

Peak Travel in America – Where are We Going?

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Abstract

Understanding peak period travel is vital for finance initiatives, congestion mitigation, and air quality policies among other important policy and planning initiatives. Historic trends show that non-work travel is growing faster than commuting, even beyond the growth in trip-chaining (stopping for incidental purposes) during the commute. The amount and effect of non-work travel on peak period is poorly understood

The goal of this research is to apply consistent definitions across all weekday vehicle travel to estimate the base-level of peak travel that is mandatory. We utilize the National Household Travel Survey (NHTS) data series, and especially the 2001 chained trip files (the most recent available) to categorize peak weekday vehicle travel into mandatory travel; including work and school trips with typically more rigid schedules and fixed destinations; and flexible travel; such as getting a meal and going to the gym that may be less rigid in time or destination choice. The concept of a work tour is used to include incidental non-work stops into the commute and therefore the ‘mandatory’ category. The trips classified as ‘flexible’ are trips wholly separate from the commute tour.

This research concludes that using very stringent definitions of mandatory travel (for instance, not including trips for medical purposes) nearly 75 percent of am peak vehicle trips are for ‘mandatory’ purposes while only 34 percent of pm peak vehicle trips are ‘mandatory’.

Importantly, we find that the mean income of peak travelers is slightly lower than the average for all travelers. Workers with the least flexible schedules, such as people in sales and service occupations, are more likely to be commuting during the peak. Part-time workers and workers in households with children are more likely to make ‘flexible’ trips during peak, and 38 percent of workers making flexible trips during peak go to work at another time on the travel day.

Forecasts of peak period vehicle trips are made for selected age groups. This research shows that drivers 65 years and older will be a larger share of peak travel in coming decades. Although this forecast is simply based on Census population forecasts and current travel, this exercise allows us to see the effect of growth and change in population groups and the potential impact on travel demand holding all other factors, such as trends in flexible work places, constant.

Introduction

Understanding peak period vehicle travel is vital for finance, congestion, and air quality policies. Commuting for work is well-documented and Census journey-to-work data as well as copious research on trip-chaining can illuminate peak period work trips (Pisarski, 2006, McGuckin, et. al. 2005).

However, what motivates people to travel for non-work purposes during peak periods is poorly understood. The impact of the growth of non-work travel on the peak period was identified more than 20 years ago, and the phenomenon continues to grow (Gordon, et. al. 1988). The purpose of this research is to untangle some of the complexity of the mix of purposes during peak periods, and to understand the characteristics of peak travelers.

For example, it is often assumed that work travel in the peak period is mandatory and all other purposes discretionary. However, some commuters may have flexibility in work arrival times while other travelers may consider their non-work trip (such as a medical appointment) inflexible. Peak period travel, like all travel behavior, is complex.

The main intent of this research is to describe peak period travel and its components in a way that illuminates that complexity. Using the NHTS and its detailed trip purposes we divide vehicle travel into two categories – Mandatory and Flexible. ‘Mandatory’ trips include commute tours, trips related to work such as meetings, and going to school, all of which tend to be more scheduled and rigid. ‘Flexible’ travel includes maintenance and discretionary travel--family errands, shopping, getting a meal, and medical trips_all of which may be required but also may have some flexibility in terms of schedule and/or destination choice.

This research uses the concept of a commute tour (or trip chain) to help capture incidental stops (30 minutes or less) chained into a commute. It does not matter what the purpose of the stop is, the entire commute tour is included in the ‘Mandatory’ category and only separate trips not related to a commute are counted as ‘Flexible’.

Of course these categories are subjective, since an individual traveler might make a different judgment as to the importance and flexibility of an individual trip. For instance, a traveler may

consider a trip to visit a sick parent mandatory, but consider attending a school lecture that day optional. But for discussion purposes these categories are helpful.

In addition to calculating the proportion of vehicle travel in each category during morning and evening weekday peak periods, the research examines the demographic characteristics of people who make both ‘Mandatory’ and ‘Flexible’ trips during the peak. Further, forecasting future levels of peak period travel (based on current rates and future populations), shows that peak period travel will continue to grow but the mix of purposes and travelers is likely to change as the population changes.

Unfortunately, the urgency and individual motivation for each trip is unknown in the current data. What proportion of travel is considered mandatory *by the traveler*, and what trips can be re-scheduled or discarded is also uncertain. Suggestions for further research, including more comprehensive survey techniques such as semi-directed interviewing and panel surveys, are outlined as part of the conclusions.

Mandatory and Flexible Peak Travel

Historically, the level of commuting is highly correlated to the number of workers, with each worker making approximately 1.6 weekday work trips (part-time workers, off-site travel, vacation and holidays included) (McGuckin et. al., 2005). But trips for other purposes are growing faster than work trips (or added workers). Growth in travel over the last decade has come from people traveling more for shopping (including eating out), errands, and social and recreational purposes.

Importantly, these trips often conflict with commuting in the peak period and add to congestion. To understand peak period travel, this research looks at the kinds of vehicle trips and amount of vehicle miles during the peak period on weekdays (defined as 6-9:00 am and 4-7:00 pm).

