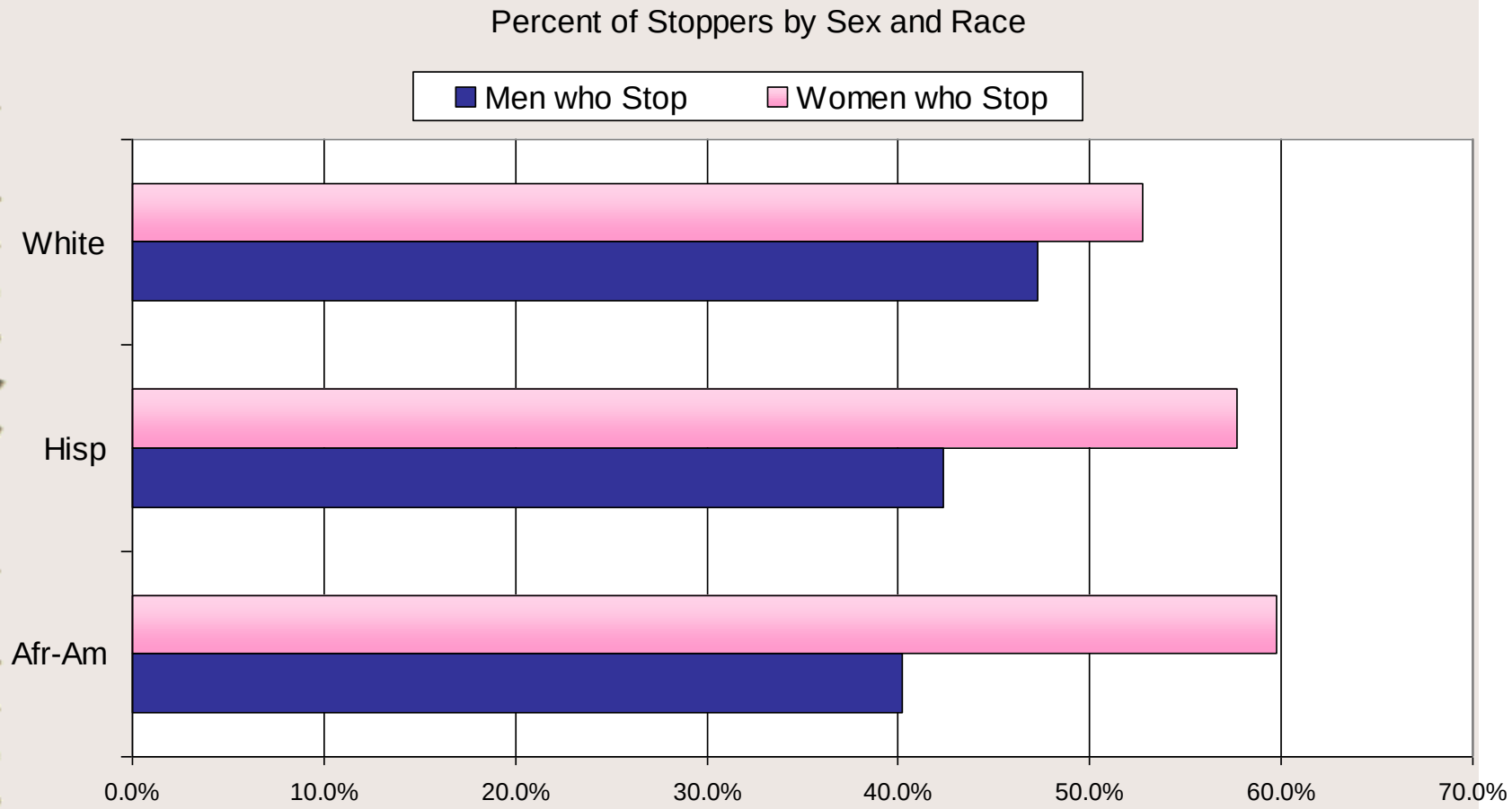
The purpose of stops differs by gender…



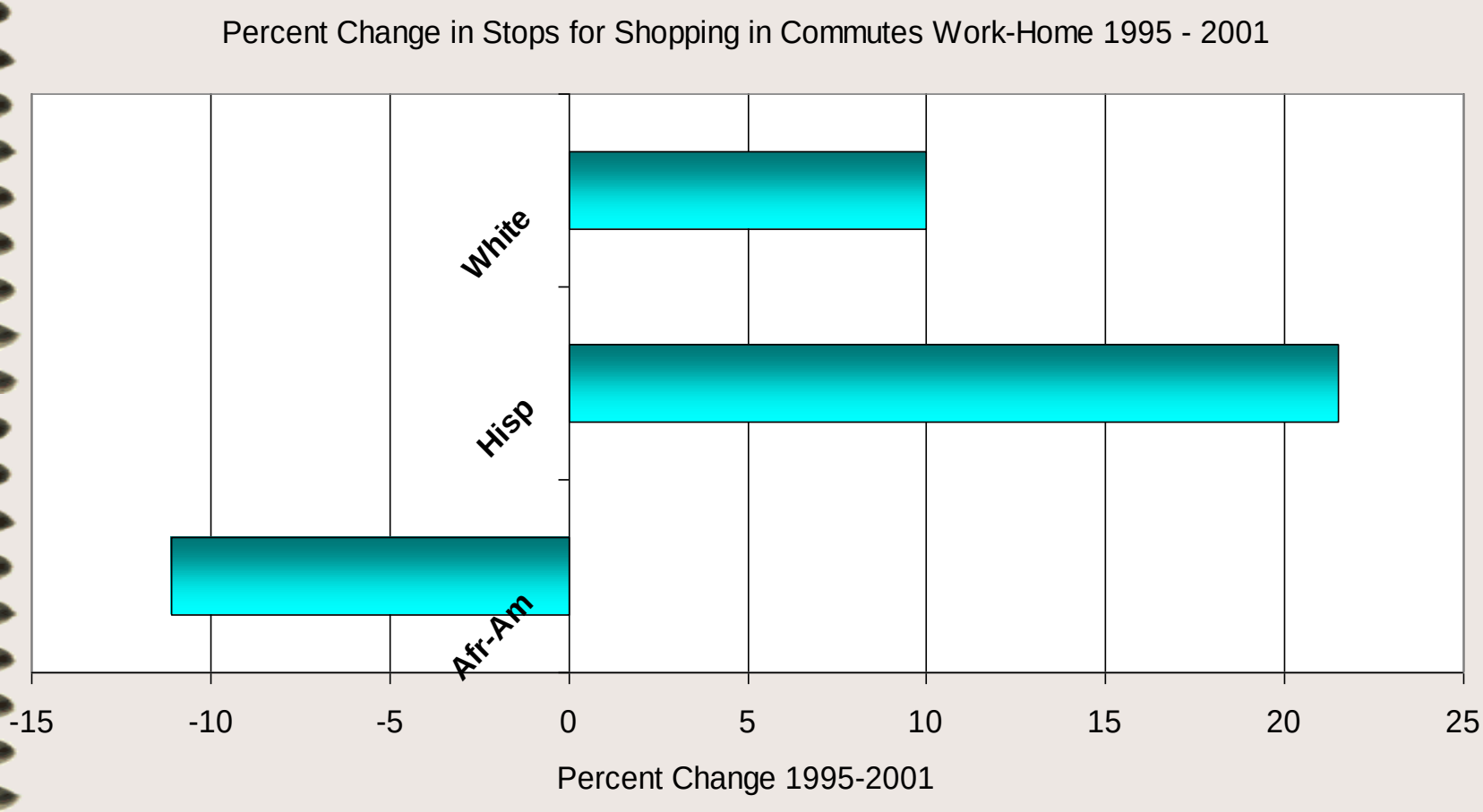
And by direction…



