

# Mode Choices of Millennials: How Different? How Enduring?



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### ABSTRACT

It has been written that nationwide Millennials (born 1982-2000) use cars less often and alternative modes (bike, walk, public transit) more often than previous generations. Therefore, this analysis seeks to determine *whether we should plan for a quantum leap in demand for alternative transportation for commuting in Hampton Roads' future when Millennials and following generations comprise the workforce*. To answer this question, HRTPO staff measured how Millennials' mode choices differ from other generations in Hampton Roads, finding Millennials twice as likely to use alternative modes. In order to forecast usage of alternative transportation in Hampton Roads, staff developed a model (based on NHTS surveys) incorporating various factors—including generation—which impact alternative transportation usage to work. First, our regression revealed that usage of alternative transportation to work is a function of at least seven (7) factors—1. Income, 2. Age, 3. Era, 4. Generation, 5. MSA size, 6. Urbanized Area status, 7. Gender—concluding that **the HRTPO staff will consider all seven (7) of these factors when planning alternative transportation infrastructure for commuting**. Second, our regression revealed that being a part of the Millennial generation is a positive factor concerning usage of alternative transportation. Based on a model forecast, if all *other* things (besides generation) were the same in the future as today (income, age, etc.), HRTPO staff would expect **usage of alternative transportation for commuting in Hampton Roads to increase from 5.3% (2010) to 6.9% (2050)**.

### ACKNOWLEDGMENTS

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Staffers James Clary and David Pritchard added valuable research to this paper.

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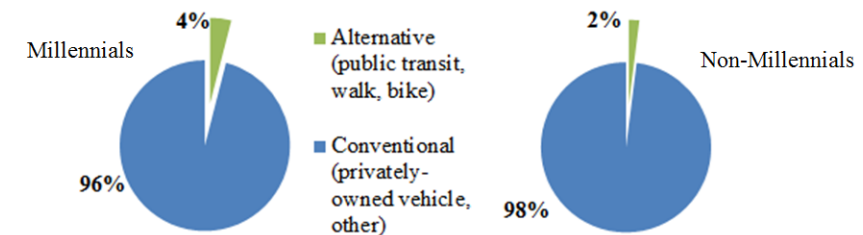
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## EXECUTIVE SUMMARY

It has been written that persons born 1982-2000—the Millennial generation—tend to use cars less often for commuting, and use alternative modes (walking, biking, and public transit) more often than other persons. Since Millennials and following generations will comprise the workforce of the future, HRTPO staff investigated these reports and forecasted how this phenomenon might affect the future, so that wise investments in transportation infrastructure can be made. This analysis seeks therefore to determine whether Millennials—in fact—have higher usage of alternative modes (“How Different?”), and whether that behavior is expected to dominate the future (“How Enduring?”), i.e. *whether we should plan for much higher commuter demand for alternative transportation in the future in Hampton Roads.*

Concerning the difference between current Millennial behavior and that of others, in Hampton Roads in 2008/2009, Millennials were twice as likely as non-Millennials to use alternative modes to work, as shown at right.



Mode to work by generations, Hampton Roads, NHTS, 2008/2009  
Source: HRTPO Staff preparation of NHTS data

To answer the future demand question, staff developed a model incorporating various factors—including generation—which impact alternative transportation usage. HRTPO staff compiled and regressed a dataset of National Household Travel Survey (NHTS) records from three different years: 1983, 1995, and 2008/2009. With the commuting mode choice of workers as the dependent variable, this study measured the strength of the association between seven (7) sets of commuter characteristics (1. income, 2. gender, 3. age, 4. generation, 5. era, 6. MSA status, 7. Urbanized Area status) and the usage of alternative transportation (“alt trans”) to get to work. All other modeled things being equal:

### 1. Income

- being in a low-income household (<\$20k/year) gives someone odds of using alt trans to work 3.4 times higher than households with income between \$40k and \$60k

### 2. Gender

- being female gives someone odds of using alt trans to work 1.15 times higher than males

### 3. Age

- being 16 or 17 years old gives someone odds of using alt trans to work approximately twice as high as other ages

### 4. Generation

- being a Millennial gives someone odds of using alt trans to work 1.6 times higher than Baby Boomers (born 1946-1964)

#### 5. Era

- working during the Reagan Era gives someone odds of using alt trans to work 2.5 times higher than working during the Bush/Obama Era

#### 6. MSA Status

- living in a mega metro (>3m population) gives someone odds of using alt trans to work 2.4 times higher than not living in any MSA

#### 7. Urbanized Area Status

- living in an Urbanized Area gives someone odds of using alt trans to work 3 times higher than not living in an Urbanized Area.

The authors provide evidence that the above “era” effect may reflect the suburbanization of work, lengthening of the work trip, increasing stigma, and higher affordability of autos.

First, our regression revealed that usage of alternative transportation to work is a function of at least seven (7) factors—1. Income, 2. Age, 3. Era, 4. Generation, 5. MSA size, 6. Urbanized Area status, 7. Gender—concluding that **the HRTPO staff will consider all seven (7) of these factors when planning alternative transportation infrastructure for commuting.** Second, our regression revealed that being a part of the Millennial generation is a positive factor concerning usage of alternative transportation to work. Based on our model forecast, if all other things (besides generation) were the same in the future as today (income, age, etc.), HRTPO staff **would expect usage of alternative transportation to work in Hampton Roads to increase from 5.3% (2010) to 6.9% (2050).**

Finally, this study recommends future research examining the relationships between the seven (7) commuter characteristics used in this study and each alternative mode *individually*: walking, biking, and public transit. This research would provide HRTPO decision-makers with specific information with which to plan for these modes.



## INTRODUCTION

### Motivation and Purpose

In recent years, the U.S. has experienced substantial demographic shifts that have affected employment, diversity, housing, transportation, and other aspects of American life. According to Figure 1, the Millennial generation (considered to be born 1982 through 2000, also called Generation Y) will outnumber Baby Boomers this year (2). Millennials already make up the largest share of the American workforce at 34%, followed by Generation Xers and Baby Boomers, at 32% and 31%, respectively (3).

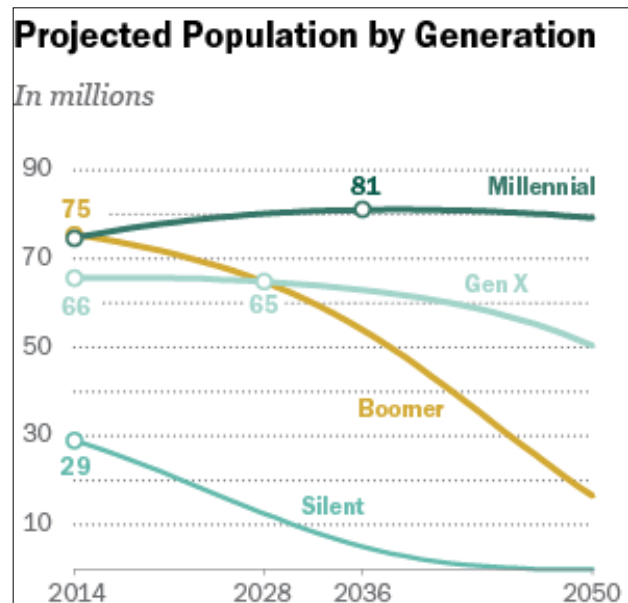
The literature suggests that Millennials are more likely to use alternative modes (walk, bike, transit) than members of previous generations.

Therefore, the resulting research question is:

“Given recent Millennial reports, should we plan for a quantum leap in demand for alternative transportation to work in the future in Hampton Roads?”

In order to answer this question, HRTPO staff prepared a three-part study:

- appropriate data
- analysis of that data
- forecast



**FIGURE 1 Projected population by generation, U.S.**

Note: *Millennial* refers to those aged 18-34 as of 2015.

Source: Pew Research Ctr. tabulations of U.S. Census Bureau population projections released Dec. 2014 (2)

## DATA

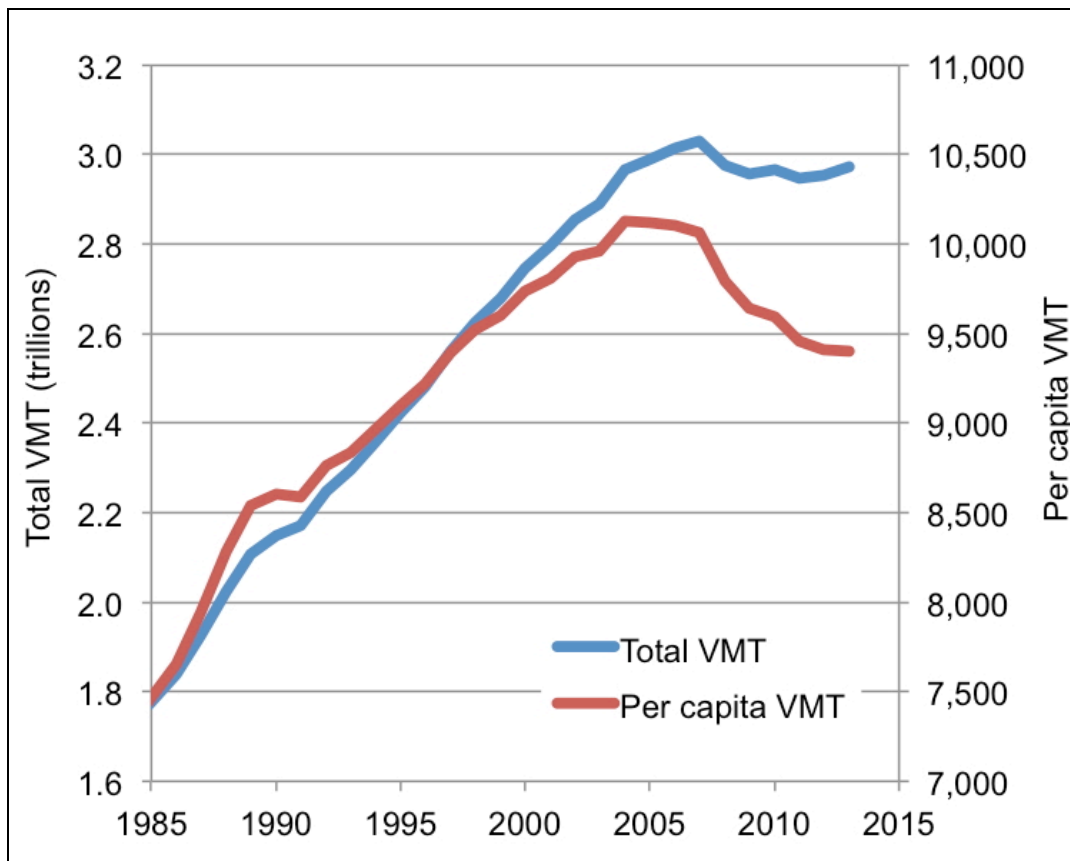
In the first section below, HRTPO staff reviewed transportation literature to see if someone had already answered the question of how the mode choices of Millennials across the U.S. differ from those of other generations. In the second data section, staff performed its own analysis of Millennials vs. others for Hampton Roads.

### Data in the Literature

There is ample existing research based on survey data that documents the mode choices of Americans. Most studies examine either a) the general population or b) individual groups segregated by age or generation. Both of these are described below.

#### *Mode Choice of the General Population*

Concerning the mode choices of the general population, from 1985 to 2007 the U.S. experienced a steady rise in total annual Vehicle Miles Traveled (VMT). After this trend peaked in 2007 at 3 trillion annual VMT, the number decreased slightly, then was fairly constant, and has been increasing since 2011 (see Figure 2). In April 2015, the Federal Highway Administration (FHWA) reported the highest number of VMT (267.9 billion miles) since the agency began making estimates (9).”



**FIGURE 2 VMT trends for the U.S. through 2013.**

Source: State Smart Transportation Initiative (2014) (8)

Although (as shown above) total VMT is increasing again, per capita VMT declined between 2004 and 2013, and automobile mode share by American workers dropped from 2000 (87.9%) (10) to 2013 (86.1%) (11).

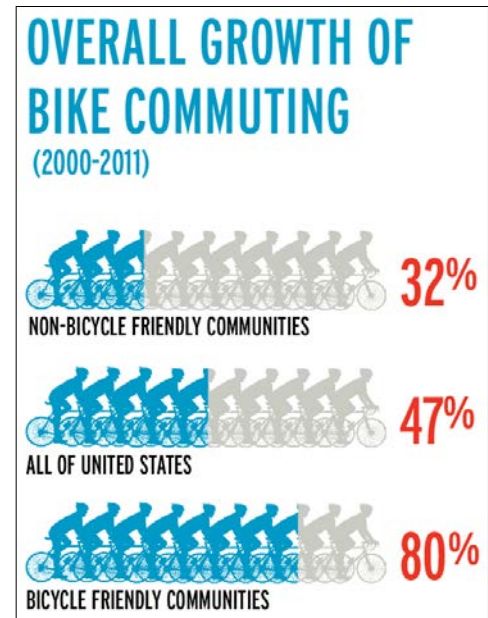
Biking to work has become more popular. For instance, from 1990 to 2011, Philadelphia's portion of bike commuters more than doubled; Washington, D.C. experienced a threefold increase, and Lexington's share of commutes by bike more than quadrupled (12). Overall U.S. growth (i.e. all cities and counties) is shown in Figure 3.

Although biking is an increasingly popular mode choice in some cities, it still represents only a small fraction of commuting in the nation's largest metros: New York (1.2%), Los Angeles (1.2%), and Chicago (1.4%) (13, p. 3).

#### *Mode Choice of Millennials*

Noreen McDonald recently studied the question "Are Millennials Really the 'Go-Nowhere' Generation?" (21). She considers that Millennials were born starting in 1979. Using the 1995 and 2009 NHTS, she found that "Changes in [auto] licensure are most apparent among older Millennials aged 25 to 30, who [were in 2009] five percentage points less likely to report being drivers than the same age group in 1995 [i.e. Gen Xers]. (21, p. 3) She notes, however, "there is little evidence of increased use of other modes."

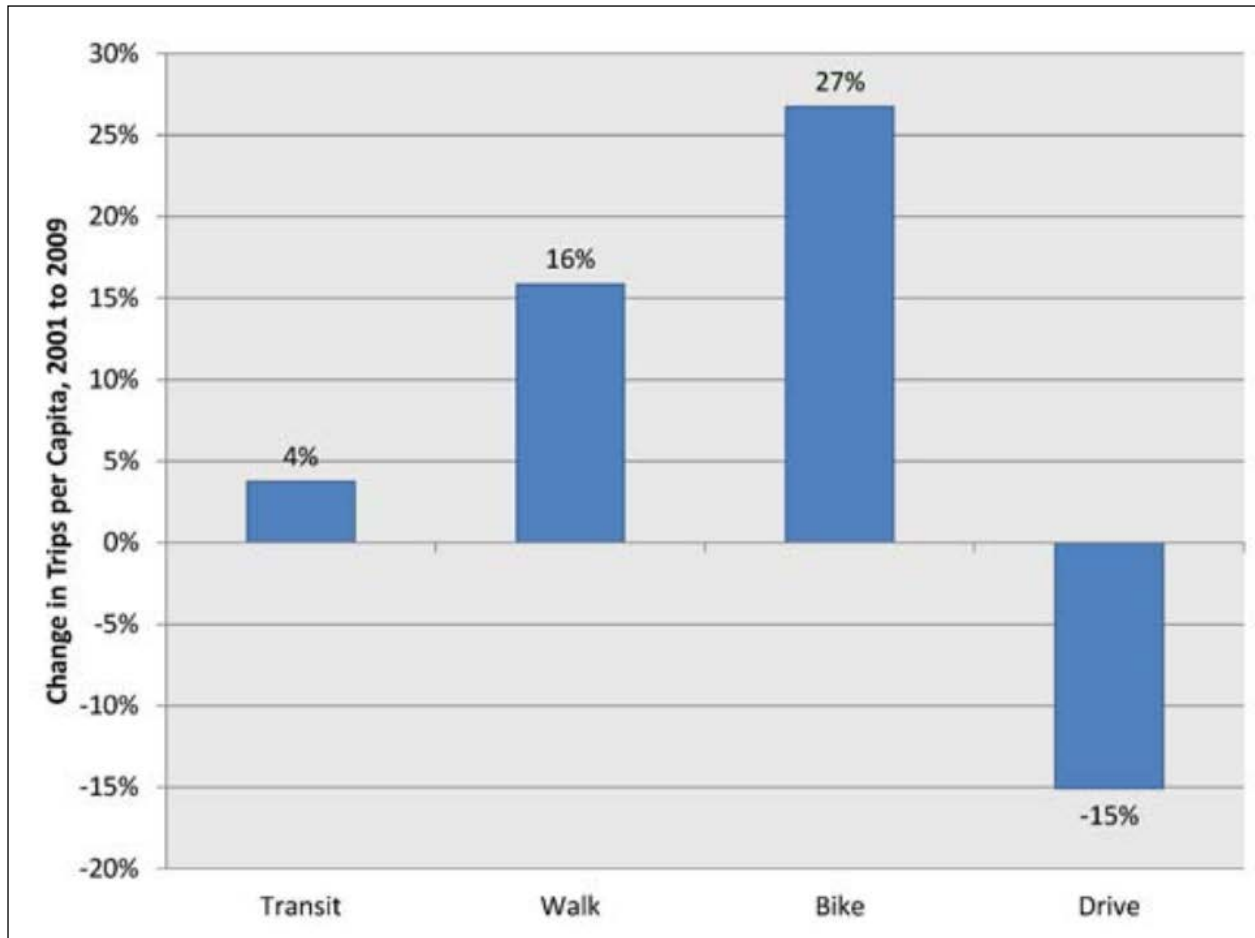
According to other literature, Millennials place high importance on the ability to get around without a car. Fifty-four percent of them would consider moving to another city for a better, wider range of transportation options (14, p. 9). In addition, parents under age 30 who have school-age children are more likely to use transit than those over age 30 (5, p. 6). Some studies have found that certain lifestyle characteristics of Millennials decrease their propensity to drive when compared to previous generations. These include complex living arrangements, lower incomes, lower licensure rate (6, p. 62), living in walkable neighborhoods, and usage of mobile technologies (7, pp. 23, 25).