For discussion purposes, we can roughly divide peak period travel into mandatory travel, such as work, work-related, and school; more flexible trips, also described as maintenance and discretionary, such as shopping, medical or household errands. The commute tours, including any incidental stops chained in along the way, were placed as a whole into ‘Mandatory’, which also includes work-related trips and students driving to or from school. Vehicle trips to drop off or pick up a passenger, commonly referred to as ‘serve passenger’, can be either mandatory or flexible depending on the passenger’s purpose, for example vehicle trips to drop children at school are ‘mandatory’ even if not chained into a commute. More than 10 percent of weekday peak period vehicle trips are to drop someone off or pick someone up, and well over half of these are to serve a passenger to or from work or school.

Table 1 shows the trip purposes and percent of daily travel within the categories of ‘Mandatory’ and ‘Flexible’ (only including the most common purposes in ‘Flexible’).

Table 1 – Vehicle Trip Purposes and Percent--Mandatory and Flexible Categories

Mandatory		Flexible	
Go to work (tours*)	59.36	Buy goods: Groceries/clothing/hardware	38.84
Return to Work	16.64	Visit friends and relatives	26.20
Other work related	16.06	Go to gym/exercise/sports	21.23
Attend school	4.79	Get/eat meal	18.85
Attend meeting/bus. Trip	1.82	Buy services: video/dry cleaner/post office/car service/bank	14.32
Other School	1.34	Family and personal	11.46
Work Tours include work trips chained with incidental stops for purposes listed as 'Flexible'		Go out to entertainment/sports event/bar	9.12
		General Shopping/errands	8.95
		Medical/dental	6.82
		Buy gas	6.17
		Coffee/ice cream/snacks	5.12

Many 'flexible' trips are made by workers who make a non-work trip, but do not chain it into their commute. One major finding of this research is that 38 percent of workers who make a non-work 'flexible' trip during the peak go to work at another time. These workers may be traveling in the peak because of their work schedule or simply convenience, such as making a separate trip to and from the grocery store before going to work.

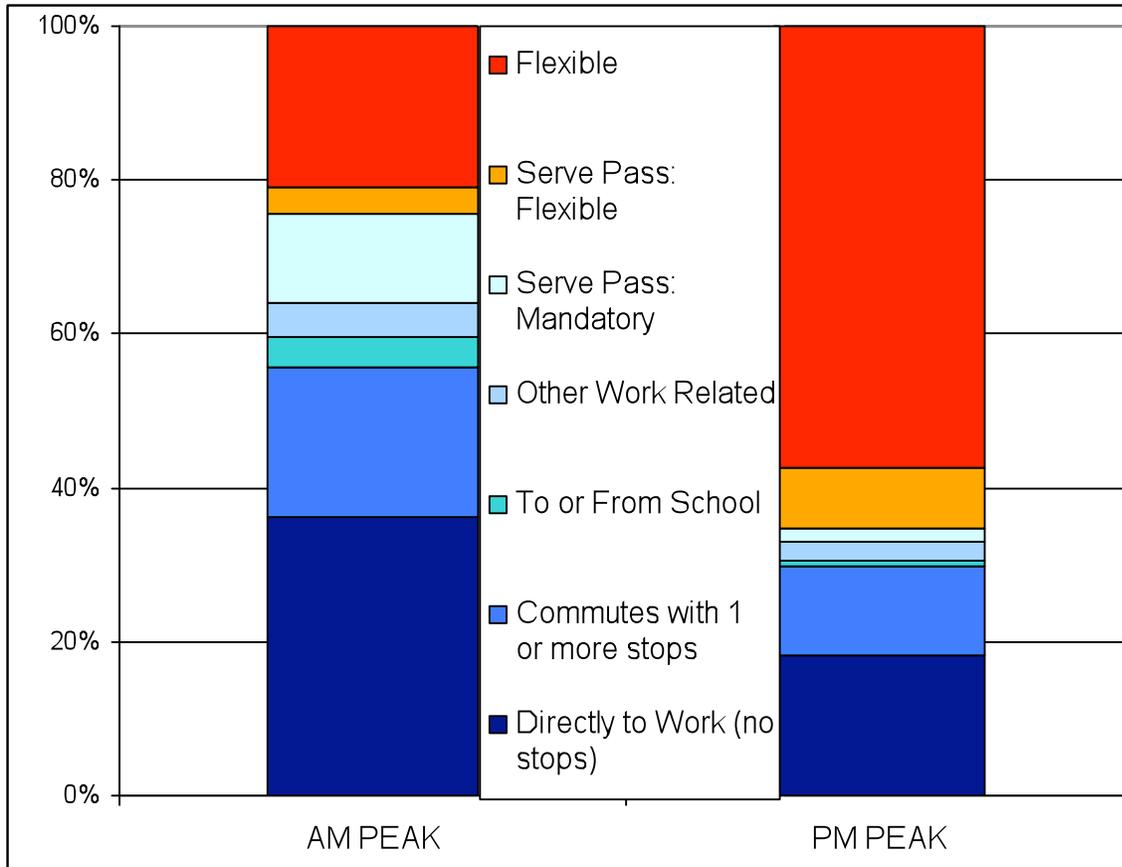
The Components of Peak Travel

It surprises people that about half of all travel in the peak periods is not related to work. But that doesn't mean that all non-work travel is completely discretionary. Some non-work trips may be constrained by the individual's schedule or, in the case of medical trips, the doctor's schedule. Trips to drop someone or pick someone up may be constrained by auto availability and the schedule and purpose of the passenger.

Figure 1 shows the components of weekday am and pm peak vehicle trips (6-9:00 am and 4-7:00 pm). As shown in Figure 1, the morning peak and the evening peak have a very different character, with the evening peak consisting of more flexible travel. Table 2 show the percent of each component for each time period.

