

Peak Travel in America

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Abstract

Understanding peak period travel is vital for transportation finance initiatives, congestion mitigation, and air quality policies among other important policy and planning programs. Historically, the peak period was considered the domain of work travel. Commuting is still predominantly a weekday activity, tied to the morning and evening hours, and has traditionally defined peak travel demand.

Over the last four decades the number of work trips grew as the population of workers grew. But by the early 80's the National Household Travel Survey (NHTS) showed that the number of non-work trips were growing faster than work trips. By the early 90's the concept of trip chaining during a work tour was commonly used to allow more complex commutes to be recognized as work travel by including stops for incidental purposes during the commute. Even beyond the growth in trip chaining, non-work travel continues to grow faster than work travel, and it is growing during the peak periods.

As we look forward to initiatives that aspire to smooth travel demand across time periods, one question that is difficult to answer is ‘How much of peak period travel is really mandatory?’ This research utilizes the NHTS data chained trip files (2001 are the most recent available, but this analysis can be updated in late fall with the 2008 NHTS) 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. In contrast, 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 the peak, and many (38 percent) of the workers making Flexible trips during peak go to work at another time, indicating schedule constraints on their Flexible travel.

Key Words: Peak Period, Peak Travel Demand, Congestion, HOT Lanes, Air Quality, Discretionary Travel, Mandatory Travel, Flexible Travel

Introduction

Understanding peak period travel is vital for transportation finance initiatives, congestion mitigation, and air quality policies among other important policy and planning programs. Historically, the peak period was considered the domain of work travel. Commuting is still predominantly a weekday activity, tied to the morning and evening hours, and has traditionally defined peak travel demand. Census journey-to-work data is well documented, for instance in the “Commuting in America” series (Pisarski, 1987, 1996, and 2006), and these data are commonly used to develop peak period ‘flows’ in travel demand forecasting.

The journey-to-work data shows that over the last four decades, the number of work trips grew as the population of workers grew. But by the early 80’s the National Household Travel Survey (NHTS) and other data sources showed that non-work trips were growing faster than work trips and spilling over into the peak (Gordon, et. al. 1988). By the early 90’s the concept of trip chaining during a work tour was commonly used to allow more complex commutes to be recognized as work travel by including stops for incidental purposes during the commute (Nishii, 1988, Strathman, 1995). But even beyond the growth in trip chaining, non-work travel continued to grow faster than work travel, and continued to grow during the peak periods.

About half of all travel in the combined AM and PM 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.

What motivates people to travel for non-work purposes during peak periods is poorly understood. The main intent of this research is to describe peak period travel and its components. 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 such as 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’. So if an individual leaves home, stops at the coffee shop and then the dry cleaners and continues to work, the trips and miles between home and the coffee shop, the dry cleaners and work would be considered ‘Mandatory’ because they were included in the work tour.

The assumption that work travel in the peak period is mandatory and other travel non-mandatory is a research area that should be addressed in the future as the lines are blurring. For example, many workers have flexibility in work arrival times—the unweighted 2008 NHTS indicates that more than 1/3 of full-time workers can ‘set or change their own start work time’. On the other hand, some non-work trips, notably medical appointments, can be inflexible. Peak period travel, like all travel behavior, is complex, and these categories are subjective.

In addition to calculating the proportion of vehicle travel in each category during AM and PM weekday peak periods, this research examines the demographic characteristics of people who make both ‘Mandatory’ and ‘Flexible’ trips during the peak. Further, looking at these characteristics we predict that peak period travel will continue to grow but the mix of purposes and travelers is likely to change as the population changes.

Unfortunately, with the NHTS data we do not know what proportion of travel is considered mandatory *by the traveler*, and what trips can be re-scheduled or discarded. Suggestions for further research, including more comprehensive survey techniques such as semi-directed interviewing and panel surveys, are outlined as part of the conclusions.