**FIGURE 3 U.S. bike commuting.**

Source: The Growth of Bike Commuting (The League of American Bicyclists, 2014) (10)

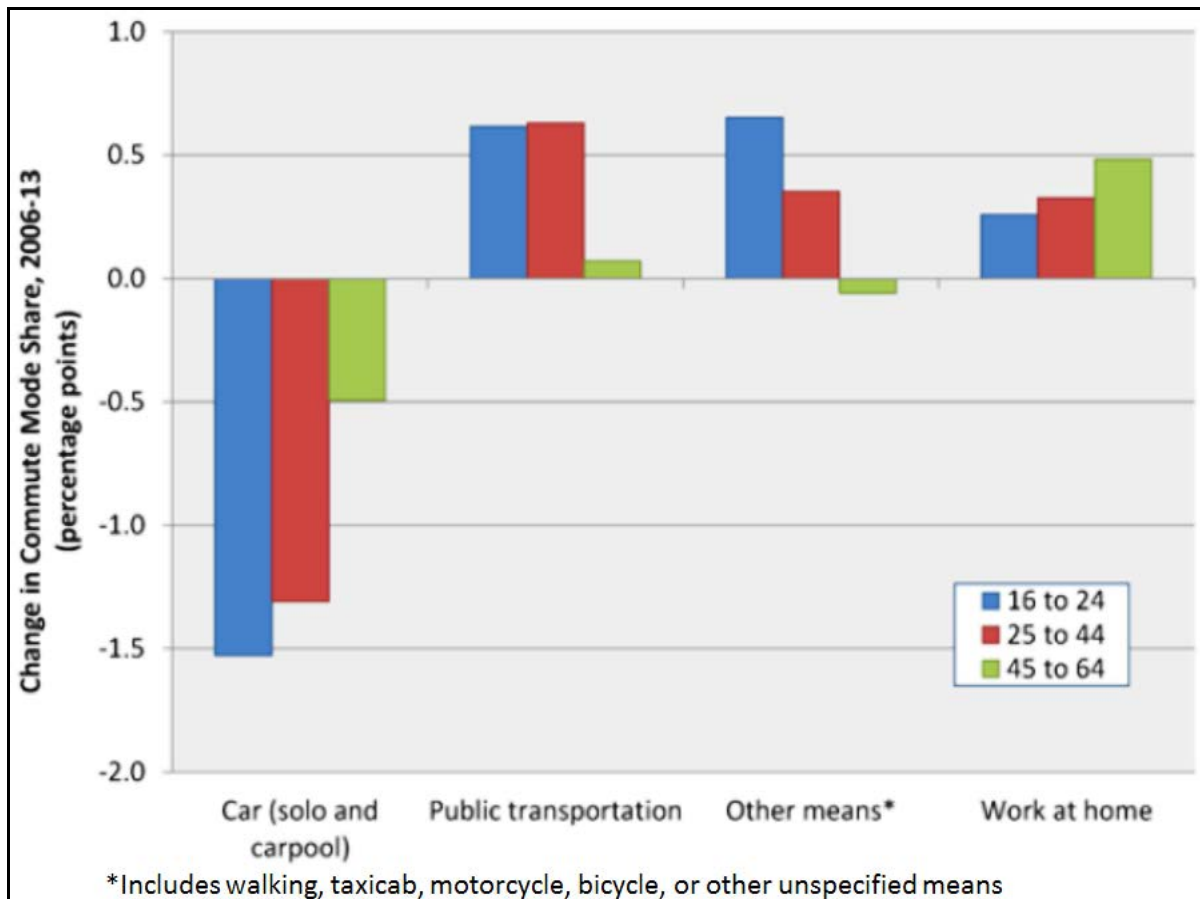
From 2001 to 2009, among young workers (aged 16 to 34, therefore born between 1967 and 1993, therefore consisting of Generation Xers and Millennials), the percentage of trips per capita by car decreased. Meanwhile, the percentage of trips by transit, walking, and biking increased. See these changes in Figure 4 below.



**FIGURE 4 Change in # of trips per capita among 16 to 34 year-olds, 2001 to 2009, U.S.**

Source: Millennials in Motion (U.S. PIRG, 2014) (16, p. 11)

Between 2006 and 2013, young workers (aged 16 to 24, therefore born between 1982 and 1997, and thus part of the Millennial generation) experienced the greatest decrease in commute trips made by car (both driving alone and commuting by carpool), as shown in Figure 5 below.



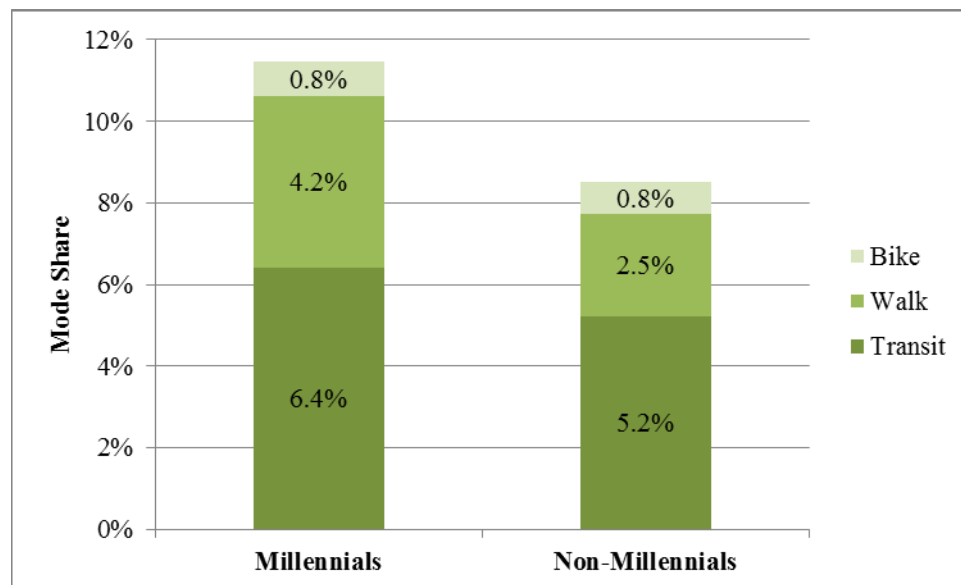
**FIGURE 5 Change in commute mode share, 2006 to 2013, by age group, U.S.**

Source: Millennials in Motion (U.S. PIRG, 2014) (16, p. 12)

## Original Data

### *United States*

To examine how the mode choices of Millennials (born 1982 through 2000) differ from those of other ages in the U.S., HRTPO staff used the person records in the most recent National Household Travel Survey (NHTS) dataset (2008/2009). Using person weights, HRTPO staff calculated that Millennials have a significantly higher alternative mode share (11.5%) than non-Millennials (8.5%), as shown below.



**FIGURE 6 Millennial vs. non-millennial journey to work, U.S., 2008/09 (weighted).**

Source: HRTPO staff analysis of NHTS data (PER2PUB- key columns.xlsx)

Therefore, considering the descriptive statistics above (literature and original), Millennials in the U.S. have been using alternative transportation to work to a significantly higher degree than persons of other ages/generations.

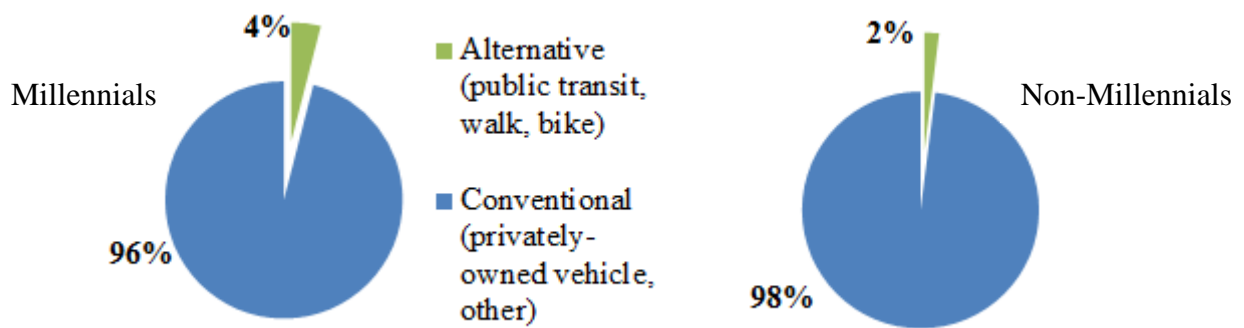
### *Hampton Roads*

To examine how the mode choices of Millennials (born 1982-2000) differ from those of other ages and generations in Hampton Roads, HRTPO staff used the 6,690 Hampton Roads person records in the most recent National Household Travel Survey (NHTS) dataset (2008/2009). Those persons whose “mode to work” (i.e. method of commuting) was either unknown or appropriately skipped (non-workers) were excluded from the following table.

**TABLE 1 Millennial vs. Non-Millennial Workers, Hampton Roads, 2008/09, Unweighted**

Binary Variables	Millennials				Non-Millennials			
	Observations (commuters)	Share (%)	Min	Max	Observations (commuters)	Share (%)	Min	Max
<u>Age</u>								
16-17	38	14	0	1	0	0	0	0
18-34	233	86	0	1	189	8	0	1
35-54	0	0	0	0	1321	55	0	1
55-74	0	0	0	0	846	35	0	1
75+	0	0	0	0	29	1	0	1
	271	100			2385	100		
<u>Gender</u>								
Male	130	48	0	1	1238	52	0	1
Female	141	52	0	1	1137	48	0	1
	271	100			2385	100		
<u>Total Annual Household Income</u>								
<\$20,000	8	3	0	1	81	3	0	1
\$20,000-\$39,999	35	13	0	1	244	10	0	1
\$40,000-\$59,999	50	18	0	1	397	17	0	1
\$60,000-\$99,999	105	39	0	1	839	35	0	1
\$100,000+	73	27	0	1	824	35	0	1
	271	100			2385	100		
<u>MSA Population</u>								
<1 million	0	0	0	0	0	0	0	0
1 million-3 million	271	100	1	1	2385	100	1	1
>3 million	0	0	0	0	0	0	0	0
Household not in MSA	0	0	0	0	0	0	0	0
MSA size not identified	0	0	0	0	0	0	0	0
	271	100			2385	100		
<u>Urbanized Area Status</u>								
Household in Urbanized Area	240	89	0	1	2059	86	0	1
HH not in Urbanized Area	31	11	0	1	326	14	0	1
Urbanized Area status unknown	0	0	0	0	0	0	0	0
	271	100			2385	100		
<u>Mode to work</u>								
<b>Alternative modes (public transit, walk, bike)</b>	<b>12</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>55</b>	<b>2</b>	<b>0</b>	<b>1</b>
Conventional modes (privately-owned vehicle, other)	259	96	0	1	2330	98	0	1
	271	100			2385	100		

Source: HRTPO staff analysis of NHTS data (PER2PUB – HR only.xlsx)



**FIGURE 7 Mode to work by generations, Hampton Roads, NHTS, 2008/2009, unweighted.**

Source: HRTPO Staff preparation of NHTS data (pies.xlsx)

As shown in Table 1 and Figure 7 above, Millennials in Hampton Roads use alternative modes to work *twice as frequently* as Non-Millennials.

### Data Summary: How Different are Millennials?

In the first section above—examining data in the literature—staff discovered that:

- From 2001 to 2009, workers age 16 to 34 (Generation Xers and Millennials) shifted somewhat from cars to public transit, walking, and biking.
- Workers age 16 to 24 (Millennials) shifted somewhat from cars to transit and other modes between 2006 and 2013.

In the second section above—staff analysis of NHTS data—staff discovered that:

- Millennials in Hampton Roads use alternative modes to work *twice as frequently* as Non-Millennials.

### Next Step

Having found that Millennials use alt trans to work twice as frequently, HRTPO staff wanted to see what effect that difference might have on usage of alt trans in Hampton Roads when Millennials (and following generations) comprise the workforce. Theorizing that usage of alt trans to work is a function of more than just generation, HRTPO staff prepared a multi-variate model with which to a) measure the impact of each factor, and b) forecast a future without working Baby Boomers or Gen Xers.



## DATA ANALYSIS

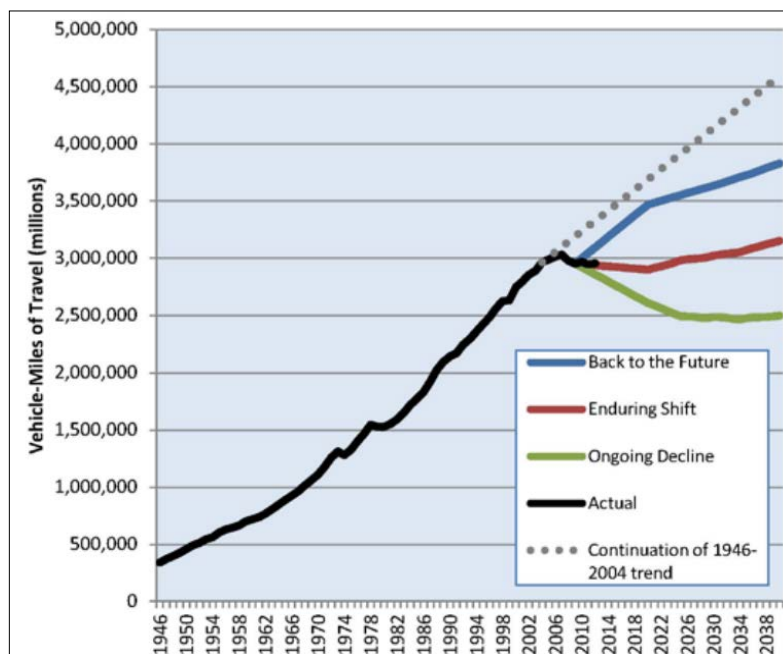
In preparation for conducting a multi-variate regression for forecasting usage of alt trans to work, staff reviewed the literature a) to see the forecasts for other geographies (e.g. for the U.S.), and b) to gather sound analytical methodologies to be used in our Hampton Roads analysis.

### Literature Review

#### *Mode Choice Forecasts*

Dutzik and Baxandall have suggested three possible scenarios for the future of vehicle-miles traveled (VMT) (7, pp. 29-30), VMT theoretically being related negatively to the usage of alternative transportation. The three scenarios are listed below and shown in Figure 8:

1. *Back to the Future* Under this scenario, the U.S. decline in driving since 2004 is assumed to be the effect of temporary conditions: poor economic conditions and higher gas prices. As these conditions reverse, the travel preferences of Millennials will increasingly mimic those of previous generations.
2. *Enduring Shift* In this scenario, the shift in travel behavior that has occurred over the last decade is assumed to be lasting, consistent with the view that the preferences of Millennials will be embraced by future generations.
3. *Ongoing Decline* This scenario assumes that the decline in driving over the last decade is the beginning of a broader change that makes driving less necessary. The outcome of this scenario is that driving will stabilize at a much lower level per capita.



**FIGURE 8 Vehicle-miles traveled under three scenarios, U.S.**

Source: A New Direction (U.S. PIRG, 2013) (5, p. 30)

In her analysis of Millennial travel mentioned above, after Noreen McDonald found that Millennials in 2009 drove less than Gen Xers in 1995, in order to determine how much of current Millennial behavior will endure as they age, she measured the degree to which three factors explain their decrease in driving. She found that 1) decreased employment and other lifestyle shifts explain 10-25% of the decrease in driving, 2) general dampening of travel demand across all age groups explains 40% of the decrease, and 3) different attitudes and online shopping/media (i.e. the factor inherent to the Millennial generation) explains the remaining 35-50% of the decrease. Millennials would be expected to carry this different attitude into the future.

In Kelcie Ralph's dissertation "Stalled on the Road to Adulthood?" (22), Dr. Ralph looked for factors to explain why people fall into four mode-based categories: 1) "Drivers", 2) "Long-distance Trekkers", 3) "Multimodals", and 4) "Car-less". Her conclusion:

"I find that economic constraints, role deferment, and racial/ethnic compositional changes in the population primarily explain the travel trends during this period. The evidence in support of preferences and residential location explanations was substantially more limited." (22, p. iii)

This finding indicates that much of the decrease in auto travel associated with Millennials is expected to reverse itself as the generation ages and economics change.