In the AM peak, Mandatory travel is 75.6 percent of all vehicle trips. Within Mandatory travel, direct trips to or from work (HBW) are 36.3 percent, commutes with at least one stop are 19.3 percent, students driving to school are 4.0 percent and other work related are 4.5 percent of all vehicle trips. Driving a passenger to work or school adds another 11.5 percent. In the PM peak, Mandatory travel falls to 34.8 percent while Flexible rises to 65.2 percent, including the 7.9 percent of drivers serving a passenger not related to work or school.

Figure 1 – The Purpose of AM and PM Peak Vehicle Trips on Weekdays



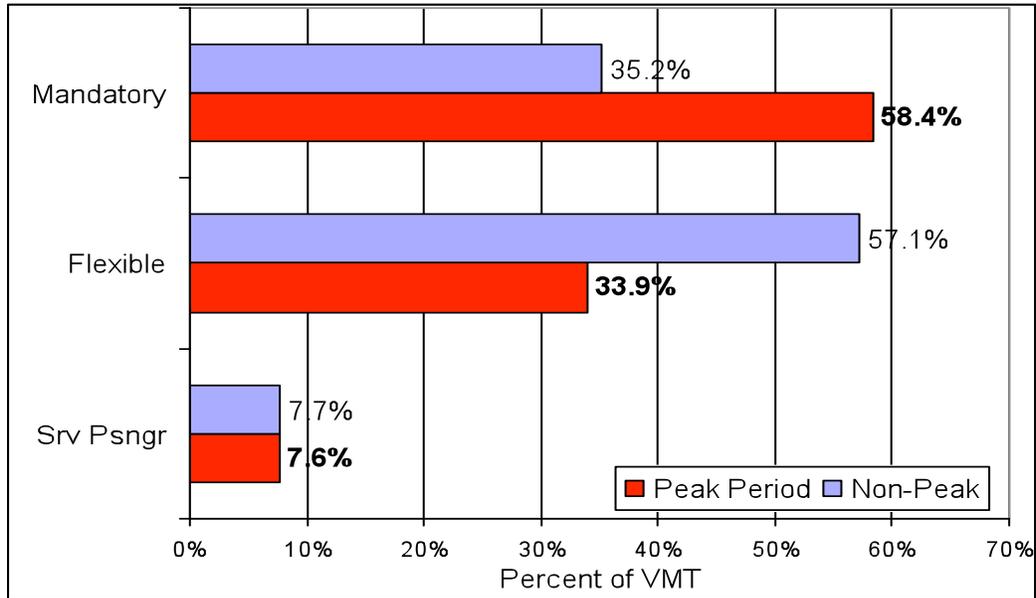
Source: NHTS 2001 Chained trip Files

Table 2 - Proportion of Mandatory and Flexible Vehicle Trips within AM and PM Peak

	AM Peak	PM Peak
Mandatory	75.6%	34.8%
Directly to/from Work (no stops)	36.3%	18.3%
Commuters with 1 or more stops	19.3%	11.6%
Students driving to/from School	4.0%	0.7%
Other Work-Related	4.5%	2.4%
Serve Pass: Mandatory (work or school)	11.5%	1.8%
Flexible	24.4%	65.2%
Serve Pass: Flexible	3.4%	7.9%
Other Flexible	21.0%	57.3%

Altogether, nearly 60 percent of peak period vehicle miles are for Mandatory purposes, as shown in Figure 2. Another 38 percent of vehicle miles during peak are for Flexible purposes, and trips to drive a passenger add just a small amount of vehicle miles.

Figure 2 – Percent of Vehicle Miles in Three Purpose Categories, Peak and Non-Peak



Source: NHTS 2001 Chained Trip Files

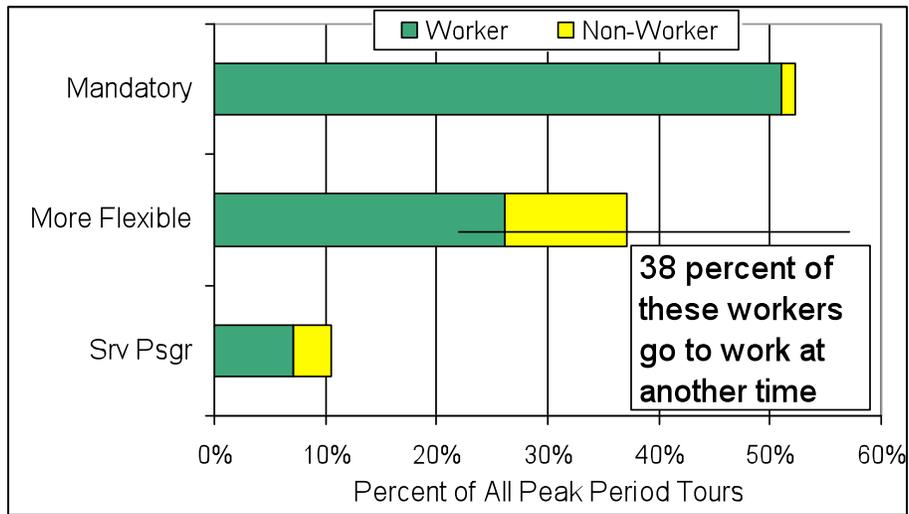
Who is Traveling in the Peak

The Census, Bureau of Labor Statistics, and the NHTS estimate between 65 and 70 percent of persons 16 and over are workers. Workers make up the majority of travelers on an average day and the majority of peak period travelers as well—73 percent of all weekday travel (at all times of day) is by workers, and that proportion is also reflected in peak travel (see Figure 3).