Definition of Mandatory and Flexible

To describe peak period travel, this research confines itself to vehicle trips and vehicle miles during the peak period on weekdays (defined as Monday through Friday with vehicle start times between 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 and Flexible travel, often called ‘maintenance’ and ‘discretionary’, such as shopping, visiting, medical, or household errands. The commute tours, including any incidental stops chained in along the way, are placed as a whole into ‘Mandatory’, which also includes work-related trips and students driving to or from school.

Table 1 shows the detailed trip purposes and percent of weekday peak period vehicle trips within the categories of ‘Mandatory’ and Flexible’. 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, and are not included in the table. 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 – Peak Period Weekday Vehicle Trip Purposes--Mandatory and Flexible Categories

Mandatory		Flexible	
Go to work (tours*)	59.4%	Buy Goods	23.8%
Return to Work	16.6%	Get Meal/coffee	14.2%
Other work related	16.1%	Visit Friends/Rel	10.3%
Attend school	4.8%	Go to Gym/Exercise	7.4%
Attend meeting/bus. Trip	1.8%	Buy Services	6.9%
Other School	1.3%	Shop/Errands	5.1%
		Hangout	4.5%
*Work Tours include work trips chained with incidental stops for purposes listed as ‘Flexible’		Family/Personal	4.2%
		Medical	4.2%
		Buy Gas	4.2%
		All Other	15.1%

It should be noted that workers make both work trips and non-work trips during peak periods. 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.