Wanting to conduct its own forecast, HRTPO staff also reviewed the literature for help in designing a multi-variate analysis on which to base that forecast.

#### *Conceptual Framework*

For generational research, the literature identifies the following types of effects on travel behavior (3, p. 9), (4, p. 3):

1. *Period (or Era) Effect* The effect of a situation that impacts an entire population for a period of time. Example: WWII
2. *Age Effect* An effect associated with a particular person age.  
Examples: Being of high school age, being of working age, being of retirement age
3. *Generational Effect* The effect of events whose consequences follow a group of people, born at a specific time, throughout their lifetimes.  
Example: The Great Depression's effect on the Silent Generation

Based on the literature, staff designed its multi-variate analysis to include each of these three effects—era, age, and generation—on mode choice.

### *Methodology*

In her analysis of Millennial travel mentioned above, McDonald used a linear regression model to explain auto mileage, and a negative binomial model to explain auto trips. In order to identify to what extent differences between Millennials and Gen-Xers (at the same age) reflect preferences (as opposed to demographic—including economic—and era effects), she used the regression coefficients from her 1995 model to forecast 2009 mileage, comparing that forecast to the actual. (21, p. 12)

Dr. Ralph, on the other hand (in her dissertation mentioned above), used “multinomial logistic regression to identify the independent relationship between traveler type and economic resources, adult roles, residential location, and race/ethnicity.” (22, p. iii)

As in these two papers, staff’s multi-variate model includes demographic, economic, and location variables. Like Dr. Ralph, staff developed the model using logistic regression.

### **Multi-variate Regression**

Understanding (and forecasting) the *individual factors* contributing to a phenomenon allows one to forecast that phenomenon more effectively than simply looking one-dimensionally at the changes in that phenomenon over recent years. Therefore, before HRTPO staff forecasted the future of alternative transportation to work, we conducted a multi-variate analysis to prepare a model on which to base that forecast.

### *Source of Data*

In order to conduct an original analysis that considers the factors identified in the literature—age, era, generation, etc.—HRTPO staff chose a survey containing that data: the National Household Travel Survey (NHTS), a comprehensive travel survey conducted by FHWA approximately every 7 years since 1969. Using a multi-year survey like the NHTS enables the analyst to isolate generational effects using multiple regression.

## Variables for Regression

**Dependent Variable** The research question being related to mode choice, HRTPO staff chose “usage of alternative transportation to work” (i.e. for commuting) as the dependent variable. In the 1983 and 1995 NHTS surveys, this was described as “principal (or main) means of transportation to work.” In the 2008/2009 survey, this variable was labeled as “transportation mode to work last week.”

HRTPO staff categorized each mode as either “alternative” (bike, walk, transit) or “conventional” (all other modes) in each year’s dataset as shown in table below.

**TABLE 2 Mode-to-Work Variables in the Three NHTS Datasets**

1983		1995		2008/2009	
Alternative	Conventional	Alternative	Conventional	Alternative	Conventional
Bus	Auto	Bus	Automobile	Local public bus	Car
Train	Station wagon	Amtrak	Van	Commuter bus	Van
Streetcar	Pass. van	Commuter train	Sport utility vehicle	City to city bus	SUV
Elevated rail/subway	Other van	Streetcar/trolley	Pickup truck	Shuttle bus	Pickup truck
Bicycle	Pickup truck	Subway/elevated rail	Other truck	Amtrak/intercity train	Other truck
Walk	Pickup with camper	Bicycle	RV	Commuter train	RV
	Other truck	Walk	Motorcycle	Subway/elevated train	Motorcycle
	Motorized camper coach	Other public transit	Other private vehicle	Street car/trolley	Light electric veh (golf cart)
	Motorcycle		Plane	Ferry	School bus
	Motorized bicycle/moped		Taxi	Bicycle	Charter/tour bus
	Work at home		School bus	Walk	Taxi
	Other (POV)		Other	Special transit-people w/disabilities	Plane
	Plane				Other
	Taxi				
	School bus				
	Other				

Source: HRTPO staff tabulation of information from NHTS user guides from 1983, 1995, and 2009

**Independent Variables** To the degree that Millennials’ preference for alternative modes is a function of their age (and associated income) and the current economy (both of which will change)—as opposed to an inherent generational trait (which will not change)—the usage of alternative modes by all generations in the future will be similar to that of today. Therefore, in order to forecast the usage of alternative transportation to work, HRTPO staff included independent variables for income, age, generation, and era.

**TABLE 3 Relationship between Era, Age, and Generation**

	<b>Younger Aged People</b>	<b>Older Aged People</b>
<b>Future Era</b>	Generation Z	Millennials
<b>Present Era</b>	Millennials	Baby Boomers
<b>Past Era</b>	Baby Boomers	Silent Generation

Source: HRTPO Staff

In addition to income, era, age, and generation, the literature and logic dictate controlling for gender, and location when studying mode choice. Therefore, in order to identify and measure all above factors related to alt-trans-to-work, HRTPO staff included seven (7) groups of factors as independent variables:

1. era
2. age
3. generation
4. gender
5. income
6. MSA size
7. Urbanized Area status.

1. *Era* NHTS Datasets from the Reagan Era (1983), Clinton Era (1995), and Bush/Obama Era (2008/2009) were selected. (The 2008/2009 NHTS contains survey results from March 2008 through May 2009 (1).)

2. *Age* To improve the likelihood of obtaining statistically significant results, ages were grouped into the following categories:

- a. 16-17 years old
- b. 18-34 years old
- c. 35-54 years old
- d. 55-74 years old
- e. 75+ years old

3. *Generation* HRTPO staff used NHTS year and age data to calculate generation based on the following assumed ranges of birth years:

- a. Lost Generation (b. 1883-1900)
- b. G.I. Generation (b. 1901-1924)
- c. Silent Generation (b. 1925-1945)
- d. Baby Boomer Generation (b. 1946-1964)
- e. Generation X (b. 1965-1981)
- f. Millennial Generation (b. 1982-2000)

4. *Gender* Males and females having shown different commuting habits in the literature, gender was included as an independent variable.

5. *Household Income* In the 1983 and 1995 NHTS datasets, HRTPO staff calculated household income by combining family and non-family incomes. Then this number was adjusted for inflation to 2009 dollars using the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI). In 2009, with total household income being reported as a single figure, no adjustment was necessary.

Total household income was divided into five categories:

- a. <\$20,000
- b. \$20,000-\$39,999
- c. \$40,000-\$59,999
- d. \$60,000-\$99,999
- e. \$100,000+

6. *MSA Population Category* Concerning Metropolitan Statistical Areas (MSAs), respondents' household locations were classified as follows:

- a. Household not in MSA
- b. MSA size not identified
- c. MSA with population <1 million
- d. MSA with population 1 million - 3 million
- e. MSA with population >3 million

7. *Urbanized Area Status* In the 1983 and 2008/2009 NHTS person datasets, all respondents were classified as either living in an Urbanized Area, or not.

### *Data Preparation*

The raw 1983 NHTS dataset (U.S.) contains 17,383 person records. The 1995 and 2008/2009 sets contain 95,361 and 308,902 records, respectively. Due to computational limitations, HRTPO staff reduced the sizes of the later two sets to approximately that of the first set using random selection. Then, after removing non-workers, HRTPO staff combined all three sets into one database of 22,483 records for the analysis.

All variables (dependent and independent) in this analysis were entered into the regression in binary form. For the discrete variables in the NHTS dataset (era, generation, gender, MSA population category, and Urbanized Area status), a set of sub-variables was created for each. For example, HRTPO staff created an “era” set containing three binary sub-variables: “Reagan Era (1983),” “Clinton Era (1995),” and “Bush/Obama Era (2008/2009).” For the continuous NHTS variables—age and income—HRTPO staff transformed each into a categorical variable set, as shown above.

The dependent variable—mode to work—was categorical in the NHTS data set. Given our focus on alternative transportation, HRTPO staff converted the NHTS mode data into a binary variable: alternative vs. conventional, as shown in Table 2.

**Handling Missing Data** Records that had missing or unknown responses to the mode question were excluded from the analysis. Records with missing data on income (an independent variable), however, were given the average income of respondents reporting such data.

### *Description of Data Set*

Descriptive statistics for the variables used in this analysis are shown in Table 4 on the following page.

As shown at the bottom of the table, in our dataset of 22,483 NHTS person records from the 1983, 1995, and 2008/2009 NHTS surveys, 8% of working persons used alternative means to get to work (0.5% biked, 3.0% walked, and 4.6% used public transportation).

Baby Boomers, not surprisingly, comprise half of the dataset, with the Silent and X generations contributing approximately one-fifth of the records, each. Millennials, who only appear as workers in the latest survey, comprise 9% of the 2008/2009 set and 3% of the total database. Records are evenly split between males and females. Median household income is approximately \$60,000 per year. Four-fifths of the surveyed persons lived in an MSA, and two-thirds lived in an Urbanized Area.

**TABLE 4 Descriptive Statistics (unweighted), HRTPO Model**

Binary Variables		Observations (commuters)	Share (%)	Min	Max
<u>Era</u>					
Reagan Era (1983)		7,560	34	0	1
Clinton Era (1995)		8,352	37	0	1
Bush/Obama Era (2008/2009)		6,571	29	0	1
		22,483	100		
<u>Age</u>					
16-17		508	2	0	1
18-34		7,288	32	0	1
35-54		10,369	46	0	1
55-74		4,164	19	0	1
75+		154	1	0	1
		22,483	100		
<u>Generation</u>	<u>Years born</u>				
Lost Generation	1883-1900	5	0	0	1
G.I. Generation	1901-1924	696	3	0	1
Silent Generation	1925-1945	5,065	23	0	1
Baby Boomer Generation	1946-1964	11,830	53	0	1
Generation X	1965-1981	4,266	19	0	1
Millennial Generation	1982-2000	621	3	0	1
		22,483	100		
<u>Gender</u>					
Male		11,707	52	0	1
Female		10,776	48	0	1
		22,483	100		
<u>Total Annual Household Income</u>					
<\$20,000		1,573	7	0	1
\$20,000-\$39,999		4,168	19	0	1
\$40,000-\$59,999		4,582	20	0	1
\$60,000-\$99,999		7,649	34	0	1
\$100,000+		4,511	20	0	1
		22,483	100		
<u>MSA Population</u>					
<1 million		6,489	29	0	1
1 million-3 million		4,744	21	0	1
>3 million		6,605	29	0	1
Household not in MSA		4,237	19	0	1
MSA size not identified		408	2	0	1
		22,483	100		
<u>Urbanized Area Status</u>					
Household in Urbanized Area		14,704	65	0	1
Household not in Urbanized Area		7,733	34	0	1
Urbanized Area status unknown		46	0	0	1
		22,483	100		
<u>Mode to work</u>					
Alternative modes (public transit, walk, bike)		1,837	8	0	1
Conventional modes (privately-owned vehicle, other)		20,646	92	0	1
		22,483	100		

Source: HRTPO staff (all data.xlsx)



### *Regression Structure*

Given the binary nature of the dependent variable (alternative vs. conventional mode to work), binary logistic regression was performed using SPSS. Coming from a logistic regression, the model estimates the odds of the subject person using alternative transportation to work, as follows:

$$\text{Odds}_i = e^{(\beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_n X_n)}$$

where  $\text{Odds}_i$  is the odds of using an alternative mode,  $X_1$  through  $X_n$  are the regressors,  $\beta_1$  through  $\beta_n$  are the coefficients of those regressors, and  $\beta_0$  is the “Constant” at the end of the regression results. In addition, for ease of interpretation, “Odds Factors” have been calculated for the coefficients of the independent variables (Table 6, following page). Each “Odds Factor” indicates the impact of the subject regressor/variable being 1 (or true) on the odds of using an alternative mode, vs. the basis. For example, if an odds factor for a “male” variable is 0.9 (vs. basis variable “female”) and the odds of Betty using alternative transportation is 0.50:1 (for:against, i.e. a 33% chance), then the odds of Betty’s twin brother Bill using alternative transportation—all other modeled factors being equal—would be 0.45:1 ( $0.50 \times 0.9 = 0.45$ ; 0.45:1 odds is a 31% chance).

A basis variable in each set of independent variables being needed for the calculation of odds factors, basis variables were selected as summarized in Table 5 below.

**TABLE 5 Basis Variables**

<b>Variable Set</b>	<b>Basis Variable</b> (to which other variables are compared)
Era	Reagan Era (1983)
Age	16-17
Generation	Baby Boomer Generation
Gender	Female
Total Annual Household Income	\$40,000-59,999
MSA Population	Household not in MSA
Urbanized Area	Household not in Urbanized Area
Source: HRTPO Staff	

The regression results are summarized in Table 6 on the following page.

**TABLE 6 Regression Results, HRTPO Model**

**Logistic regression**

**Observations (commuters)**

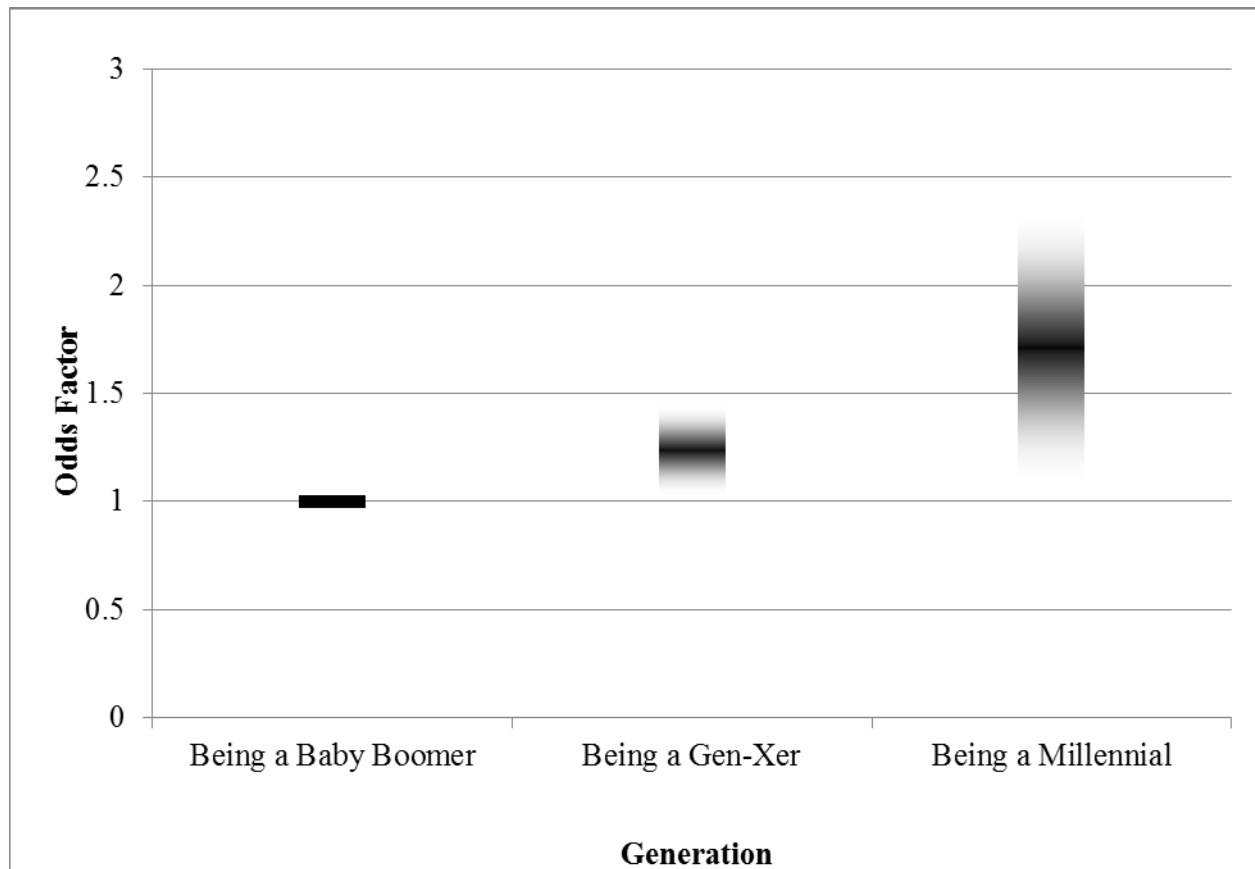
**22,483**

DV: Alternative Mode to Work		Signif.	Coeff.	Std. Error	Odds Factor	95% Conf. Interval	
						Lower	Upper
<b>Independent Variables- Regressors</b>							
<u>Era</u>							
Reagan Era (1983) (basis)					1.000		
Clinton Era (1995)		0.000 <sup>++</sup>	-.321	.073	.726	.629	.838
Bush/Obama Era (2008/2009)		0.000 <sup>++</sup>	-.934	.116	.393	.313	.494
<u>Age</u>							
16-17 (basis)					1.000		
18-34		0.000 <sup>++</sup>	-.509	.144	.601	.453	.797
35-54		0.000 <sup>++</sup>	-.703	.169	.495	.355	.690
55-74		0.005 <sup>++</sup>	-.591	.210	.554	.367	.836
75+		0.121	-.630	.406	.533	.240	1.181
<u>Generation</u>	<u>Years born</u>						
Lost Generation	1883-1900	0.144	1.619	1.107	5.050	.576	44.243
G.I. Generation	1901-1924	0.545	-.118	.194	.889	.607	1.301
Silent Generation	1925-1945	0.147	-.132	.091	.876	.732	1.048
Baby Boomer (basis)	1946-1964				1.000		
Generation X	1965-1981	0.022 <sup>++</sup>	.198	.086	1.219	1.029	1.443
Millennial Generation	1982-2000	0.015 <sup>++</sup>	.467	.192	1.596	1.095	2.326
<u>Gender</u>							
Male		0.006 <sup>++</sup>	-.139	.051	.870	.787	.961
Female (basis)					1.000		
<u>Total Annual Household Income</u>							
<\$20,000		0.000 <sup>++</sup>	1.211	.090	3.357	2.813	4.006
\$20,000-\$39,999		0.000 <sup>++</sup>	.356	.080	1.428	1.220	1.672
\$40,000-\$59,999 (basis)					1.000		
\$60,000-\$99,999		0.062 <sup>+</sup>	-.142	.076	.867	.747	1.007
\$100,000+		0.001 <sup>++</sup>	-.290	.088	.748	.630	.889
<u>Metro Area Population</u>							
<1 million		0.000 <sup>++</sup>	-.492	.104	.612	.499	.750
1 million-3 million		0.002 <sup>++</sup>	-.331	.109	.718	.580	.889
>3 million		0.000 <sup>++</sup>	.886	.098	2.425	2.001	2.939
Household not in MSA (basis)					1.000		
MSA size not identified		0.025 <sup>++</sup>	-.470	.210	.625	.414	.943
<u>Urbanized Area Status</u>							
Household in Urbanized Area		0.000 <sup>++</sup>	1.082	.081	2.950	2.515	3.460
Household not in Urbanized Area (basis)					1.000		
Urbanized area status unknown		0.030 <sup>++</sup>	1.002	.462	2.723	1.101	6.738
Constant		0.000 <sup>++</sup>	-2.537	0.174	0.079	N.A.	N.A.