The vast majority of the ‘Mandatory’ peak vehicle trips made by workers are for commuting—but the vast majority of ‘Flexible’ vehicle trips (71 percent) during the combined peak period are also made by workers. It is important to note that 38 percent of the workers making ‘Flexible’ trips during peak actually go to work at another time, so their flexibility may in fact be constrained by their work schedules.

More than two-thirds (67 percent) of the trips to drive someone somewhere are made by workers as well. Remember, here we are talking about separate trips not related to the commute. Short stops to drop someone at school or work that are linked into commutes are counted as part of the single commute tour, and therefore ‘Mandatory’.

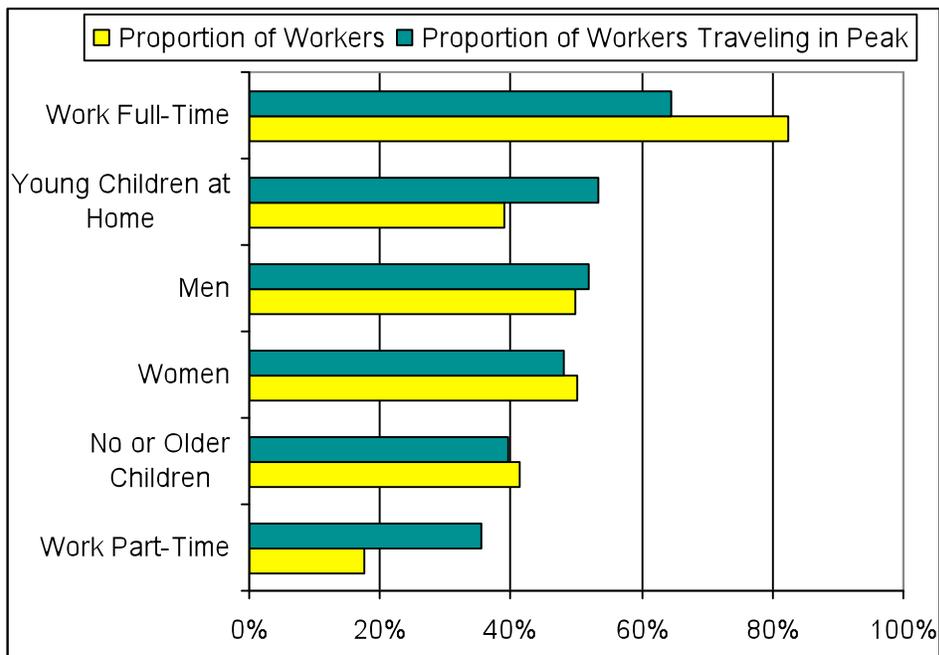
Figure 3 - Percent of Peak Period Vehicle Trips Made by Workers



Source: NHTS 2001 Chained Trip Files

To understand what kind of workers are most likely to travel during peak periods, Figure 4 compares the proportion of all workers and the proportion of workers traveling on weekdays during peak. For instance, 82 percent of all workers work full-time, but surprisingly only 64 percent of workers traveling in the peak periods are full-time workers.

Figure 4 - Characteristics of Workers Driving During Peak Period (6-9:00 am and 4-7:00 pm, weekdays)

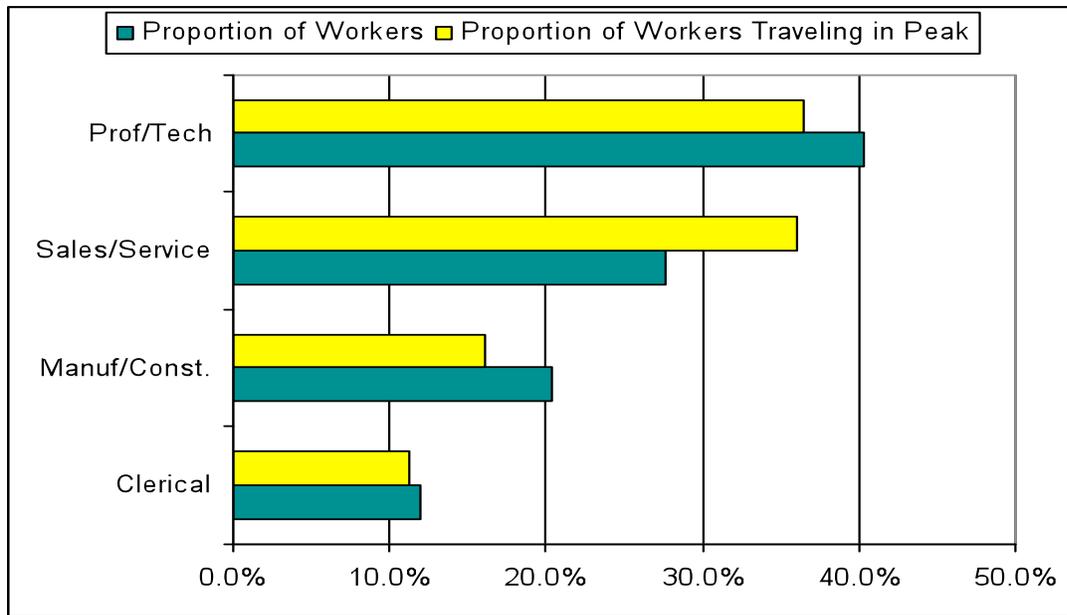


Source: NHTS 2001 Chained Trip Files

As shown in Figure 4, workers in households with young children at home are just 40 percent of the workforce but represent 53 percent of workers traveling in the peak. Part-time workers are just 18 percent of all workers but represent 36 percent of workers traveling in the peak. This may demonstrate that workers with young children at home and part-time workers have less flexibility in the timing of their non-mandatory travel, hence adding to peak period non-work travel levels.