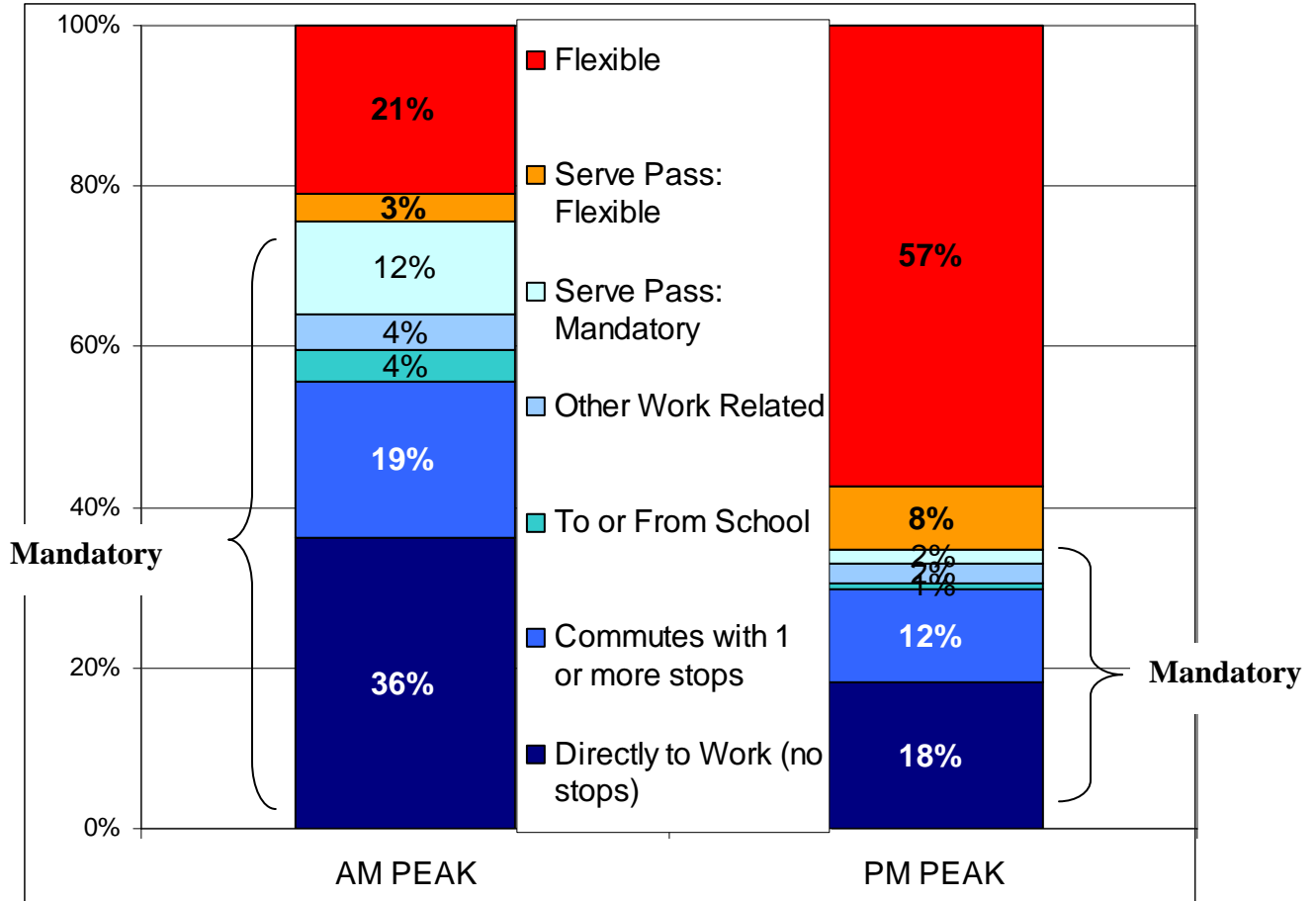
The Components of Peak Travel

Figure 1 shows the components of weekday AM and PM peak vehicle trips. The morning and evening peaks have a very different character, with the PM peak consisting of a greater percentage of 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, over 36 percent of all vehicle trips are direct trips to or from work (HBW) followed by commutes with at least one stop (19.3 percent), students driving to school (4.0 percent) and other work related (4.5 percent). Driving a passenger to work or school adds another 11.5 percent. In the PM peak, ‘Mandatory’ travel falls to 34.8 percent of all vehicle trips 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 – Proportion of ‘Mandatory’ and ‘Flexible’ AM and PM Peak Vehicle Trips on Weekdays