Source: HRTPO staff (final.pdf)

<sup>+</sup>Significant at the 0.10 level, <sup>++</sup>Significant at the 0.05 level

Statistically, the model has great explanatory power (to be interpreted carefully given the inherent causation issues of any regression). The -2 Log Likelihood was 11,269, the Nagelkerke R-Square was 0.145, and 24 of the 29 independent variables are statistically significant at the 95% level. The results for each of the seven factors are presented graphically below.

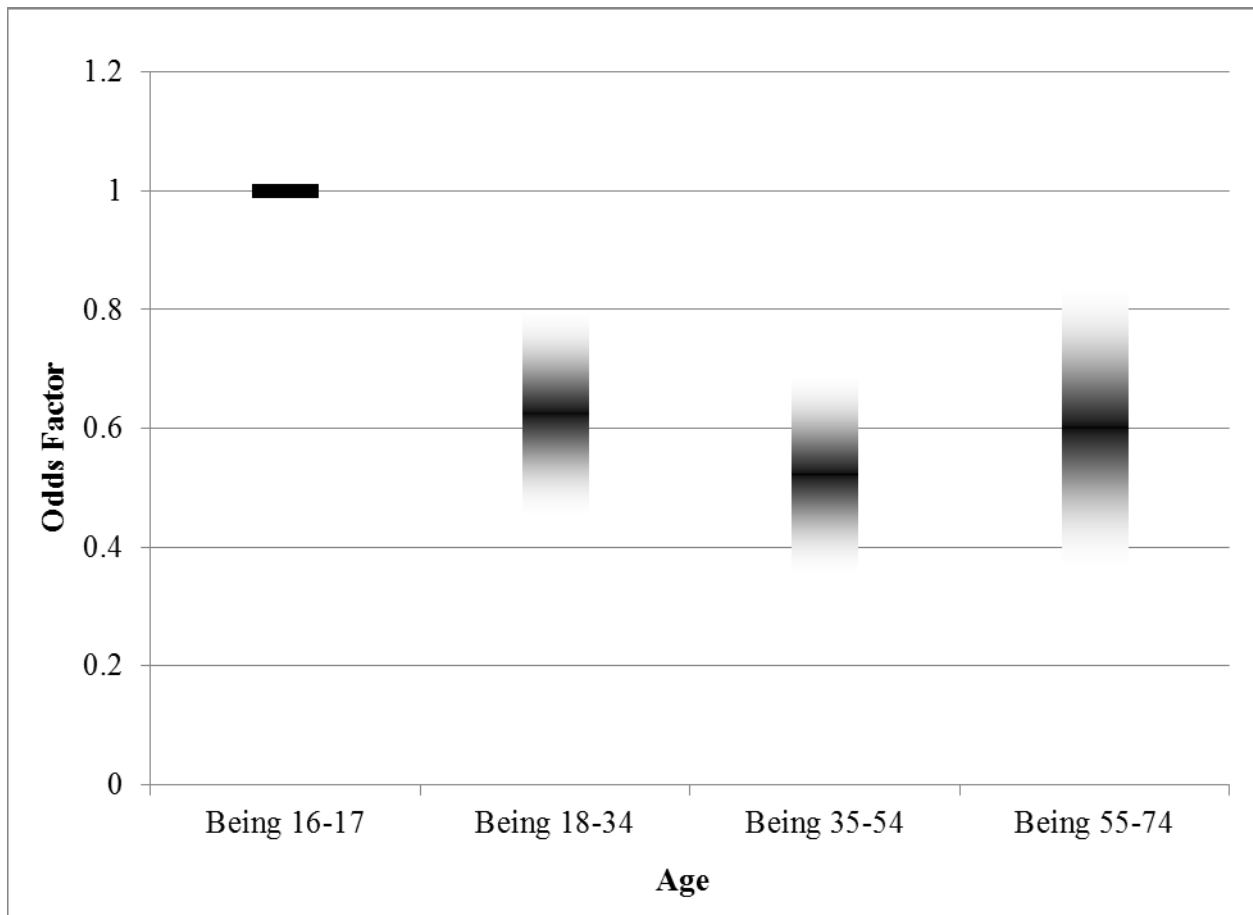


**FIGURE 9 Alt. mode to work, by generation, odds factor (vs. Boomer), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

The model coefficients for the Lost Generation, the G.I. Generation, and the Silent Generation being statistically insignificant, odds factor estimates for those generations are not shown on the above figure.

As shown in Figure 9, all other modeled factors being equal, the predisposition to use alternative modes to work increased slightly with membership in each generation.

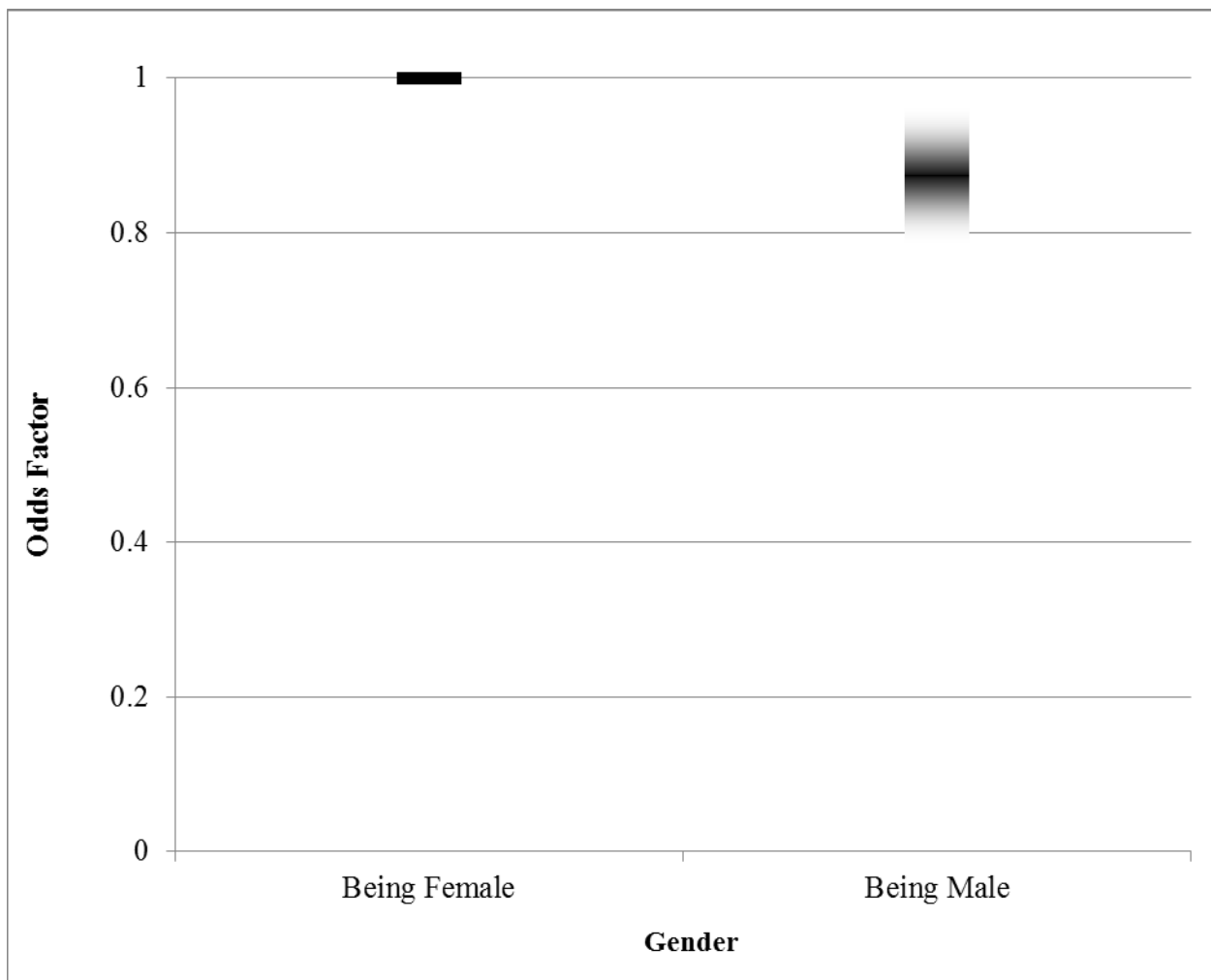


**FIGURE 10 Alternative mode to work, by age, odds factor (vs. 16-17), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

The model coefficients for age 75+ not meeting the 95% statistical significance level, the odds factor estimate for that age group is not shown on the above figure.

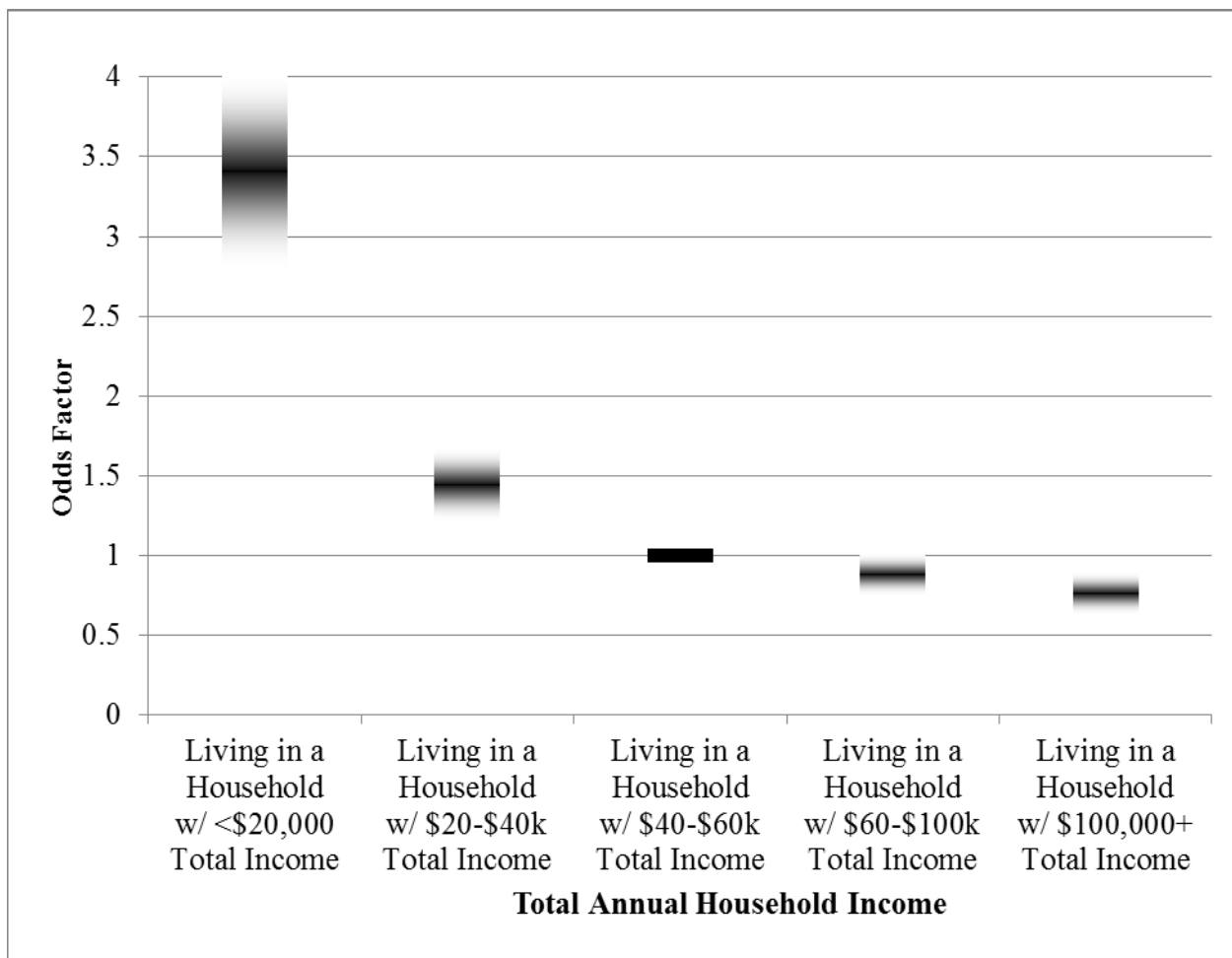
Figure 10 shows that, all other modeled factors being equal, the predisposition to use alternative modes to work is highest for being aged 16-17.



**FIGURE 11 Alternative mode to work, by gender, odds factor (vs. female), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

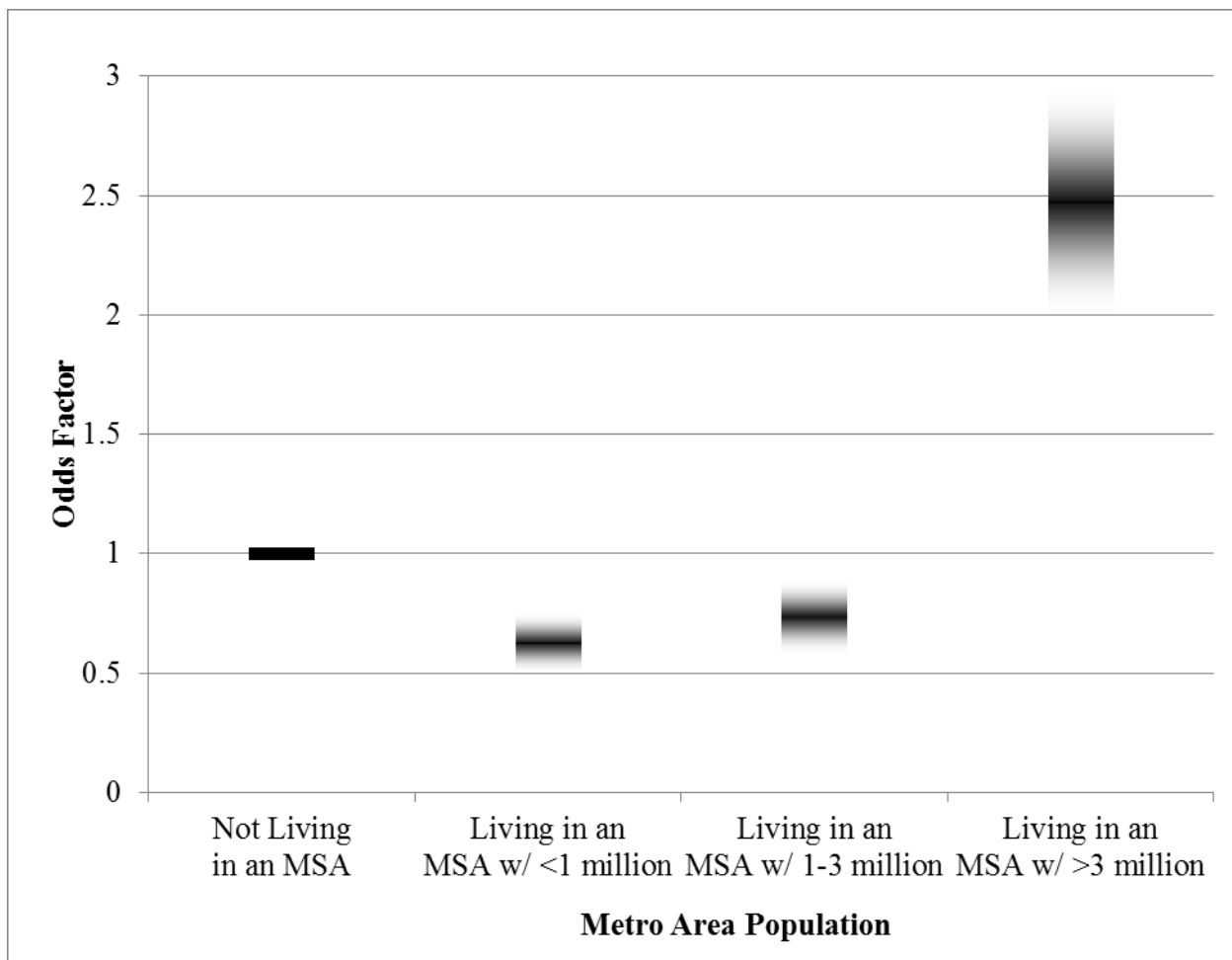
Figure 11 shows that, all other modeled factors being equal, the predisposition to use alternative modes to work is slightly lower for being male than for being female.