Figure 5 shows the occupation of workers traveling in the peak. The disparate proportion of part-time workers and workers in sales and service jobs may explain the lower median household income of workers who travel in the peak period--\$47,500 compared to \$52,500 for all workers. We also found a very slight overrepresentation of African-American and Hispanic workers amongst peak travelers.

Figure 5 - Occupations of Workers Driving During Peak Periods (6-9:00 am and 4-7:00 pm)



Source: NHTS 2001 Chained Trip Files

The mean household income for people traveling for ‘Mandatory’ trips is only slightly higher than those traveling for ‘Flexible’ reasons (\$62,500 compared to \$57,000), which may simply reflect the fact that fewer flexible travelers are workers and more are retired.

Women are slightly more likely than men to make ‘Flexible’ trips during the peak, which could reflect the greater proportion of women work part-time or alternative schedules, and have greater household responsibilities. Note that workers of both sexes with children are more likely overall to be traveling in the peak (Figure 4 above), however twenty-three percent of drivers during peak period are retired.

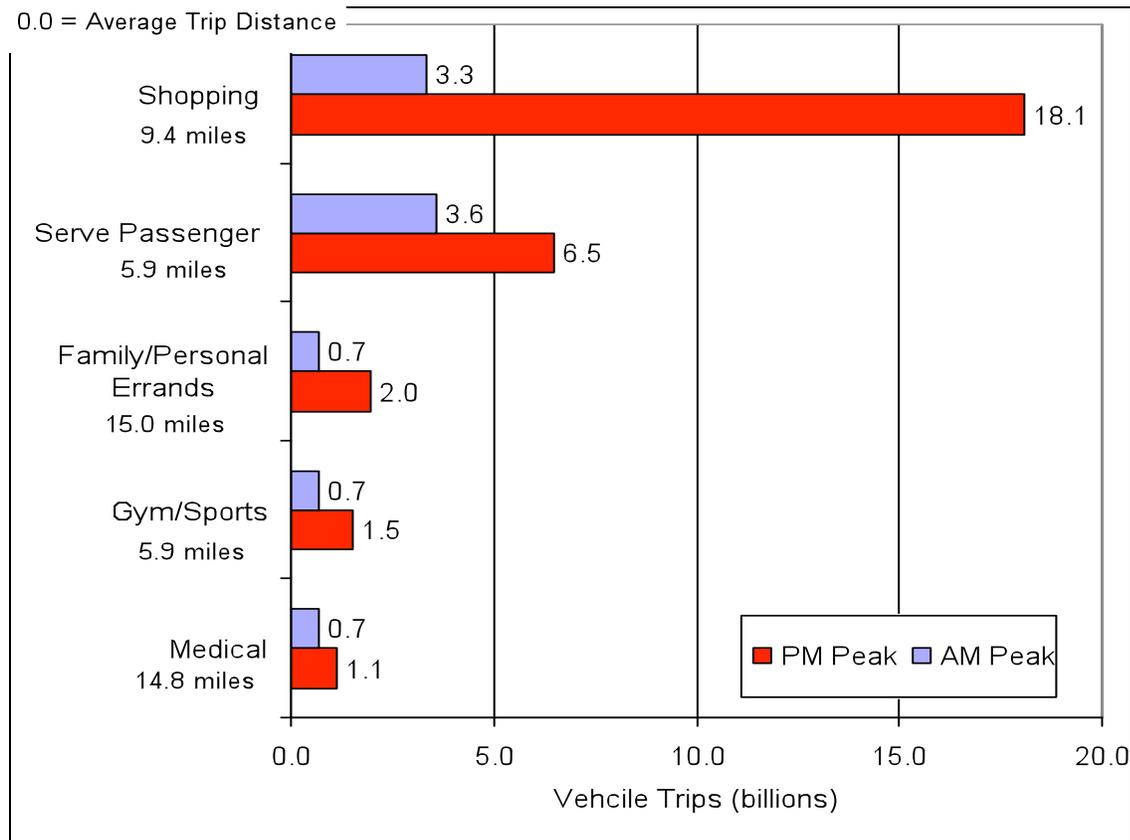
The Impact of Flexible Travel

How much of an impact on congestion, air quality, or fuel use does Flexible travel during peak periods have? Many Flexible trips may be short trips on arterial roads, and may not add significantly to system-wide vehicle miles or congestion.

Over half of all 'Flexible' trips are to buy goods (39 percent) or to buy services (14 percent); the daily shopping and errands. To help assess the impact, Figure 6 shows the number and average trip distance for some of the common 'Flexible' peak vehicle trips.

Shopping and serve passenger are the most common am peak vehicle trip purposes, but shopping alone, including getting a meal (and not related to a commute), dominates vehicle travel in the pm peak period. More than 18 billion vehicle trips are made for shopping in the PM peak, which adds over 170 billion vehicle miles (18.1 times the average trip distance of 9.4 miles). Family and personal errands add another 2 billion trips and 30 billion vehicle miles of travel to the PM peak.