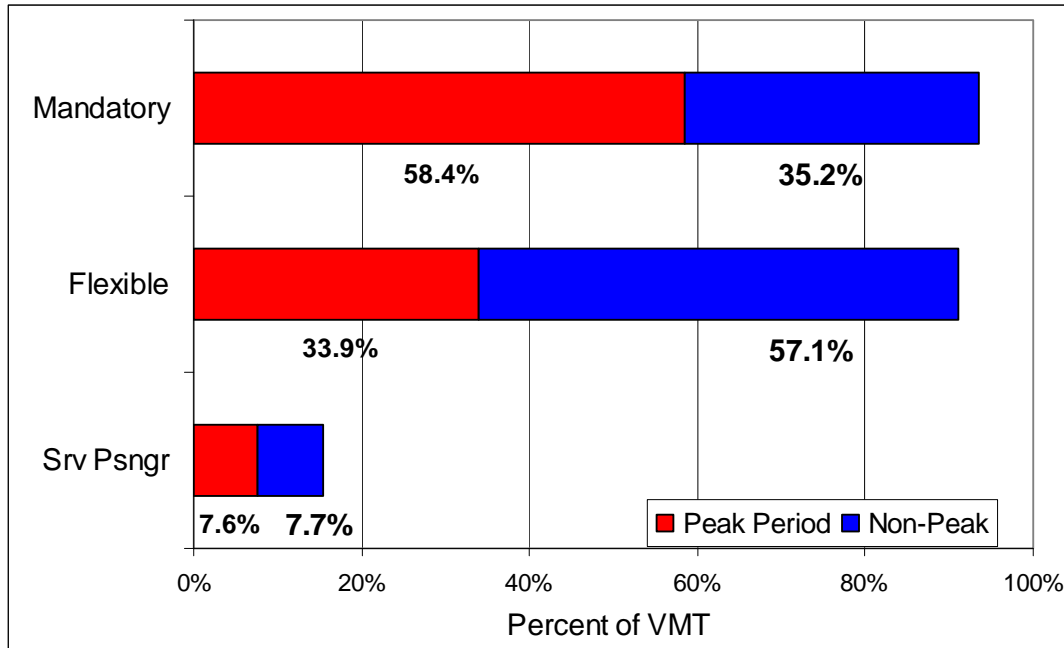
Source: NHTS 2001 Chained trip Files

Table 2 - Proportion of ‘Mandatory’ and ‘Flexible’ AM and PM Peak Vehicle Trips on Weekdays

	AM Peak	PM Peak
Mandatory	75.6%	34.8%
Directly to/from Work (no stops)	36.3%	18.3%
Commutes 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%

In looking at vehicle miles (VMT), altogether nearly 60 percent of combined peak period vehicle miles are for ‘Mandatory’ purposes, as shown in Figure 2. Another 38 percent of vehicle miles during the combined peak are for ‘Flexible’ purposes, and trips to drive a passenger account for just one out of twelve vehicle miles.

Figure 2 – Percent of Vehicle Miles for ‘Mandatory’ and ‘Flexible’ Peak Travel

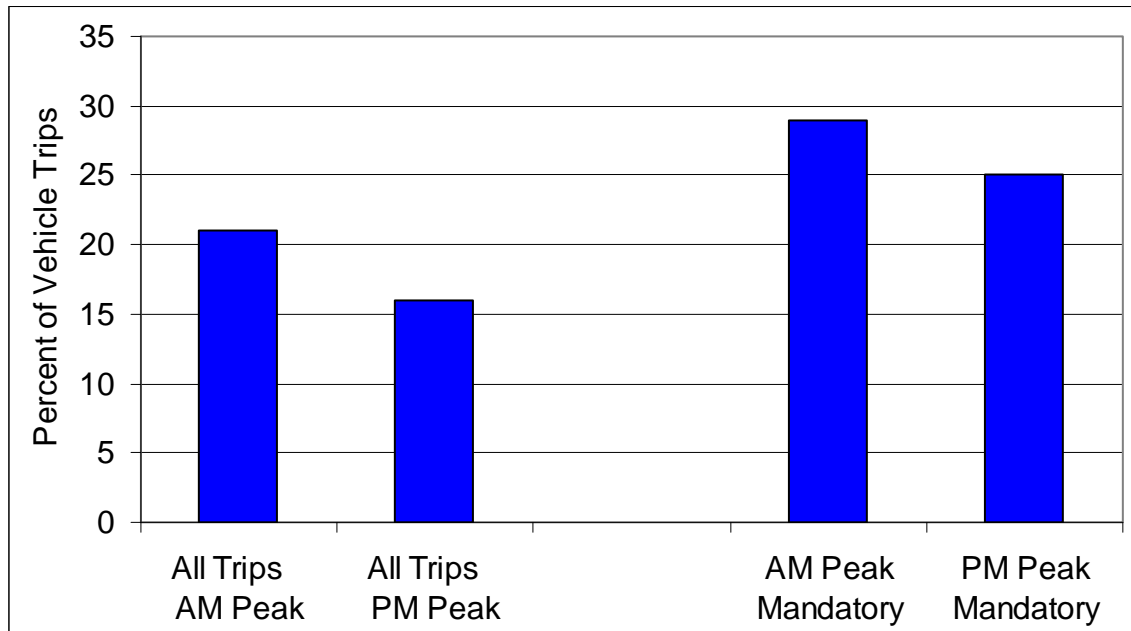


Source: NHTS 2001 Chained Trip Files

Of course, most congestion management strategies are focused on highway travel. The national travel data origins and destinations are not flowed onto a network of roadways, but the 2008 NHTS added a question: whether any part of the trip used an interstate or toll road. The preliminary 2008 NHTS shows that Mandatory vehicle travel is more likely than travel for other purposes to use an interstate or toll road.