**FIGURE 12 Alternative mode to work, by income, odds factor (vs. \$40-\$60k), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

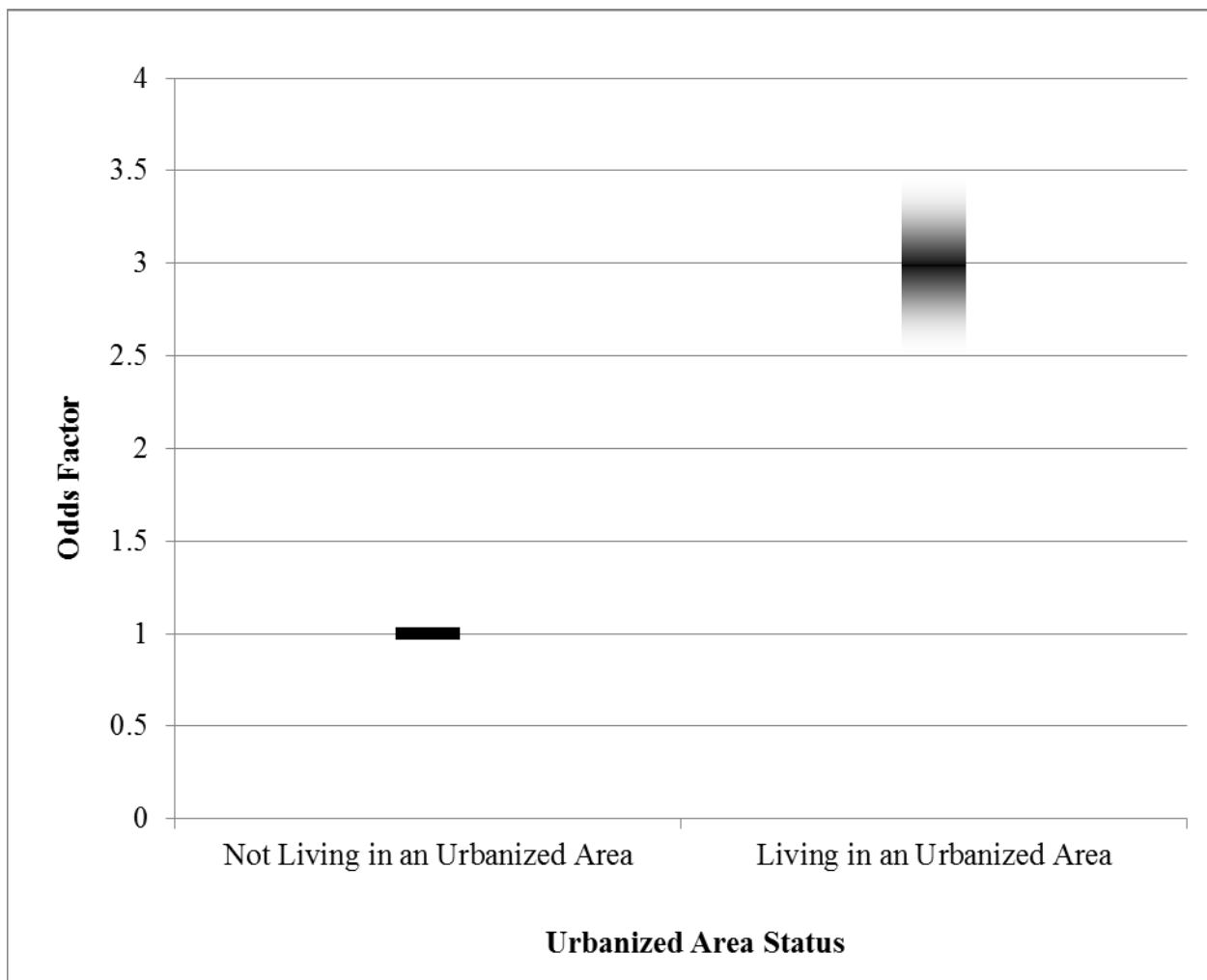
In Figure 12, it is evident that, all other modeled factors being equal, the predisposition to use alternative modes to work decreases as household income rises, particularly comparing living in a household in the lowest category to living in a household in the next category.



**FIGURE 13 Alt. mode to work, by MSA status, odds factor (vs. not in MSA), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

As shown in Figure 13, all other modeled factors being equal, the predisposition to use alternative modes to work increases as metro area population rises. This inclination is particularly high for living in MSAs with more than 3 million population.

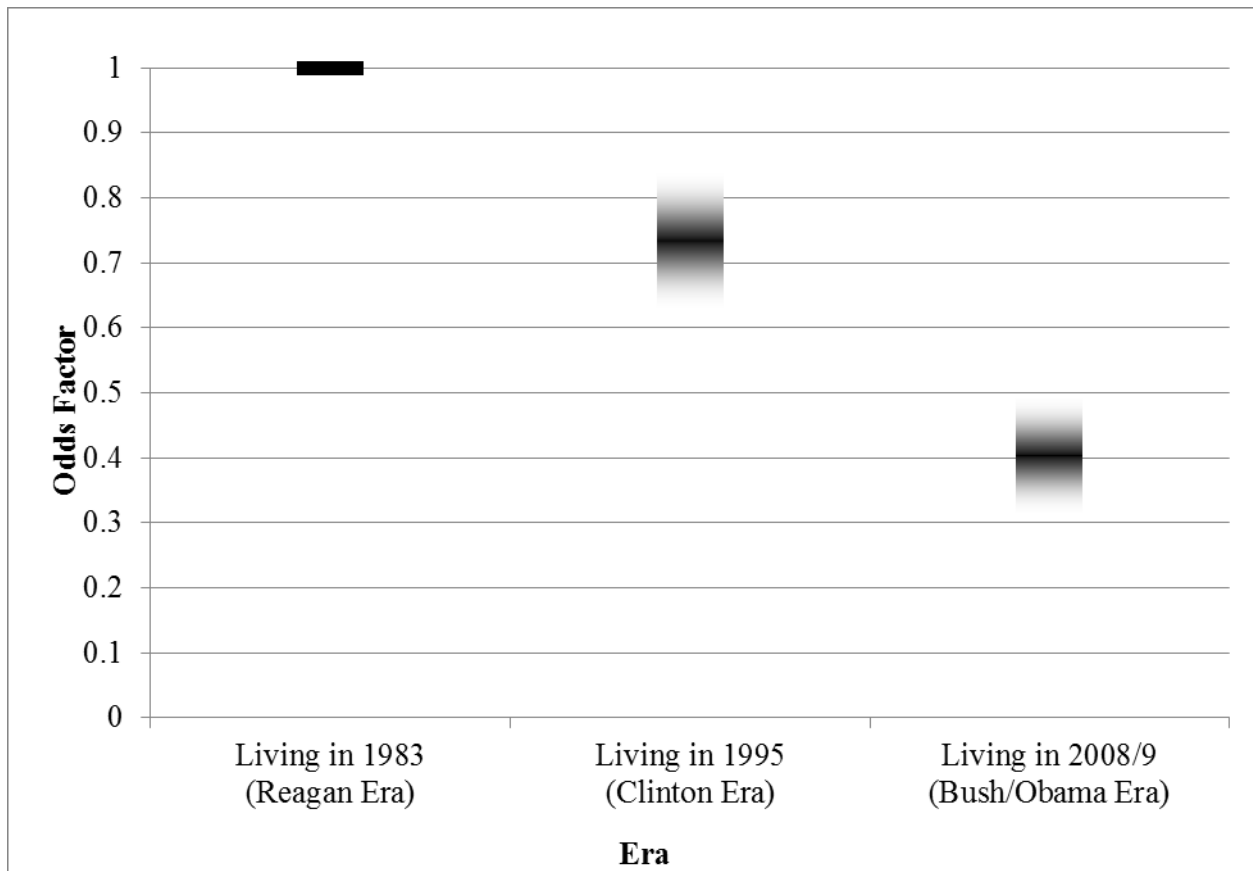


**FIGURE 14 Alternative mode to work, by Urbanized Area status, odds factor (vs. not living in Urbanized Area), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

As shown in Figure 14, all other modeled factors being equal, the predisposition to use alternative modes to work is higher for living in Urbanized Areas.



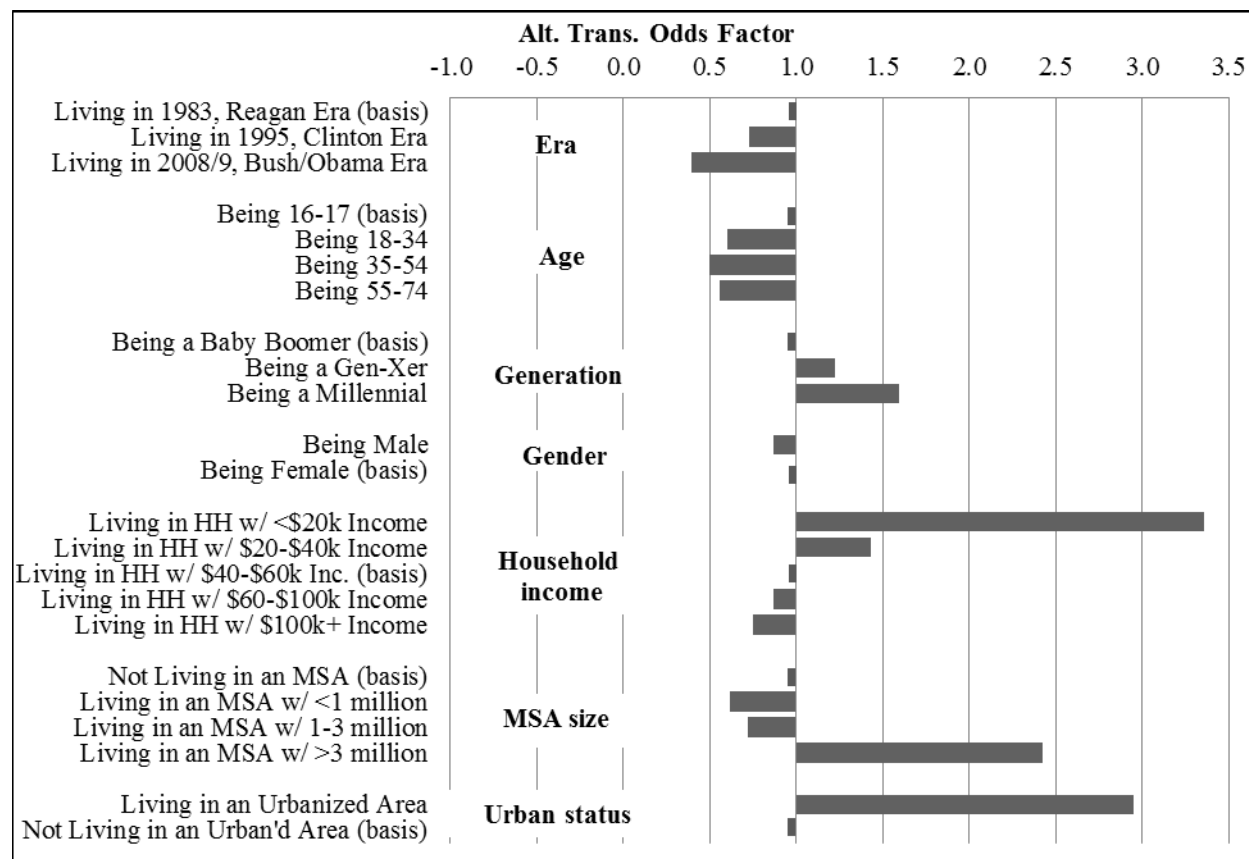


**FIGURE 15 Alternative mode to work, by era, odds factor (vs. living in Reagan Era), U.S., NHTS.**

Note: Bars represent 95% confidence interval. (results charts.xlsx)

As shown in Figure 15, all other modeled factors being equal, living in the Bush/Obama era is associated with a much lower predisposition to use alternative transportation to work than living in the Reagan era.

To enable cross-factor comparison, results for all seven (7) alt-trans-to-work factors are presented together in Figure 16 below.



**FIGURE 16 Alternative mode to work, odds factors, U.S., NHTS, using HRTPO model.**

Source: HRTPO staff (results charts.xlsx)

### Discussion of Regression Results

The results for each of the seven (7) factor groups are discussed below.

#### 1. Age

All of the *age* variables (except 75+) were significantly related to mode choice. With the youngest age group (16-17) as basis, the alt-trans-to-work odds factors of the other age groups (18-34, 35-54, and 55-74) all being roughly 0.55 indicates that, all other modeled factors being equal, 1) being 16-17 gives one a bent toward alternative transportation to work, and 2) excluding teenagers, the bent of American workers toward such modes surprisingly *does not vary with age*. The regression having controlled for income, the teenage bent toward alternative transportation to work cannot be explained by being unable to afford a car, but may perhaps be explained by lack of a driver's license.

## 2. Gender

All other modeled things being equal, the *gender* odds factors show that the predisposition to use alt-trans-to-work is slightly lower for being male (odds factor 0.9) than for being female.

## 3. Household Income

All of the *income* variables being significantly related to mode choice, the regression indicates that, all other modeled factors being equal, the bent toward alternative modes associated with living in a household drops with increasing household income. In particular, living in a household with the lowest income (<\$20k/year) is a factor with a large positive impact on using alternative transportation to work (alt-trans-to-work odds factor approx. 3.5 vs. middle income [\$40-60k]). This bent is likely explained by the longer travel times and greater exposure to the elements associated with alternative transportation, and the typical proximity of transit infrastructure to the residences of low-income households.

## 4. MSA Status

Not surprisingly, concerning *MSA status and size*, all other modeled factors being equal, living in MSAs with more than 3m population (alt-trans-to-work odds factor approx. 2.5 vs. not being in an MSA) is a factor with a large positive impact on using alternative modes to work. This can be explained by the higher densities and greater alternative mode infrastructure of large metros.

## 5. Urbanized Area Status

Similarly, all other modeled factors being equal, living in *Urbanized Areas* (alt-trans-to-work odds factor approx. 3.0 vs. not living in an Urbanized Area) is a factor with a large positive impact on using alternative modes to work. This too can be explained by higher densities and greater alternative mode infrastructure.

## 6. Generation

Figure 9 shows the regression results for the *generation* factor group. The model coefficients for the Lost Generation, the G.I. Generation, and the Silent Generation being statistically insignificant, odds factor estimates for those generations are not shown on the figure.