Figure 6 - Number of Vehicle Trips and Average Trip Length for Flexible Trips by the Most Common Purposes



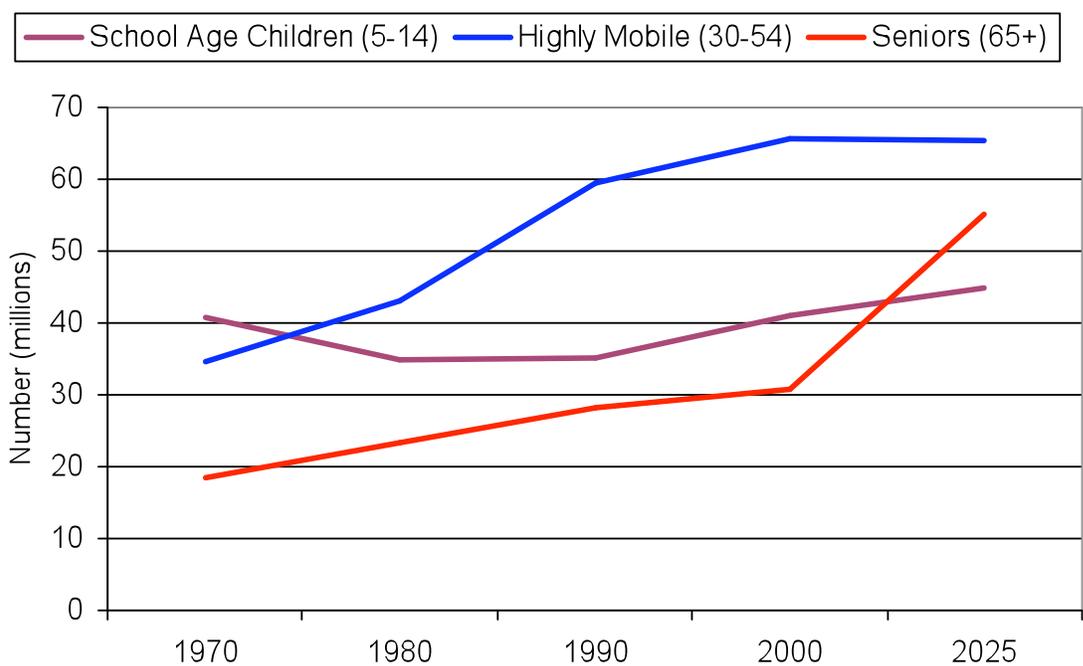
Source: NHTS 2001 Chained Trip Files

Peak Travel: Where Are We Going

As the US population ages, there has been a lot of speculation on changes in travel, including congestion, safety, and mobility issues. Figure 7 shows the number of people in the US from the Census population forecast to 2050 in three broad categories: school age children, the traditional age of high mobility (30-54 years old), and seniors (65 years and over). Pertinent to this discussion, the population in their highly mobile years is projected to slow in growth between 2000 and 2020, which may account for some early indications of a slowing of growth in VMT (Polzin, 2006). Adding to that, a sharp increase in the number of older Americans has already begun, and by 2050 the number of people over 65 will nearly equal the number of children under 16 (86.7 million 65 and over versus 87.9 million less than 16).

These changing dynamics impact travel behavior. For example, households with children in the NHTS average 14.3 trips per household compared to 6.8 for households without children. But on a per-person basis in the highly mobile age group, people with children in the household average 4.4 person trips per day per person compared to 4.2 per day for highly mobile people in households without children.

Figure 7 - US Population Projected in Three Categories



Source: US Census

Table 3 shows the trip rate for person trips and vehicle trips by broad

population age groups. As shown, school age children make half of their person trips during the peak period (but no vehicle trips, as they are not drivers). In terms of vehicle trips, the 'highly mobile' age group of 30-54 year olds make 3.9 vehicle trips per day, and half are during peak period. Seniors make 3.2 vehicle trips per day on average, and 37.5 percent of those are during the peak periods.