Figure 3 shows that while 21 percent of all AM peak vehicle trips used an interstate or toll road during the trip, 29 percent of ‘Mandatory’ AM peak trips used an interstate or toll road during the trip. Likewise, while 16 percent of all vehicle trips in the PM peak used an interstate or toll road, 25 percent of ‘Mandatory’ PM peak trips used an interstate or toll road.

Figure 3 – Percent of Weekday AM and PM Peak Vehicle Trips that Used an Interstate or Toll Road (Preliminary 2008 NHTS)



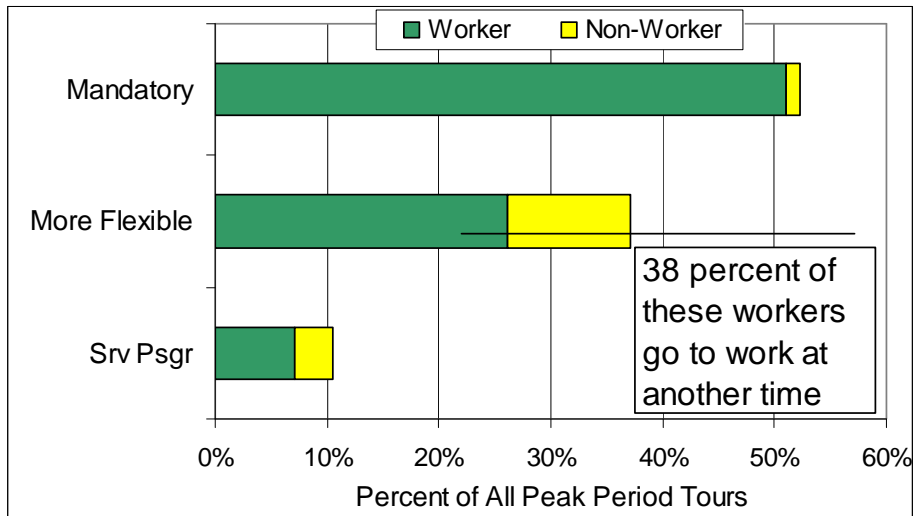
Source: Preliminary 2008 NHTS

Who is Traveling in the Peak

Since the majority of people aged 16 and older in the US are in the paid workforce, the majority of travelers are workers-73 percent of all weekday vehicle trips (at all times of day) are made by workers. As Figure 4 shows, workers account for the vast majority of ‘Mandatory’ and simple majority of ‘Flexible’ vehicle trips during peak periods.

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’.

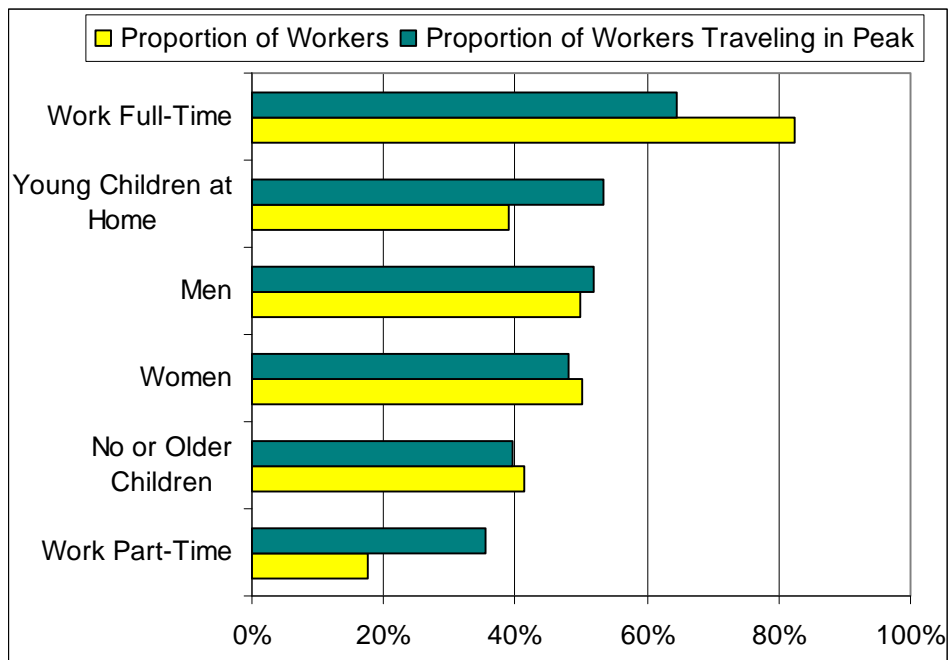
Figure 4 - Percent of Peak Period Vehicle Trips Made by Workers



