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Trips Underway by Time of Day by Travel Mode and Trip Purpose for Metropolitan Chicago

Weekday Accumulations of Trips in Motion

Analysis of 2007 Travel Tracker Household Travel Inventory

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CMAP Congestion Management Process

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Introduction

This paper uses 2007 *Travel Tracker* household travel inventory data to compile a picture of weekday travel underway by time of day in the Chicago region. These charts illustrate travel behavior in the Chicago region by mode, purpose, and time.

Potential uses for this information include emergency management planning ("how many people might be in transit if a disaster struck at this time?") and congestion management ("How many users are in the system at a particular time? Why are they traveling? Might they travel in a way that reduces congestion?"). Broadly, these charts help deepen the understanding of the Chicago region's transportation system and inform the policy response to the region's traffic congestion. The charts do not answer congestion issues directly, but provide a resource demonstrating the scale and timing of travel in the context of why people travel and the means of transportation employed.

Perhaps most interestingly, the data shows how "peak spreading," or changing the times of peak-period trips to "shoulder" periods before and after the peaks, actually plays out in terms of trip purposes and time of day. There are large numbers of trips before the traditional work-trip peak period near 5:00 p.m. The afternoon peak shown in this paper's charts is now quite long in duration, with a definite peak shortly after 5:00 p.m. This is consistent with prior CMAP analyses. Any substantial regional congestion relief from peak spreading in the afternoon might need to come from delaying trip-making until after 6:30 or even 7:00 p.m., a proposition that would need more study.

Further analysis of the data shows other opportunities for travel demand management to reduce highway traffic congestion. Examination of the charts show that afternoon peak work-to-home trips mirror morning trips to work in the sharp peak shape, but there is more non-work travel taking place in the afternoon peak than in the morning. This causes additional afternoon congestion. Focusing travel demand management on the work-trip commutes in the afternoon peak is one option and this might be more effective in trip-reduction than we have been assuming, since there is less work-trip peak spreading than the lengthened afternoon peak period would have suggested. Alternatively, policies could be instigated that are tailored to affect the timing of non-work trips. Understanding the characteristics of the travel in the region will allow for more effective traffic management programs.

The charts in this paper can be used as a resource for policy analyses. For example, the data indicate how many more vehicle trips might be underway in peak periods if school busing were reduced because of the financial constraints in local communities. Another example is the school day—one can quickly discern from the data that delaying school dismissal times in the afternoon may exacerbate afternoon peak traffic congestion by having more non-work trips underway during the work-trip peak, while extending the school day with earlier arrivals might reduce morning peak congestion. Other such information can be discerned from the charts, subject to further, more in-depth policy evaluations.

Summary of Methods

The *Travel Tracker* sample survey of households resulted in a database of trips with associated weights that, taken together, can be used to analyze large-scale travel patterns in the Chicago region. The charts in this paper were developed by totaling trips in motion for each five-minute increment. These totals are compiled by the travel mode (often called the means of transportation) and by the purpose of the trip. The results are running totals of travelers in motion among residents living in households, shown by time of day, trip purpose, and travel mode for weekdays. For the charts in this paper, moving averages over running twenty-five minute intervals were used to make the charts readable and to account for the lumpiness of reported starting and ending times in the travel survey data (reported trip times started at the half-hour at disproportionate rates).

The data shown here represents Chicago-region household behavior. Other travel demand, such as freight handling and travel with termini outside of the region, are not included in the charts here. However, most travel is associated with households.

Note that the data shown here does not represent mode share in the classic sense of the share of trips initiated, but rather the number of trips underway at a particular point in time. Trips underway will be a function of the mode share and travel speed. In turn, the travel speed will be a function of service and facility characteristics, the beginning time of the trip, and the number of users. Thus, for example, because buses are generally slower than autos, the proportion of bus passengers underway to all travelers underway will be greater than the proportion of bus trips to all trips.

This report analyzes the data based on purpose and travel mode. Further, trip purpose is analyzed in two ways. For the charts at the beginning of the report, the analyses focused on "trips," while charts toward the end concentrate on "tours." "Trips" are defined as travel from one location to another. Each stop for an activity, or change in mode, ends the trip. Trips have an individual mode and purpose. "Tours," sometimes called "trip chains," are a series of individual trips linked together. In this paper, the last few charts depict work tours. These tours may include changes in mode or other stops en route to and from work.

Travel Tracker is posted at http://www.cmap.illinois.gov/TravelTrackerData.aspx. Previous reports by the Congestion Management Process on Travel Tracker data include the *Revised CMAP Weighting Methodology* (http://www.cmap.illinois.gov/uploadedFiles/regional_data/TravelTrackerSurvey/TravelTrackerWeighting.pdf) and *Chicago Regional Household Travel Inventory: Mode Choice and Trip Purpose for the 2008 and 1990 Surveys* (http://www.cmap.illinois.gov/WorkArea/DownloadAsset.aspx?id=20564). Travel tracker survey data was collected from January, 2007 to February, 2008.