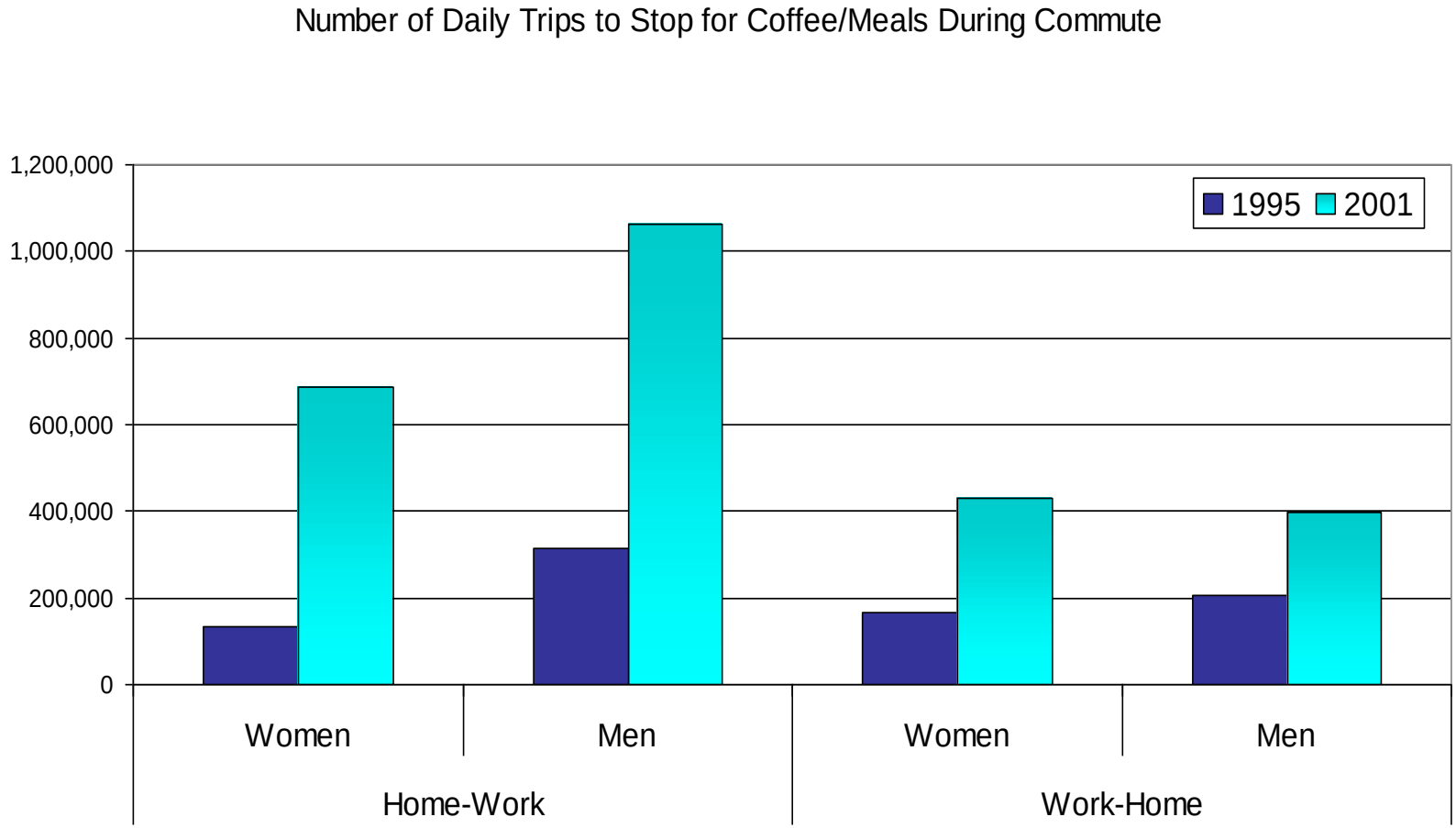
There is variation in trip chaining by race and ethnicity…



And by Race/Ethnicity within Purpose….



Stops for meals and/or coffee increased pretty dramatically between 1995 and 2001…



We call this the “Starbucks” effect

Make mine a venti!