Source: NHTS 2001 Chained Trip Files

To understand what kind of workers are most likely to travel during peak periods, Figure 5 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 only 64 percent of workers traveling in the peak periods are full-time workers.

Figure 5 - Characteristics of Workers Driving During Peak Period (6-9:00 AM and 4-7:00 PM, weekdays)

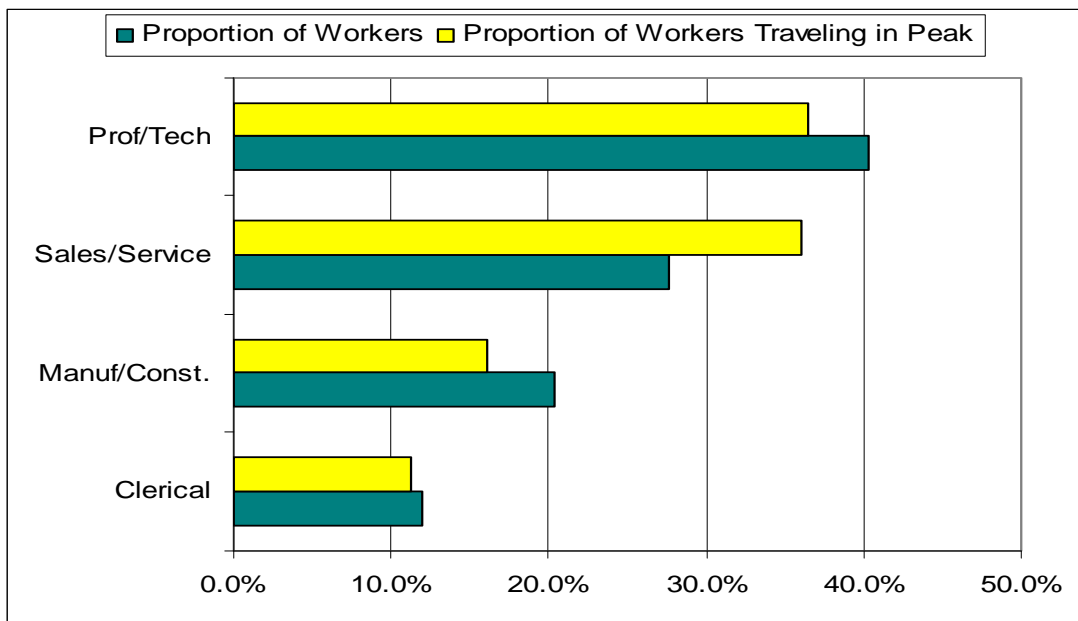


Source: NHTS 2001 Chained Trip Files

As shown in Figure 5 above, workers in households with young children at home are 40 percent of the workforce but represent 53 percent of workers traveling in the peak. Part-time workers are 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 fewer options in the timing of their Flexible travel, hence adding to peak period non-work travel levels.

Figure 6 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.