Table 3 – Person Trips and Vehicle Trips per Day and in Peak Period

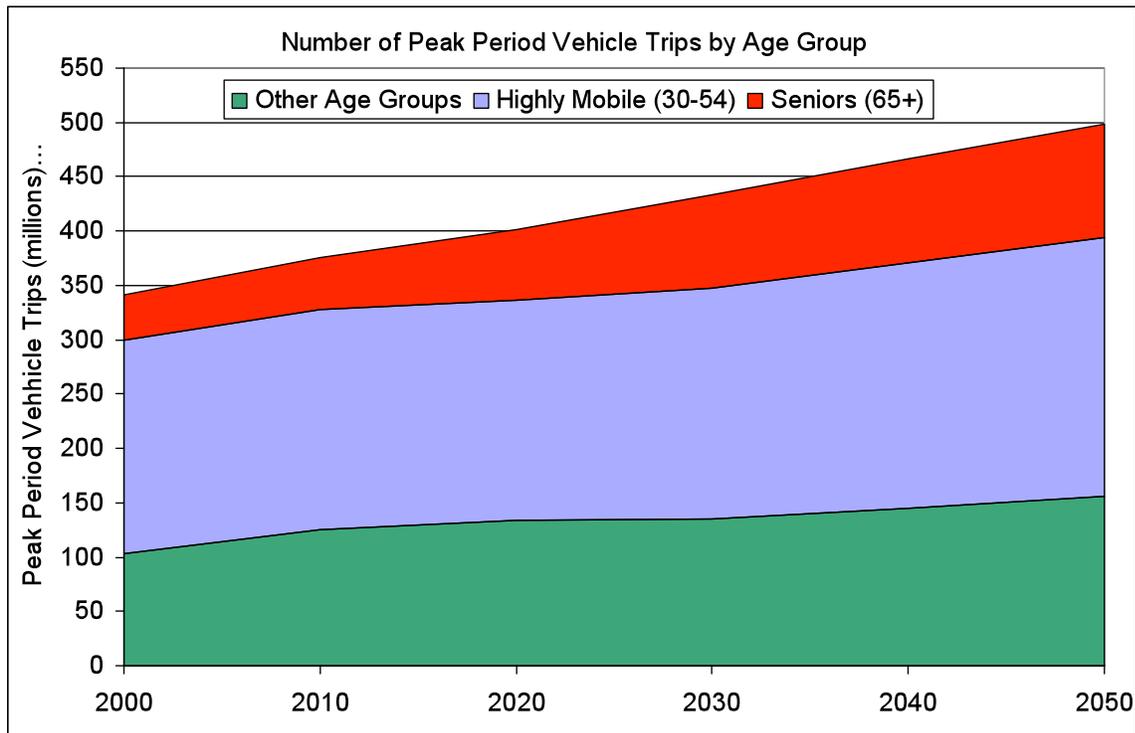
	Person Trips per Day (All Modes)	Person Trips in Peak (All Modes)	Vehicle (Driver) Trips per Day	Vehicle (Driver) Trips in Peak
School Age Children (5-14)	3.8	1.9	0.0	0.0
Highly Mobile (30-54)	5	2.4	3.9	1.9
Seniors (65+)	4.7	1.9	3.2	1.2
Other Age Groups	4.6	2.1	2.7	1.3

If the current peak travel rates are forecasted to future populations, we can see that the mix of peak travelers will shift. Figure 8 shows the growth in peak period vehicle travel by three age groups (school age children were excluded since they may be passengers but not drivers).

In this scenario, simply based on the increase in the population of people 65 and older, we might expect to see peak period travel by older drivers increasing nearly 60 percent, while peak vehicle travel from the highly mobile increases just 17.5 percent. All other age groups (over 16) increase peak vehicle travel by 34 percent.

This exercise is demonstrative, since so many factors can affect travel, including policy, economic changes, workforce participation, technology and communications. And peak travel may be even more difficult to forecast since congestion itself alters travel behavior—if traffic is bad some travelers will change the time or destination of their trip, or forego the trip altogether.

Figure 8 – Forecast of Peak Vehicle Travel for Three Age Groups



Some Thoughts on Future Trends

Historically, worker status has been used as a descriptor of household travel demand and as a measure of usual commute characteristics. But the power of employment status as a predictor of typical daily peak travel may be jeopardized by the changing nature of work in the US. Working at home has been on the rise since 1980 (Pisarski, 2006). Currently 28 million people occasionally "telework" under formal company policies--a leap from 4 million in 1990--and millions more work informally out of the office one or more days a week.

And over the past year, the US has experienced unprecedented declines in VMT as a result of increased fuel prices and an economic recession. During an economic recession, people change travel behavior by changing the type of activities and locations perhaps by not eating out as much, changing shopping trips to different retailers. During the summer of 2008 when gas prices spiked in addition to the economic recession, transit agencies around the country reported higher peak ridership. As the economic downturn continues, workers may take unpaid leave days or weeks and traditional 9-5 workers may move to service jobs, part-time employment, and/or multiple part-time jobs.

Adding to the trends toward less traditional working arrangements will be the growing numbers of older workers. The preliminary data from the 2008 NHTS shows a sharp rise in working at home for people over 65 who consider themselves 'retired'. With increased longevity, physically undemanding jobs, and for economic reasons, baby boomers are more likely to continue working in their 60s and 70s (Srinivasan, et. al., 2006). People in 'Working Retirement' may have more flexible schedules and are more likely to work part-time.

Another factor in the changing workforce is immigration. Over 80 percent of immigrants arriving in the five years prior to the 2000 Census were in the main working years of 16-64—in fact, new immigrants constitute all the growth in the number of workers between the ages of 16-54. This has significant implications for commute trips as new immigrants are much more likely to use carpooling or to walk, bike, or use public transit for their commute to work (Pisarski, 2006).

And finally, in efforts to cut expenses, more companies are depending on contract labor, temporary and part-time workers. In the global marketplace, there is also a striking change toward 24-hour business. Approximately two in every five workers in the United States work mostly during nonstandard times—evenings, nights, rotating shifts, or weekends. Jobs where employees typically work outside of the traditional work shift are among occupations with the largest projected growth in the next decade (Saenz, PRB).

As the nature of work changes, forecasters are challenged to go beyond the idea of a 'typical day' and understand the variations and flexible arrangements that come with non-standard work arrangements and travel. This is important as the prevalence of these flexible arrangements is much more likely to grow over time.

Another traditional characteristic associated with travel demand is family structure, especially the presence of children. Although children add to the number of driver trips the proportion of households in the US with children is declining--the fastest-growing proportion of households in the US single-person households.

Single-person households have more than doubled since 1960 (from 13 percent of all households in 1960 to 27 percent in 2004). Nearly 30 million Americans now live alone. About one-third of these solo singles are men and women 65 years of age and older. The most recent annual data from the Census Bureau reports that 7.5 million senior women and 2.6 million senior men live alone. According to the Urban Institute, the number of seniors who are widowed, divorced, or never married will be at a historic high in 2025 (34% of all 62 year-olds).