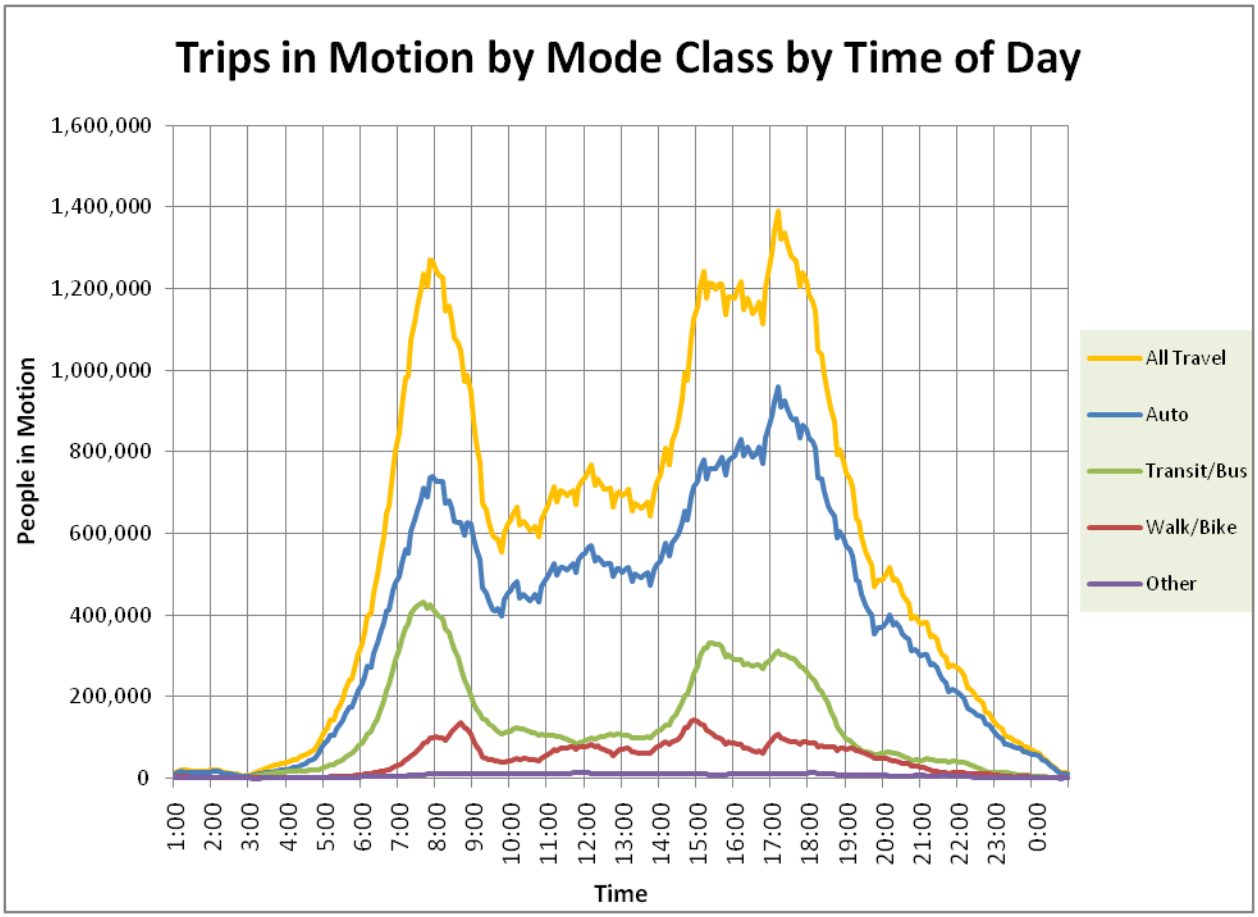
Trips in Motion by Travel Mode Class

Figure 1 shows the estimated number of trips in motion by residents of Chicago region households by broad categories of travel mode by time of day. The number of trips by travel mode are not displayed cumulatively here. Looking at the total number of travelers in motion (the yellow line in Figure 1), the chart shows two daily peaks of household travel in the region, with the afternoon peak being much longer in duration and having a greater number of peak trips in motion than the morning peak.

This chart supports the following observations:

- The number of auto travelers in the afternoon peak is much greater than in the morning peak, but transit usage (including school buses) peaks in the morning.
- Afternoon peaks for auto and transit modes are longer in duration than morning peaks.
- Walking and bicycle trips in motion peak during the school travel peaks, though substantial numbers of these trips also occur during the afternoon commute trip peak after 5:00 p.m.