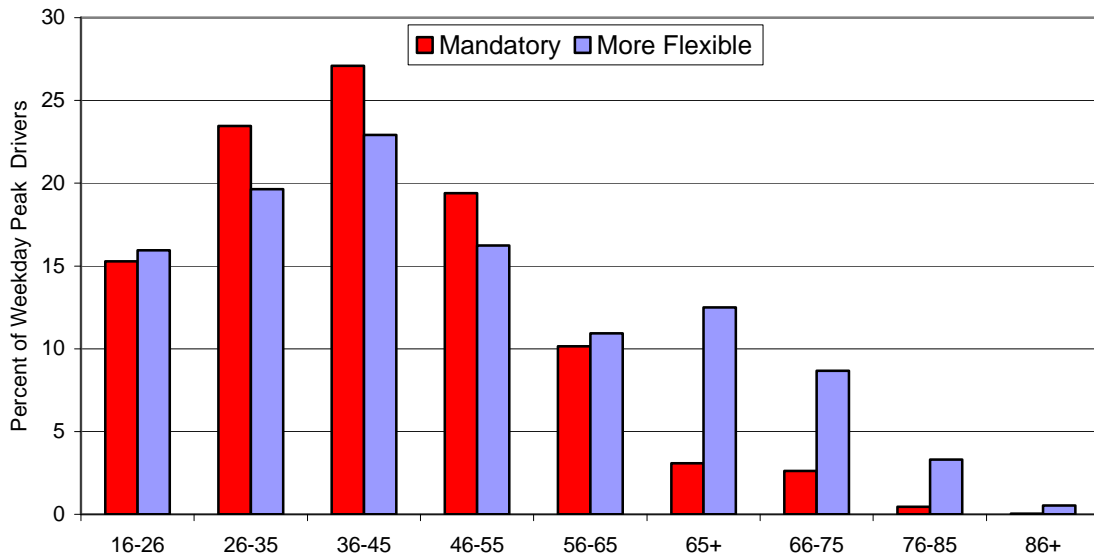
Figure 6 - Occupations of Workers Driving during Peak Periods (6-9:00 AM and 4-7:00 PM)



Source: NHTS 2001 Chained Trip Files

Overall, older individuals are more likely to be traveling for 'Flexible' purposes during the peak periods. Figure 7 shows the distribution of vehicle drivers by age for 'Mandatory' and 'Flexible' purposes. 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. Overall, twenty-three percent of drivers during peak period are retired.

Figure 7 – Age Distribution of Vehicle Drivers for Peak Period Mandatory and Flexible Trips