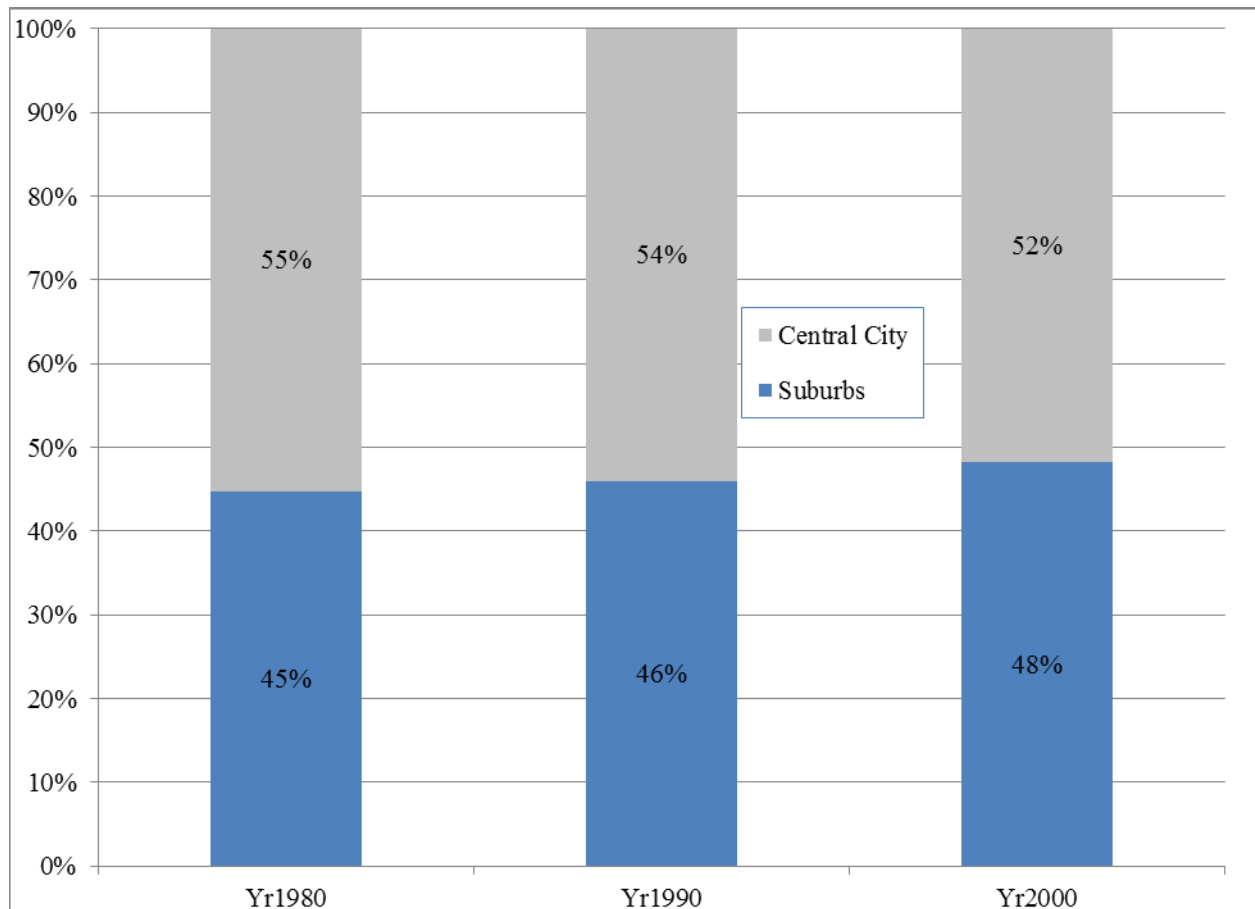
The regression shows that, all other modeled factors being equal, being a member of the Millennial generation (and, to a lesser extent, Generation X) *is a factor with a positive impact on using alternative transportation to work* (vs. Baby Boomers: Gen X alt-trans-to-work odds factor 1.2, Millennial alt-trans-to-work odds factor 1.6).

## 7. Era

Figure 15 shows that, all other modeled factors being equal, living in 2008/9 (and, to a lesser extent, living in 1995) is a factor with a *negative* impact on using alternative transportation to work (vs. 1983: 2008/9 odds factor 0.4, 1995 odds factor 0.7).

This era trend not being explained by age, income, generation, or location—all of which were controlled for—theories explaining why living in the present (as compared to living in 1983 and living in 1995) is negatively associated with using alternative transportation to work are presented below.

Our first theory explaining the era effect is that the “suburbanization of work” over that time period has made jobs harder to reach by bicycling, walking, and riding transit. This theory is based on the accommodations for bicycling (e.g. slower speed limits), walking (e.g. sidewalks), and transit (e.g. bus service hours) being typically more scarce in suburbs than central cities. As shown on Figure 17, over recent years the suburbs contain a higher and higher portion of jobs.

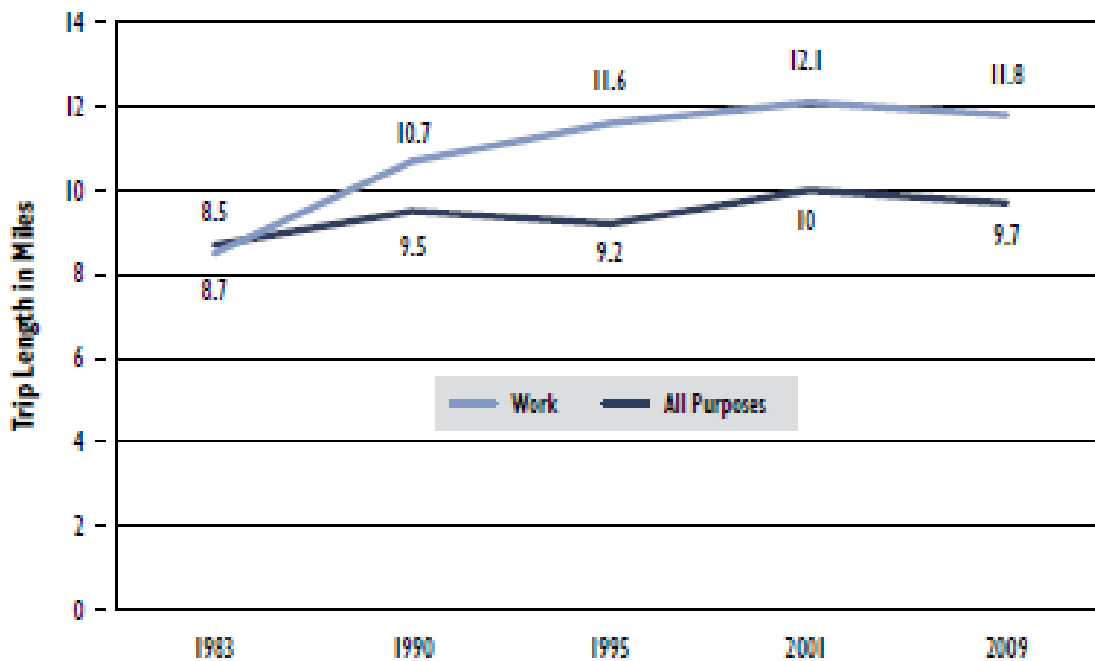


**FIGURE 17 Suburbanization of work in U.S., portion of workers.**

Source: HRTPO analysis of census data, SOCDS (23) (employment by area 1980-2000.xlsx)

Our second theory explaining the era effect, perhaps related to the above suburbanization-of-work theory, is the increase in work trip length over that time, longer trips favoring the more-

rapid automobile mode. According to *Commuting in America 2013* (20), work trip lengths increased almost 40% over the subject time period (8.5 miles in 1983, 11.8 miles in 2009).

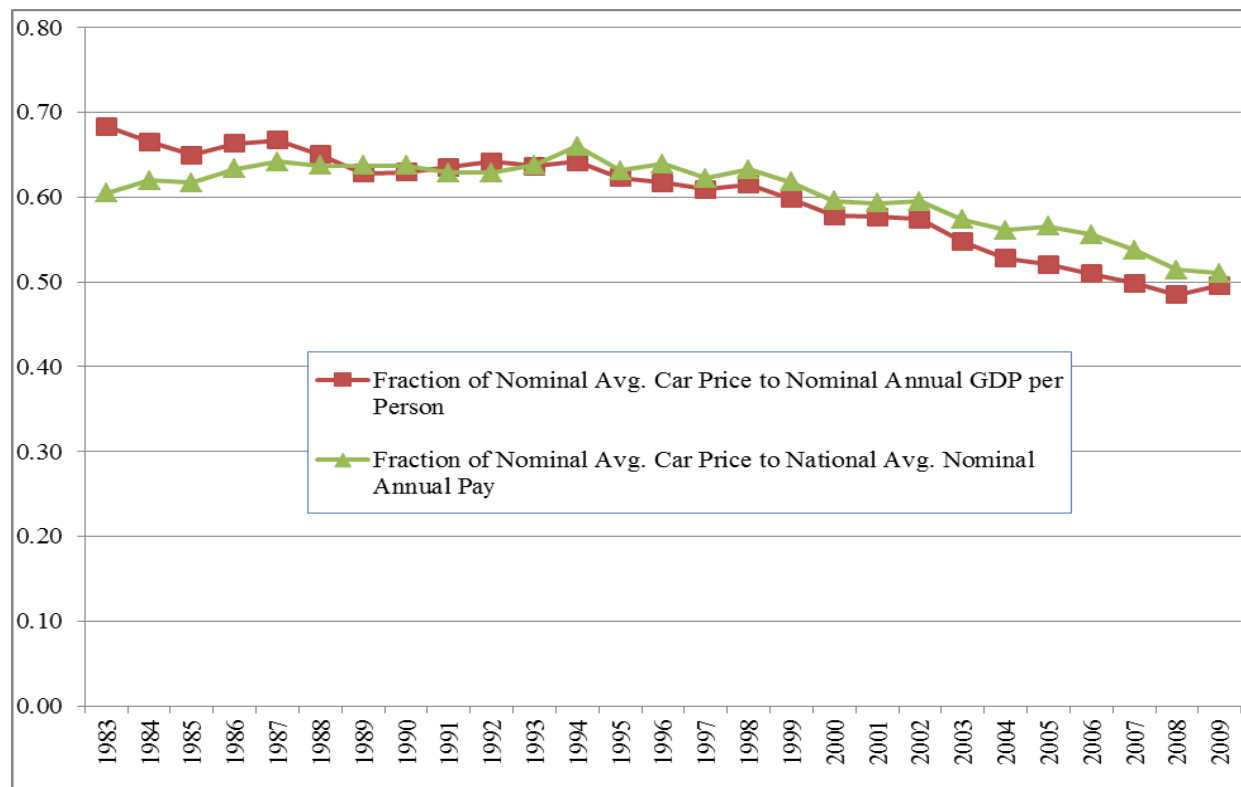


**FIGURE 18 Trip length trend in U.S.**

Source: *Commuting in America 2013*, p. 4 (20)

Our third theory explaining the era effect is a possible increase in the stigma of alternative transportation. Over the study period (NHTS survey years 1983 thru 2008/9), the prevalence of zero-vehicle households declined from 13% (1980 Census) to 9% (2010 Census) (30). Considering this decline in “carless-ness”, it is possible that the socio-economic stigma of alternative travel has increased as carless-ness has become more nonstandard. This hypothetical stigma trend would explain why the regression shows that a given person in 2009—say a 35-year-old male living in a household with \$30k/year income (in 2009\$’s)—was less likely to use alternative transportation to work than a similar person in 1983—also living in a household with income of \$30k/year (in 2009\$’s).

Our fourth theory explaining the era trend away from alternative transportation to work is the increasing affordability of automobiles. As shown in Figure 19, autos become more affordable over the study period, 1983-2009.

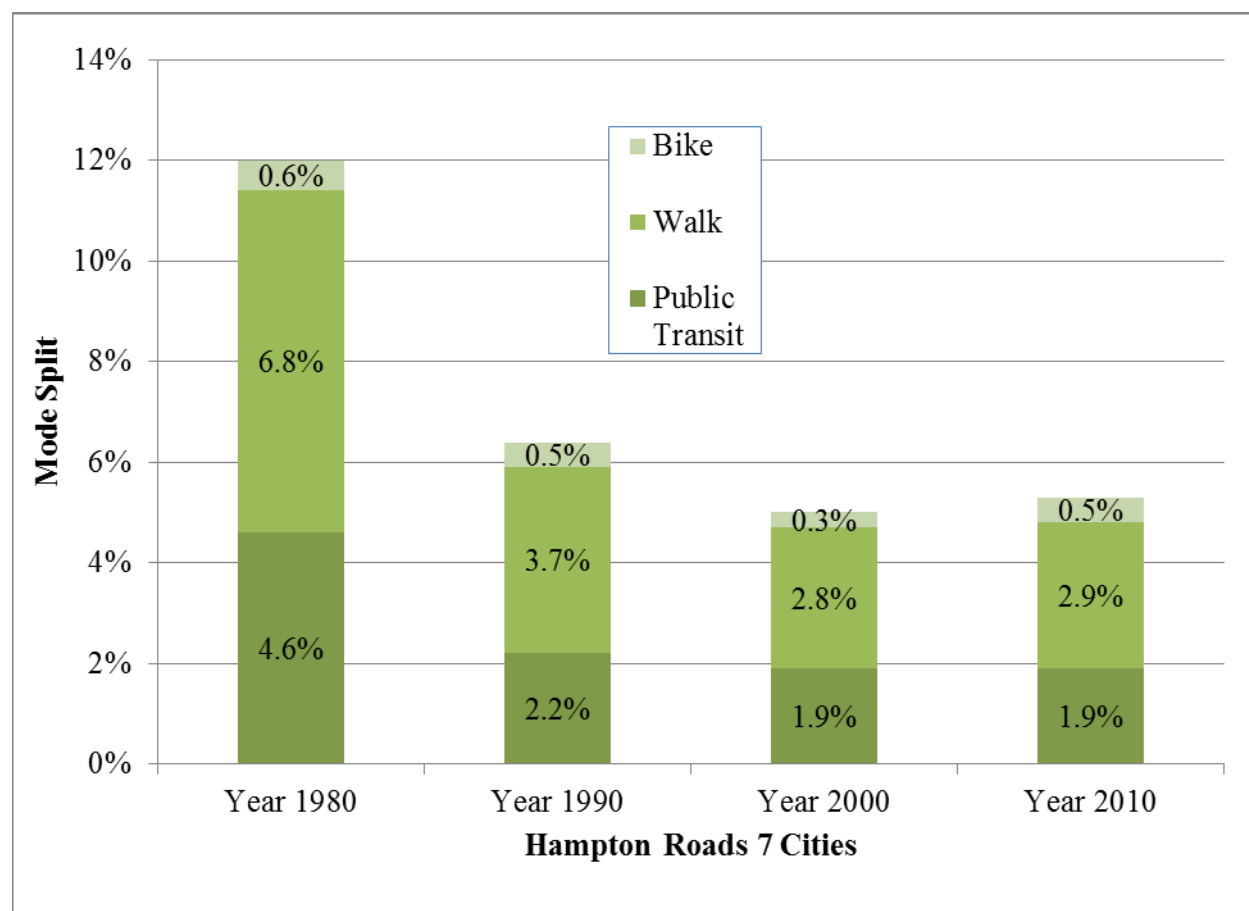


**FIGURE 19 Auto cost in U.S.**

Source: HRTPO Staff analysis of data by ORNL (24), World Bank (25), BEA (26), and BLS (27) (all car data 1980-2010.xlsx)

Each of these four theories—1) suburbanization of work, 2) lengthening work trip distances, 3) growing stigma, and 4) increasing auto affordability—being logically sound and supported by data, it appears that the observed era effect results—at least in part—from some combination of these four factors.

## FORECAST OF USAGE OF ALTERNATIVE TRANSPORTATION TO WORK IN HAMPTON ROADS IN THE FUTURE



**FIGURE 20 Usage of alternative modes to work, Hampton Roads.**

Sources: HRTPO processing of US Census data (31) (HR Census 1980-2010.xlsx)

As shown in Figure 20, usage of alternative transportation to work declined significantly from 12% in 1980 to 5% in 2000, followed by an increase of 0.3% to 5.3% in 2010.

In order to see how usage of alternative transportation for commuting *might* change in the future in Hampton Roads, HRTPO staff ran two scenarios, using the model described above, for all 2,656 Hampton Roads workers from the 2008/9 NHTS survey. The base scenario, “Actual Hampton Roads in 2008/9”, was run using the original data from the NHTS. The second scenario, “Hypothetical Hampton Roads in 2050”, was designed to reflect what Hampton Roads (HR) might look like in the future when Gen Xers have largely retired (the youngest Gen Xer will be 69 in 2050), and therefore Millennials and subsequent generations comprise the workforce.