Importantly, single person households have different travel characteristics than others, for instance people in single person households travel fewer vehicle miles per person than larger households. But of course it depends on what kind of single person households. A highly mobile single woman (ages 30-45) will travel on average 10,000 vehicle miles a year (as much as the average two-person household) while a single woman over 65 will travel just 2,400. As the population shifts, we should keep in mind that some historically homogeneous groups may be stretching to include more diverse membership.

Conclusion

Understanding peak period vehicle travel is vital for finance, congestion, and air quality policies. However, the proportion of vehicle trips during the peak that are mandatory and inflexible is poorly understood. Importantly, the greatest growth in peak vehicle travel over the last few decades has been for purposes other than work. While the number of commutes is tied to the number of workers, people are making more vehicle trips per person for shopping, eating out, family errands, and social and recreational purposes.

This paper divided detailed trip purposes obtained in the NHTS into 'Mandatory' and 'Flexible' travel purposes during peak periods. We found that 'Mandatory' travel accounts for three-quarters of the vehicle travel in the am peak, but just over a third in the pm peak.

Currently workers make the majority of Mandatory and Flexible trips, throughout the day and in during peak periods. Part-time workers, workers in service and sales, workers with children in the household are over-represented in peak period travel. However, 38 percent of workers traveling for non-mandatory purposes during the peak go to work at some time during the travel day.

The trips not related to work add many millions of miles to peak travel especially in the afternoon and evening peak. More than 18 billion vehicle trips are made for shopping in the pm peak, which adds over 170 billion vehicle miles (18.1 times the average trip distance of 9.4 miles). Family and personal errands add another 2 billion trips and 30 billion vehicle miles of travel to the pm peak.

Older travelers are more likely than other age groups to make medical trips during the peak, and these trips may be considered ‘Mandatory’ by the travelers. Medical trips also have the longest average trip distance of all non-work peak vehicle trips (14.8 miles).

In order to really understand peak period travel, some new data is required, and new techniques will be needed. Traditional household travel surveys may not be the best method of ascertaining the flexibility of individual trips, and whether a trip could be re-routed or changed in time or destination. Activity/schedule research obtains some of this information by re-interviewing people after the travel day, and other techniques include panel survey focus groups (Goulias, et.al. 2007), analysis of scheduled activities (Kreitz, et. al. 2002) and semi-directed interviewing. New methods and data to help us to more accurately categorize the distribution and amount of Mandatory and Flexible trips throughout the day is needed.

The US transportation system will face many challenges in the next 20 years: economic and finance, safety and the aging driving pool, immigration and migration, just to name a few. In response to those changes, planning and policy is challenged to be flexible. Traditional indicators of travel demand may have to be re-analyzed to ensure that the changing demographic patterns don’t catch us off guard as peak travel continues to evolve through the 21st century.

Note on the Data Source

This analysis uses the chain trip files for NHTS 2001, which are coded into commute tours that include a stop of 30 minutes or less. This definition of a work tour allows us to link those trips into the commute, or study the stops themselves, as has been done in trip chaining analysis. These commutes, including any and all short stops, are linked together and coded as 'Mandatory' in this analysis. All of the 'Flexible' travel analyzed here is not linked to a work commute.

During peak periods, even during the am, a surprising amount of non-work travel is taking place. One data gap is the location or route choice of the traveler. We do not know from the NHTS how many of these peak period vehicle trips are on the highway, or just a local road. The 2008 NHTS simply asks if any part of the trip was on a highway or toll road, and the preliminary data shows that 25-30 percent of peak vehicle travel uses a highway. A better method would be to include a GPS component to measure exact locations, time of day, and mileage.

There is a clear trend toward more non-work travel during the peak period in the NHTS data series. Although method changes aid in obtaining more incidental travel, such as the introduction of the travel diary in 1995 NHTS, the growth of non-work travel during the peak was identified as early as 1988 (Gordon, et. al., 1988) using the 1969, 1977, and 1983 surveys. The 2008 NHTS will undoubtedly shed more light on this complex subject.

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Appendix A – Percent of NHTS Detailed Trip Purpose within Mandatory and Flexible Categories

Mandatory Purpose and Pct	Flexible Purpose and Pct
Go to work 59.36	Buy goods: Groceries/clothing/hardware 38.84
Return to Work 16.64	Visit friends and rels 26.20
Other work related 16.06	Go to gym/exercise/sports 21.23
Attend school 4.79	Get/eat meal 18.85
Attend meeting/bus. Trip 1.82	Buy services:video/dry cleaner/post office/car service/bank 14.32
Other School 1.34	Family and personal 11.46
	Go out to to entertainment/sports event/bar 9.12
	Shopping/errands 8.95
	Medical/dental 6.82
	Buy gas 6.17
	Coffee/ice cream/snacks 5.12
	other uncoded 4.82
	Go to religious activity 4.44
	Social/Rec 4.43
	Personal services:haircut 3.24
	Rest/relax 2.79
	Go out to eat as social event 2.61
	Attend meeting: PTA/local gov't 2.14
	Visit public place 2.05
	Pet care:walk the dog/vet 1.65
	Attend funeral/wedding 1.18
	Meals 1.17
	Prof Services: attorney/accountant 1.11
	Go to library:school related 0.86
	Day Care 0.45