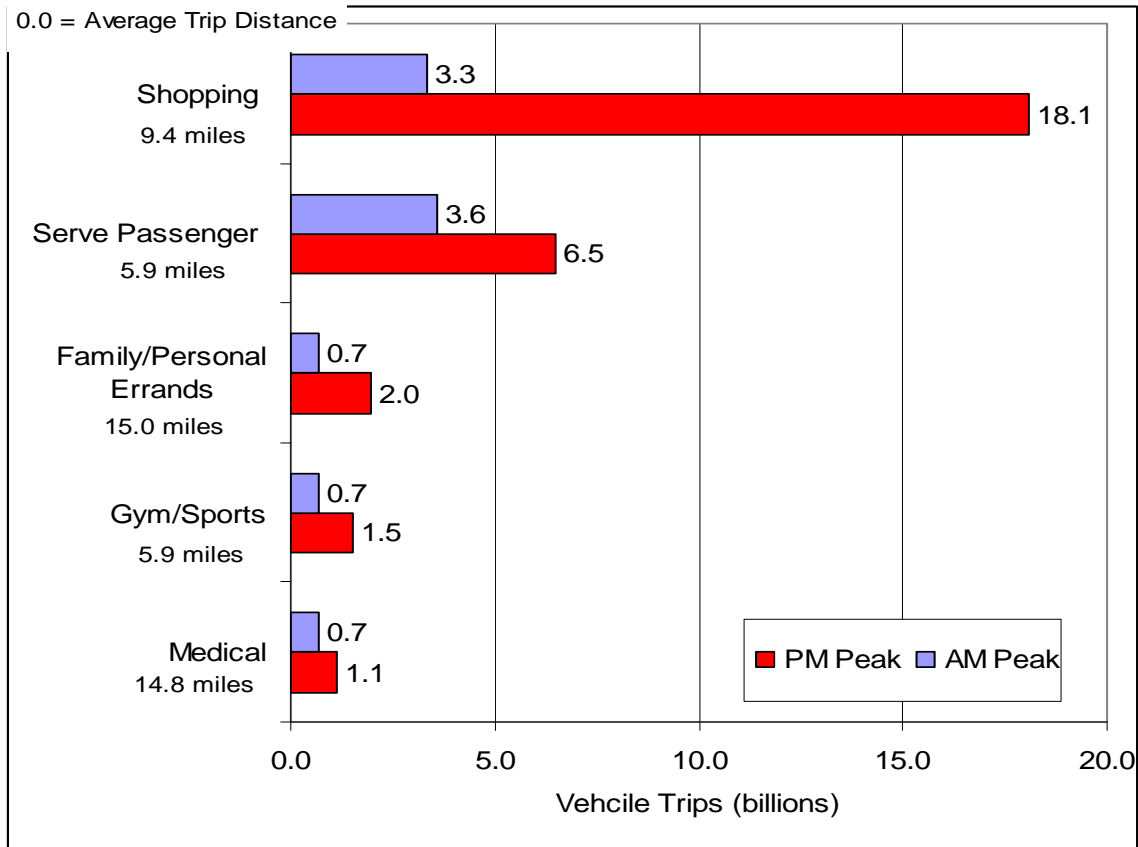
Women are slightly more likely than men to make ‘Flexible’ trips during the peak, which could reflect the greater proportion of women who work part-time or alternative schedules, and have greater household responsibilities. Note that workers of both sexes with children are more likely overall to be traveling in the peak (Figure 5).

The Impact of Flexible Travel

How much of an impact on congestion, air quality, or fuel use does ‘Flexible’ travel during peak periods have? Over half of all ‘Flexible’ trips are to buy goods (39 percent) or to buy services (14 percent). Figure 8 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 8 – Annual Number of Vehicle Trips and Average Trip Length for Peak Period Flexible Trips by the Most Common Purposes



Source: NHTS 2001 Chained Trip Files

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 as this research indicated, many workers have flexibility in work arrival time.

And over the past year, the US has experienced unprecedented declines in VMT as a result of increased fuel prices and an economic recession. Real travel changes occurred within this period including reduced vacation travel and higher peak ridership for transit. If the recession persists, people may continue to scale back their travel and work patterns may change as the newly unemployed look for work or move to service jobs and/or part-time employment.

Adding to the trends toward less traditional working arrangements will be the growing number 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 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.

Immigration patterns affect the US workforce. 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 (Pisarski, 2006). 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.

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 likely to grow over time.

Another traditional characteristic associated with travel demand is family structure, especially the presence of children. Family structure is an important influencer of travel demand as the presence of children equates to a greater number of driver trips in the households. For the first time, however, the proportion of households in the US with children is declining--currently, the fastest growing household type in the US is single person households.

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 transportation finance, congestion, and air quality policies. However, the true 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.

Looking at the mix of purposes during the peak helps planners understand how many trips might be shifted from peak period through pricing and other congestion mitigation strategies. The characteristics of these peak travelers is important in estimating the potential success of new programs and policies. 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.

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). Overall, both higher-income workers and lower-income non-workers are over-represented in peak non-work travel

In order to really understand the ‘Mandatory’ or ‘Flexible’ nature of individual travel choices, new data is required, and new techniques are 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 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, well-informed, and focused. 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. These commutes, including any and all short stops, are linked together and coded as ‘Mandatory’ in this analysis. All of the ‘Flexible’ travel analyzed is not linked to a work commute.

One data gap is 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).

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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