The Base Scenario was designed as follows:

I. “Actual HR in 2008/9” Scenario: all original data, 2,656 HR workers as surveyed

using original surveyed data for all seven (7) factors:

1. Income
2. Age
3. Urbanized Area status
4. Gender
5. Era
6. MSA size
7. Generation (mostly Boomers, Xers, and Millennials)

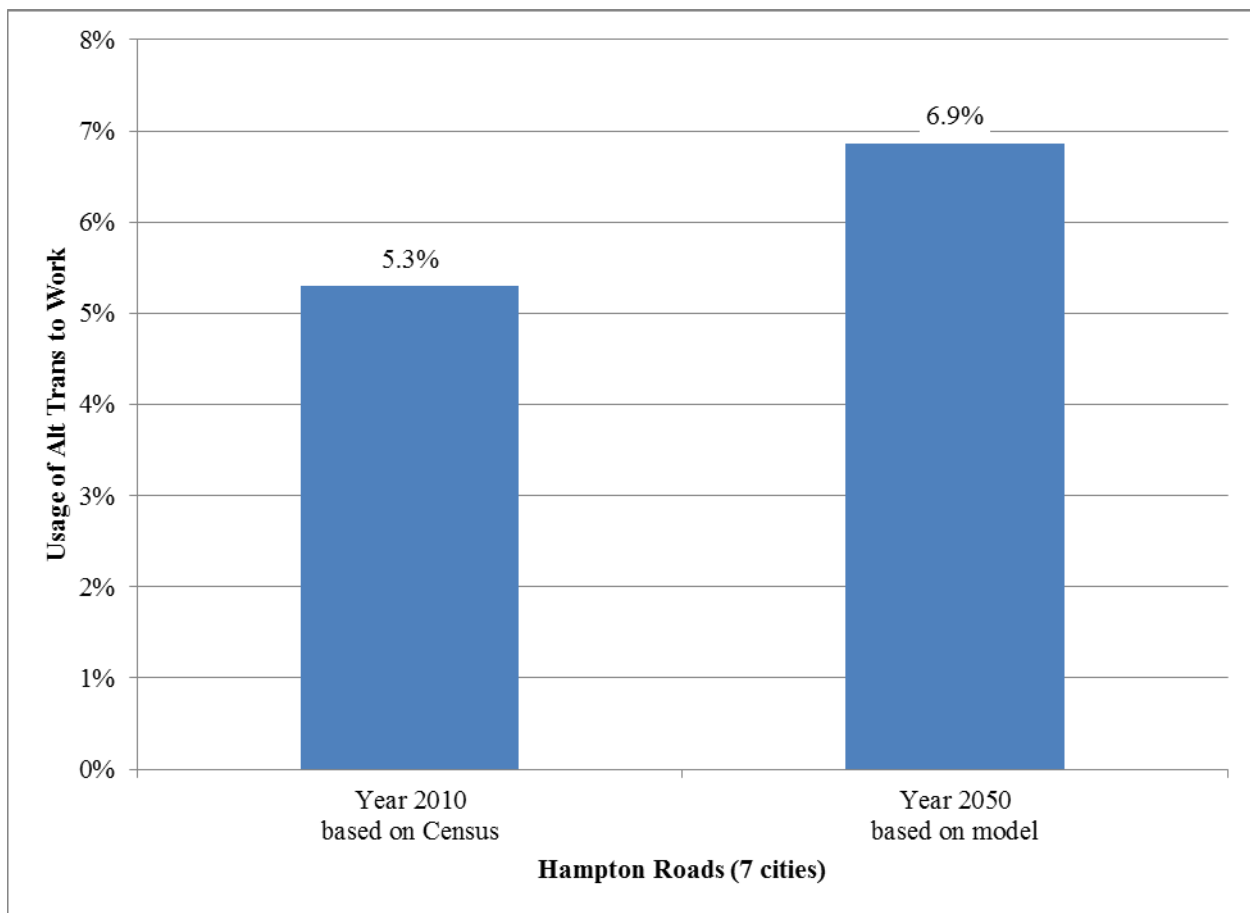
Concerning the Hypothetical Scenario, assuming that Millennials in 2050 retain the “Millennial” factor found above (1.6 odds factor vs. Baby Boomers), and assuming that subsequent generations have this same bent toward alt trans, HRTPO staff created the hypothetical scenario by giving each of the 2,656 HR workers the “Millennial” odds factor (1.6) of using alternative transportation to work. Concerning the other six factors—1. Income, 2. Age, 3. Gender, 4. Era, 5. MSA size, 6. Urbanized Area status—HRTPO staff assumed that HR workers in the future would have the same income, age, gender, etc. as HR workers did in 2008/9. Therefore, the Hypothetical Scenario was designed as follows:

II. “Hypothetical HR in 2050” Scenario: modified data for 2,656 HR workers

- |                          |  |
|--------------------------|--|
| 1. Income                | unchanged from 2008/9 scenario                     |
| 2. Age                   | unchanged  |
| 3. Urbanized Area status | unchanged  |
| 4. Gender                | unchanged  |
| 5. Era                   | unchanged  |
| 6. MSA size              | unchanged  |
| 7. Generation            | all persons given the Millennial odds factor (1.6) |

Comparing the results of the model runs for the above two scenarios indicated usage of alt trans 1.3 times higher in 2050 (with every person given the Millennial bent) than in 2008/9 (with each person having the bent of their generation). Therefore, *usage of alternative transportation being 5.3% today (as shown above), under the hypothetical scenario, usage of alternative transportation in Hampton Roads would be 1.3 times higher, or 6.9%, in 2050.*





**FIGURE 21 Actual and possible usage of alternative modes to work, Hampton Roads.**

Sources: HRTPO processing of US Census data (31) and HRTPO model (PER2PUB – HR only.xlsx)

## CONCLUSIONS AND APPLICATIONS

HRTPO staff conclude two things:

First, our regression revealed that usage of alternative transportation is a function of at least seven (7) factors:

1. Income
2. Age
3. Era
4. Generation
5. MSA size
6. Urbanized Area status
7. Gender

Therefore, **the HRTPO staff will consider all seven (7) of these factors when planning alternative transportation infrastructure for commuting.** For example, given that being 16-17 years old has a positive impact on usage of alt trans; HRTPO staff expect that bike, walk, and transit facilities placed near high schools would be used frequently.

Second, our regression revealed that being a part of the Millennial generation—“generation” being one of the seven (7) factors—is a positive factor concerning usage of alternative transportation. Along this line, if all future workers have the Millennial factor, and all other modeled things were the same as today (income, age, etc.), HRTPO staff would expect **usage of alternative transportation for commuting in Hampton Roads to increase from 5.3% (2010) to 6.9% (2050).**

## **PUBLIC INVOLVEMENT**

On July 1, HRTPO staff presented the draft version of this study to the HRTPO Board's Transportation Technical Advisory Committee (TTAC) and posted the draft to the HRTPO website for 45 days of public review. On July 30, 2015, HRTPO staff sent an email blast to our public mailing list, inviting review and comment on the draft. On August 3, 2015, the *Virginian-Pilot* published an article on the draft study. Over the 45 day period, we received comments from approximately a dozen citizens, and revised the report accordingly. See Appendix for public comments and HRTPO staff response including mention of report revisions.

## **NEXT STEPS**

Given the explanatory power of the model produced from this original analysis of the usage of alternative modes, HRTPO staff intend to examine *individually* each of the three components of alternative transportation—transit, walk, and bike—to see how the seven (7) factors (generation, age, era, income, gender, and area type) are related to each individual mode, enabling the HRTPO to apply these relationships to transportation planning and programming in Hampton Roads.

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## APPENDIX: PUBLIC COMMENTS AND HRTPO STAFF RESPONSES

On 7/30/15, 11:09 AM, perreault3 wrote:

>Given results, inclusion of a light rail tube in Patriot's Crossing  
>should be HRPDC's top priority.  
>Mark

Friday 8/14/15 1:55 PM

Dear Mark,

Thank you for your Patriots Crossing comment in response to the draft HRTPO study "Mode Choices of Millennials: How Different? How Enduring?"

HRTPO is currently waiting on an HRTAC financial study before finalizing its 2040 Long Range Transportation Plan (LRTP).

And VDOT is currently re-evaluating alternative designs for crossing Hampton Roads. See

[http://hamptonroadscrossingstudy.org/learn\\_more/default.asp](http://hamptonroadscrossingstudy.org/learn_more/default.asp)

Rob



Robert B. Case, PE, PTOE, PhD

Principal Transportation Engineer

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From: ijustwantedtoknow

Date: Thursday, July 30, 2015 at 2:16 PM

To: HRTPONEWS <[hrtponews@hrtpo.org](mailto:hrtponews@hrtpo.org)>

Subject: RE: CHECK OUT HRTPO'S NEW STUDY ON MILLIENIALS !

this is in response to the email you sent me

.interesting read--but I've also read other's saying something different giving convincing evidence

1] notice that people are moving outside of the cities whenever they can, money allowing--jobs allowing thus the sprawl of housing in every building site made available, even some that shouldn't be built on at all. I am not questioning the use of alternate means of transportation growth, pure ecominomics make driving in the cities outrageously expensive, with the problems of parking alone----imagine 13 million people in NEW YORK CITY all with cars trying to get anywhere

2]--the cost of driving--price of cars-gas, taxes,maintain, traffic congestion all are factors that make people do things, they do. some people like the 1 family home with a swiing pool in the back yard, and would love to ride their bikes to work IF THEY COULD--IF THEIR JOBS WERE CLOSE ENOUGH TO WHERE THEY LIVE, --if they could afford to live near where they worked? all factors--all reasons for people to live where they do,--

what makes a city grow?--jobs--services--entertainment--the more there is, more people are drawn to them--TO A POINT POINT BEING THE AMOUNT OF PEOPLE FROM CITIES THAT MOVED INTO OUR LOCATION--to get away from big cities some with the desires of using their bikes to go places, but the location of their jobs prevent it.

but is ridership on busses up compared to the population increase, around here? even that light rail, with thousand of people that could ride it for no cost out of their pockets, chose not to. is it the plan in the future to build tracks all over the tidewater region, going to the places you want people to go to? to make this entire region, one great big city forcing everyone to get out of cars?--taking a hundred years but who know what this place will look like in a hundred years?--underwater?-- wasting billions of dollars with years of congestion due to construction of thaoe rail lines like the ones just dug out in NORFOLK

3]--what are the plans of those jobs needed to --keep our youth here, draw more people into our area?-- the service industry?--with minimum wages?--lawyers, doctors, hospital, teachers, police, firemen, garbage collection road workers to maintain our existing roads?--clerks working on offices, working in tall buildings, destroying the reason so many people came here in the first place isn't the average wage in our region falling?--due to the lack of jobs?-- with companies not wanting to come here because of the traffic problems we now have?

roads that no one wanted to build?--but now needed by our ports, that some fear will be sold to some foreign investors, with the taxpayers still stuck with the tolls and taxes to build all of those roads needed? profits for those foreign investors coming out of the economy of our region, money the state charges those companies coming from the same sources?

cities are growing with lower paid people, looking for the services offered, paid for by those hat have what was deceit wages now stagnate,--but fees and taxes eating our their wages

like I said, an interesting read, but fortune telling should be left to other people, not the planners of any region, unless everything is taken into account I don't think this does that, not for this region A --CUL-DE-SAC, has it's drawbacks--but it's still a--CUL-DE-SAC-surrounded by water with limited abilities to expand or grow one thing we do know--the older 1 gets, the less they want to,or are able to drive-- the use of alterative means of transportation is both necessary, and even desired by many, restricted by people in power that have other reasons for the things they do it's frustrating to think that people in power will do as they please, and only history will prove them wrong, as usual

notice that all of the big cities all over this country has the same problems? the bigger the city becomes, the more crime, welfare, congestion, cost of housing, cost of taxes to pay for all of the services needed, transportation become a even bigger problem that roads will not fix?----yet our leaders still want to make cities even bigger? another draw back of big cities is the loss of the people's choice, their vote is deluted to a point that special interest groups can and do things people that can't be bothered to vote, can't control, or want but that is another story

.

Tuesday 8/11/15 5:28 PM

Dear Frank,

Thank you for taking the time to respond to our email about the draft study "Mode Choices of Millennials: How Different? How Enduring?" If you have any specific questions about the report, please feel free to contact us again.

Rob

Dear Frank,  
Find my responses below at >  
Rob

---

Sent: Wednesday, August 12, 2015 1:21 AM  
To: Rob Case  
Subject: RE: Millennials and Alternative Transportation

specific question?--how does it apply to us living in this area with the jobs present?  
do you think they will stay in this area, unless we can generate the type of jobs they want?

> I agree with you that jobs are a large determinant of people's living location choice, but it appears that there is some "chicken and egg": people locate where the jobs are, and businesses locate where workers are.

how long do you think it will take to build the type of transportation system you suggest, and, at what cost?  
reports are nice--reports relating to our Reagan is better, after all we are paying for them.

Thursday 8/13/15 1:55 PM

chicken & egg?  
businesses move to locations where taxes are agreeable, labor force is available,  
transportation is acceptable, taxes are acceptable, close to resources, & CLOSE TO CUSTOMERS .  
article--millennials and ALTERNATE transportation the name itself means no cars--even walking is an  
alternative means of transportation something that is not encouraged in the cities of Virginia--it's too  
dangerous to cross streets . don't bother answering me--we both know the reason for your report positive  
publicity for alternate transportation using millennials as an excuse no offense meant, it's your job

---

**Sent:** Monday, July 27, 2015 9:59 AM  
**To:** Rob Case  
**Subject:** Millennial report - coffee

Rob,  
Good morning! Trust you had a nice weekend. Was busy picking up kids from summer camp and lucky enough to grab some beach time yesterday.

Tracked you down looking for insight into the recent Millennial report. Have read through it a couple times and have some questions. Curious how the results are being communicated and received. Let me know if you're open to coffee and having someone pick your brain (your office our out). Would love a fuller understanding of the data.

Thanks for your consideration, Rob. Talk soon.

Will Christopher  
President  
[Hampton Roads Public Transportation Alliance](#)  
*Because Mobility Matters*



From: Mike Myer, PhD

**Sent:** Wednesday, August 05, 2015 11:29 AM

**To:** Rob Case

**Subject:** Re: Our recent Millennial analysis

Rob, I think this is a very good analysis, and I agree I haven't seen one that controls for age and era.....very interesting. I have been looking at the millennials because I am in the process of updating the ITE Transportation Planning Handbook and I wanted to include the latest perspectives on future population characteristics. A lot of MPOs have looked at the millennials, but yours is certainly one of the more comprehensive.

Mike

**Sent:** Wednesday, August 05, 2015 4:09 PM

**To:** Rob Case

**Subject:** HRTPO'S NEW STUDY ON MILLIENNIALS

Hi Robert:

Katie Turnbull sent the report my way and I really enjoyed thinking about what you did. I found your study and the methods used to analyze the research questions very interesting and refreshing. Trying to find a way to parse out period, age, and cohort effects requires a lot of creativity. Typically, one would need some sort of panel sample to be able to examine the changing behaviors of the same cohort as they age and go through different "periods." In your study we are looking at a series of cross-sectional samples in different periods. Regardless, I thought your approach was novel in answering your two research questions was novel and really made me think.

Regards,  
Johanna

Johanna Zmud  
Director, Washington DC Office  
Senior Research Scientist  
Texas A&M Transportation Institute

Sent: Fri 7/31/2015 11:43 AM  
To: Rob Case

---

Hello and good morning to you!

My name is Ms. Tanterrian Taylor and I will like to say is that. Please don't forget about people in the wheelchairs. Not just people who ride a bike, walk or use the bus or train. For those of us in a wheelchair and power wheelchair are always left out! Thank you for your time.

Signed,

Ms. Tanterrian Taylor

Date: Friday, July 31, 2015 at 12:02 PM  
To: HRTPO NEWS <[hrtponews@hrtpo.org](mailto:hrtponews@hrtpo.org)>  
Subject: Re: CHECK OUT HRTPO'S NEW STUDY ON MILLIENNIALS !

Good morning! It would be helpful if you include " Wheelchairs/Power Wheelchairs in e-mails or letters to the public.

Signed,

Ms. Tanterrian Taylor

Thursday 8/6/15 10:43 AM

Dear Ms. Taylor,

The TPO staff who coauthored the Draft Millennial Report asked me to convey their thanks to you regarding your suggestion that wheelchairs be considered alternative transportation. They check the surveys upon which the Millennial Report is based, and found that two of them did not include "wheelchair" as an option.

However they did ask me to let you know that one of the surveys did in fact include "special/disabilities" as an option.

The TPO echoes staff's sentiment and thanks you for your comments and for taking the time to help refine our planning process.

Best Regards,  
Kendall

---

**Sent:** Thursday, August 06, 2015 5:06 PM  
**To:** Kendall Miller  
**Subject:** Re: Your comment on the Draft Millennial Report

Hello Mrs. Kendall Miller,

The word "Special Disability" can mean anything! Indicate what type of disability he is talking about. In other words "Please" spell out the word Power Wheelchairs! So that activist/advocate like myself will know what he is trying to say.

Signed,

Ms. Tanterrian Taylor

Friday 8/7/15 11:21AM

Ms. Taylor,

Thank you again for your responses to our study.

We based the study on National Household Travel Surveys (NHTS) conducted by the US Dept. of Transportation, and were limited therefore by the travel modes that they used in those surveys (see those modes below from page 15 of our study):

**TABLE 3 Mode to Work Variables in the Three Datasets**

1983		1995		2008/2009	
Alternative	Conventional	Alternative	Conventional	Alternative	Conventional
Bus	Auto	Bus	Automobile	Local public bus	Car
Train	Station wagon	Amtrak	Van	Commuter bus	Van
Streetcar	Pass. van	Commuter train	Sport utility vehicle	City to city bus	SUV
Elevated rail/subway	Other van	Streetcar/trolley	Pickup truck	Shuttle bus	Pickup truck
Bicycle	Pickup truck	Subway/elevated rail	Other truck	Amtrak/intercity train	Other truck
Walk	Pickup with camper	Bicycle	RV	Commuter train	RV
	Other truck	Walk	Motorcycle	Subway/elevated train	Motorcycle
	Motorized camper coach	Other public transit	Other private vehicle	Street car/trolley	Light electric veh (golf cart)
	Motorcycle		Plane	Ferry	School bus
	Motorized bicycle/moped		Taxi	Bicycle	Charter/tour bus
	Work at home		School bus	Walk	Taxi
	Other (POV)		Other	Special transit-people w/disabilities	Plane
	Plane				Other
	Taxi				
	School bus				
	Other				

Source: HRTPO staff analysis of NHTS data

Having participated in Washington in discussions about the next NHTS survey (e.g. adding ride sharing services like Uber to the list of possible modes), if I get another chance to do so when I return to DC in January, I will mention the desirability of adding "wheelchairs" as an option.

Thanks again for your responses.

Rob

From: Wampler, Jennifer (DCR) [mailto:jennifer.wampler@dcrr.virginia.gov]

Sent: Friday, August 07, 2015 10:16 AM

To: Rob Case

Subject: comments on study

This study does not examine millennial travel behavior within the context of the built environment. There is a huge difference among jurisdictions in Hampton Roads in terms of how safe it is to bike or walk. The built environment will influence future behavior, so I think this should be factored into your analysis.

Jennifer Wampler, Trails Coordinator  
Division of Planning and Recreation Resources| Department of Conservation and Recreation  
600 East Main St., 24th floor Richmond, Va. 23219

From: Rob Case  
To: 'Wampler, Jennifer (DCR)'  
Cc: Seth Schipinski; Kendall Miller; Camelia Ravanbakht; Robert A. Crum, Jr.  
Subject: RE: comments on study

Sent: Fri 8/7/2015 11:07 AM

Message Signature Paths- FY2016 HRTPO UPWP.pdf (38 KB)

Jennifer,  
Thank you for reviewing the report and for emailing.

As I said in the phone message I just left you, I agree with you on the importance of the built environment. The best way we could capture the effect of the built environment, given the 1983, 1995, and 2008/9 NHTS datasets that we used, was to incorporate "MSA status/size" and "Urbanized Area status" as independent variables. As shown on pages 25 and 26 of the draft, both did a good job of explaining usage of alt trans (as one would expect given the infrastructure and proximity associated with mega metros (>3million) and Urbanized Areas (in all places).

Given your position in Richmond, as I mentioned on the phone, I like to "pick your brain" about our current project "Costs and Benefits of Signature Paths" (see attached).  
Rob



Robert B. Case, PE, PTOE, PhD  
Principal Transportation Engineer  
Hampton Roads Transportation Planning Organization  
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**From:** Bryan Hakey [[mailto:](#) ]  
**Sent:** Thursday, July 30, 2015 1:48 PM  
**To:** Rob Case  
**Subject:** Comment on: Mode Choices of Millennials

Thank you for your work on this study. As a millennial I feel as though it gives a much clearer picture of what I observe in my peers.

On page 25 the text below figure 13 reads:

"As shown in Figure 13, all other things being equal, the predisposition to use alternative modes increases as metro area population rises. This inclination is particularly high for MSAs with more than 3 million population."

However, the graph shows that Metropolitan Statistical Areas (MSAs) with a population under three million (such as Hampton Roads) are really less likely to use alternative modes when compared to areas outside of MSAs. Alternative modes of transit seem to only catch on in cities above three million.

So to say "alternative modes increases as metro area population rises" is miss leading because one is more likely to use alternative modes in a lower density non-MSA area then in one that is less then three million (such as Hampton Roads).

Or am I reading something wrong?

Thank you for your time,  
Bryan Hakey.

8/13/15 4:33 PM

Good Afternoon Mr. Hakey,

Thank you for taking the time to respond to the draft study "Mode Choices of Millennials: How Different? How Enduring?"

Although—as you stated—it is true that living outside of MSAs gives one slightly higher odds of using alternative modes than living in MSAs of less than 3 million, the statement in the study you refer to ("the predisposition to use alternative modes increases as metro area population rises") is still correct because it applies only to commuters who are actually living in metro areas (MSAs), not to those living outside metro areas.

Concerning your observation that "Alternative modes of transit seem to only catch on in cities above three million", living in MSAs with more than 3 million population appears to be an important factor. It is also true, however, that MSA status is only one of the seven factors we found to be related to such usage (MSA status, Urbanized Area status, income, age, gender, generation, and era).

If you have further questions about the study, please feel free to contact us again.

Rob

**Sent:** Tuesday, July 21, 2015 2:32 PM  
**To:** Rob Case  
**Cc:** Seth Schipinski  
**Subject:** Study and projections of millenials' behavior

Dr. Case and Mr. Schipinski --  
I attended your Power Point presentation to TTAC on July 1 and, as a social scientist, I found your methodology and conclusions quite fascinating!

Now I've begun studying the full report, and I have some questions:

**1. What behaviors are you actually examining?**

On pages 5-8, for example, I find various terms --

"overall annual VMT"

"to get to work"

"commuting"

"to get around"

"young workers"

"trips per capita"

**2. What does "work" include?**

Both full-time and part-time jobs?

What about commuting to high school or college classes? Is school included in "work"?

Are trips by school bus included in "commutes"? As "public transit"?

Judith E. Brown, PhD

Cc: Seth Schipinski <[sschipinski@hrtpo.org](mailto:sschipinski@hrtpo.org)>; Camelia Ravanbakht <[cravanbakht@hrtpo.org](mailto:cravanbakht@hrtpo.org)>; Kendall Miller <[kmiller@hrtpo.org](mailto:kmiller@hrtpo.org)>  
**Sent:** Wednesday, July 22, 2015 10:05 AM  
**Subject:** RE: Study and projections of millennials' behavior

Ms. Brown,  
Thank you for the attention you're giving the report.  
Concerning the questions in your email (at bottom):

1. What behaviors are you actually examining?

Our model (the development of which starts on page 14) uses NHTS (National Household Travel Survey) data to explain "usage of alternative transportation (bike, walk, transit) for work".

2. What does "work" include?

In its 2008/9 survey, the NHTS used the following questions to determine mode of travel to work:

"{Do you/Does SUBJECT} work..." "[DO NOT INCLUDE VOLUNTEER WORK.]"  
"How did {you/SUBJECT} usually get to work last week?"

We based our model on the NHTS (1983, 1995, 2008/9).

Rob

**Sent:** Friday, July 24, 2015 3:20 PM  
**To:** Rob Case  
**Cc:** Seth Schipinski; Camelia Ravanbakht; Kendall Miller  
**Subject:** More comments on your study of millennials' behavior

Dr. Case,

Thanks for your replies. I've now gone deeper into the document, and I have several more comments and questions.

First, a disclaimer: I'm a member of the Silent Generation, born during WWII. And I'm a social anthropologist, so my statistical knowledge is very basic (I can't follow all your test results and statistical statements, but that's okay – many other readers can).

I can simply serve as a general reader to foresee possible questions (or misunderstandings) by regional politicians and others. See my comments in the attachment.

Best wishes – and have a good weekend!

Judith E. Brown, PhD

## RE: Study and projections of millennials' behavior

### Comments by Judith Brown, July 24, 2015

1. Right at the very beginning (p.3), we need a list of the generations and their birth dates.  
Silent generation Born 1925-1945  
Baby Boomers Born 1946-1964 etc.

Only then will your TABLE 1 make sense to a reader.

(If one of the studies you quote uses a slightly different definition, you can point that out in small print as you go along.)

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2. TABLE 1 – We need some help, in order to grasp its significance. For example:  
Column 2 title: Who were the Younger People (ages 18-34)?  
Column 3 title: Who were the Older People (ages 45 and over)?

In the Line "2045": Millennials (ages 45-63) (or would you rather put Gen X here?)

In the Line "2015": Millennials (ages 15-33) Baby Boomers (ages \_\_\_\_\_)

Finally, I don't know what you arrows and question marks mean.

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3. TABLE 2 (page 9)  
First paragraph: Better explain "appropriately skipped" (not working, not working full time??)

Total Household Income : Assume these five categories are approximately the standard quintiles of the Census Bureau, etc., in 2008? If so, 20% of a random sample is expected in each quintile. This HR sample is heavily skewed toward higher incomes. (Was the sample not random or is HR that much above the national averages?)

MSA Population: Why include this section at all? It tells us nothing.

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4. "Mode to Work": Term first used on Page 9 (I think), defined on P. 15 (your own classification). I'm sure this is a knotty problem, but you'll probably be hearing questions like these:  
-Why is motorcycle considered conventional? – at least it's not one person in a big car....  
-What about school buses – are they somehow different from regular buses?  
-Why is "work at home" asked only in 1983 – isn't it done a lot now?  
-Weren't streetcars, trolleys, golf carts, & charter buses taking people to work in 1983?  
-Why don't you list "light rail"?  
-Why is there no distinction between "car with driver only" and "car pool"?  
Etc.  
=====



5. Page 17 Data preparation, parag. 1, line 3 Can you say "randomly reduced"?  
Parag. 3, line 3 Better explain "alternative" and "conventional".  
Paragraph "Handling Missing Data" – "did not go to work"  
Note: Table 3, 1983 "conventional" lists "work at home"

=====

6. Tables 4 and 6 Column heading "Observation" seems awkward. Can you say "People" or "Number" ?  
All tables need footnote of source of the data, and that the sample is nationwide, not Hampton Roads. Remember – tables and graphs are likely to be used separately from the full written document.

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7. Page 19 , Section "Regression" line 1. Shouldn't this say, "dependent variable (mode to work)"

=====

8. Figures 9 – 15

Please consider putting the "1" line in the exact center of every graph. Also be sure the reference point on that line is to the left of the other data. The reader can then see much more clearly what each graph is showing.  
(When I watched your rapid PPT presentation, the reference point was jumping unmercifully all over the screen)  
*I suggest you try out these graphs on several of your non-statistician friends and co-workers. Explain them in layman's terms. Then let them talk and ask questions. See if they get the point.*

=====

9. \*\* Figure 16

I first asked myself, "Why was use of alternative modes so high in 1980?"  
Then I realized that maybe it wasn't. Maybe 1970 was even higher.  
Can't you give us that data?

=====

10. Finally – can you separate "car solo" from "car pool" in any of your data?  
Nowadays, I hear folks saying that the really meaningful distinction is between "one person in a car" and "anything else".

Sent: Mon 8/24/2015 12:28 PM  
To: 'Judith Brown'  
Cc: Seth Schipinski; Robert A. Crum, Jr.; Camelia Ravanbakht; Kendall Miller

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Dr. Brown,

Thank you for your comments. Find our responses below:

1. List of generations

We added birth years to the generations mentioned in the Executive Summary (Millennial, Boomer). When we introduce all generations, we provided a table showing birth years (Descriptive Statistics table, page 18 in first draft).

2. Era, Age, and Generation table

Based on your comments, we replaced the years (2045, 2015, 1985) with generic labels, and we removed arrows and question marks.

3. "Appropriately skipped", income, MSA population

"Appropriately skipped" means the mode-to-work question was skipped because the person surveyed was not a worker. Based on your comment, we have clarified this in the paper.

As for the income categories, the HR data is provided simply to compare Millennials to others. (The US data—Table 4 in the draft—was used to create the model. Although each category did not capture 20% of the US records, each category captured enough records for statistical significance.)

As for MSA size, this section was included in the table for consistency with the US data for the model (Table 4 in the draft).

4. Mode to Work

In response to your comment, we defined "mode to work" at its first appearance.

Concerning the mode options, we did not design the survey.

5. Data preparation- terminology

The random nature of the reduction is expressed at the end of the sentence.

Concerning "alternative vs. conventional", based on your comment we added a definition of "alternative" at its first use (in "Introduction") and a definition of "conventional" at its first use (in "Variables for Regression").

Concerning "work at home", it is not clear to us whether or not those who worked at home in 1995 and 2008/9 answered "Other".

6. Tables

Based on your comment, we added “(commuters)” to each occurrence of “observations”.

Based on your comments, the tables that did not previously contain footnotes have been corrected, and U.S. vs. Hampton Roads has been clarified.

7. “Regression”

Based on your comment, we have revised the wording (see “Regression Structure” in the final).

8. Figures 9-15 (original numbering)

Based on the need for comparison that you noted, in the final, after the individual charts, we included a chart with all factors.

Based on your comment, we put the basis variable (1.0 odds factor) on the left of each chart (except for income which has basis in the middle).

9. Figure 16 (original numbering)

Concerning the drop in usage from 1980 to-date, see our four theories in the final (under “Discussion of Results”, 7. Era).

Concerning 1970, the commuting questions were not added to the Census until 1980.

10. Carpooling

Unfortunately, the mode variable that we used (NHTS’ WRKTRANS) does not distinguish between car-solo and carpool.

Thank you for improving this report.

Rob (and Seth)



## HAMPTON ROADS TRANSIT

July 14, 2015

Dr. Robert Case  
Principal Transportation Engineer  
723 Woodlake Drive  
Chesapeake, VA 23320

Dear Dr. Case:

Thank you for providing the opportunity to provide comments on the draft *Mode Choices of Millennials* analysis. I would like to submit the following comments for your consideration:

- Per Capita VMT would be a more useful measure for determining the predilection of individuals to drive. Population gains cloud the assumptions that can be made by using Total VMT, as is done in your report (p. 5).
- Consider adding the recently published paper *Are Millennials Really the "Go-Nowhere" Generation?* by Noreen C. McDonald to your literature review.
- Why was \$40,000-\$59,999 chosen as the basis variable for the Total Household Income set (p. 19)? How did you choose the basis for each set? There appears to be no explanation of why the stated basis variables were chosen. It seems that for some variable sets you selected the category the average for that variable would fall into, while for other sets you selected the first/lowest category. Please explain the methodology of this process.
- In Figure 10 you exclude the 75+ age group because it does not meet the 95% statistical significance level. In Figure 12 the \$60,000-\$99,999 category is included; however, in Table 6 this category is only significant at the 0.10 level. If you intend to use a 95% statistical significance level, you should maintain that level of significance throughout the report.
- Why were the income/gender categories for Bill Boomer/Mark Millennial and Reba/Reagan/Olive Obama chosen? Why are they different? Considering that your conclusion appears to be based on the differences in odds between the two trends illustrated by these examples, it seems reasonable that you would want to keep as many factors the same as possible.
- It is disappointing that your conclusion reinforces a self-fulfilling prophecy of declining alternative transportation use. Correlation does not necessarily indicate causation; just because the data reflects that we have been trying to build our way out of congestion with roads designed only for cars does not mean that there is less *demand* for alternative modes of transportation. The data you have chosen to examine has nothing to do with actual demand; it merely reflects the choices people have made based on existing infrastructure. You cannot infer future demand based simply on existing supply.

I hope that these comments are constructive and I look forward to seeing the final report.

Sincerely,

Samantha Sink, AICP  
Transit Development Planner

Cc: Ray Amoroso, HRT – Chief Planning & Development Officer  
Julie Navarrete, HRT – Transit Development Officer

Document Control: PS-020 GS-19 10039

August 13, 2015

Ms. Samantha Sink  
Hampton Roads Transit  
509 E. 18th Street  
Norfolk, VA 23517

Dear Ms. Sink:

Thank you for taking the time to submit comments about the HRTPO study *Mode Choices of Millennials: How Different? How Enduring?* We have addressed your questions below.

Concerning VMT, we agree that per capita VMT is a valuable measure and have added it to the study (pp. 5 and 6, under "Mode Choice of the General Population"). Along this line, note also that Figure 4 contains data on per capita trips in the U.S.

Regarding the paper written by Noreen C. McDonald; thank you for directing us to this study. Since the July draft, our team has reviewed it and we plan to incorporate its contents.

In reference to our methodology for selecting basis variables, in order to determine the effect of each variable on mode choice, there must be one basis variable per category to which the others are compared. It is not important which variable is used as the basis, as long as it meets the significance threshold. For example, we reported that commuters with total household incomes of less than \$20K were 3.4 times as likely as those in the \$40K-\$60K category to use alternative modes. Had we used the <\$20K variable as the basis, this ratio of 3.4:1 would have been inverted to 1:3.4, and we would have concluded that those in the \$40K-\$60K category were "0.3 times as likely" as those in the <\$20K category to use alternative modes.

When it comes to levels of significance, all of our charted results (Figures 9-15) include variables significant at least at the 0.10 level. The 75+ age group was not significant at that level.

Concerning the example commuters, they were selected to represent the effects of generation and era on mode choice. The two men were devised to isolate the impact of generation; therefore, all of their characteristics beside generation were made identical. Likewise, the two women were devised to isolate the impact of era; therefore, all of their characteristics beside era were kept identical.

Finally, regarding the data used in the study, since it is based on previous events, we agree that the data itself cannot reveal future demand. We used the data to examine future demand based on the era and generational trends.

Thank you again for taking the time to provide comments on the study.

Sincerely,



Robert B. Case, PhD

SS/kg



On 7/30/15, 11:09 AM, "Pennant, Christopher V"

>Kendall,

>

>When HRPTO do these surveys do they include Vanpool and car sharing as

>options to explore?

>

>Sent from my mobile device.

>

>

>Sincerely,

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>

>

>

>Enterprise Holdings

>

>Christopher V Pennant

>

>Sr. Business Rental Sales Executive

>

Sent: Mon 8/24/2015 3:30 PM

Cc: Seth Schipinski; Kendall Miller

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Dear Mr. Pennant,

Thank you for your question regarding the draft study "Mode Choices of Millennials: How Different? How Enduring?" HRTPO staff used previously collected survey data from the National Household Travel Survey (NHTS). Although the NHTS did not specifically include "vanpool" or "car-sharing" as an option in their past surveys, I understand that they will include car-sharing as an option in the next NHTS survey.

Rob