Figure 1. Trips in Motion by Mode Class



Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average.

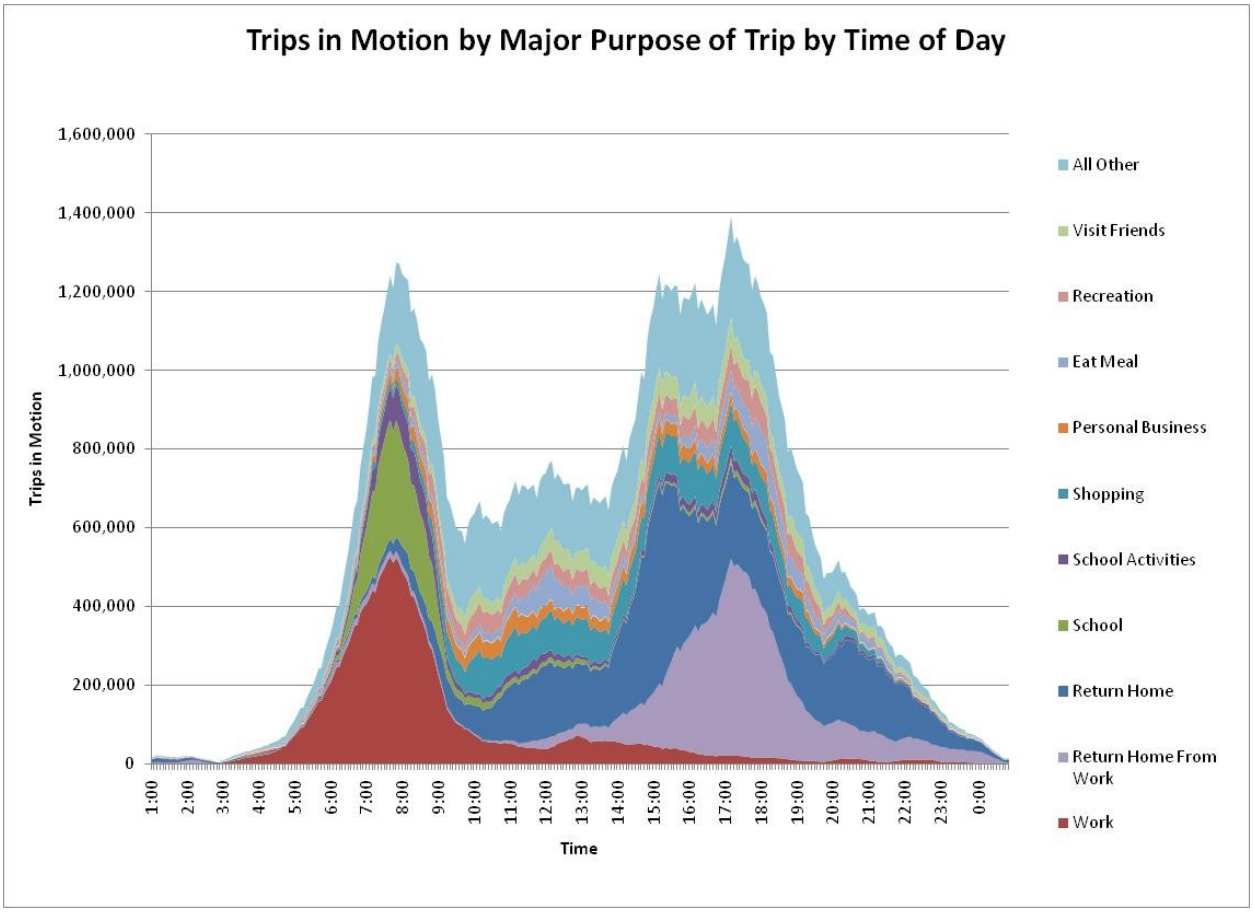
Trips in Motion by Major Trip Purpose

Figure 2 shows the estimated number of trips in motion by residents of Chicago region households by trip purpose. The data is shown cumulatively, with each purpose shown as part of a stack of many trip purposes. The cumulative total of these stacked values is, of course, equivalent to the total shown in Figure 1. Thus, the chart shows a sharp morning peak and a longer afternoon peak period.

We discerned the following from this chart:

- There is diversity in trip destinations throughout the day (recalling that the trips analyzed below may be part of larger tours, or trip chains, with multiple destinations). Trips to work are less than half of the trips in motion during the morning peak, though they are the largest single trip purpose then. Trips to school make up a substantial number of trips in the morning peak.
- The number of trips in motion during the mid-day is greater than the shoulder periods before the morning peak and after the afternoon peak travel period.
- The afternoon peak shows a greater diversity of trip purposes than the morning.

Figure 2. Trips in Motion by Detailed Trip Purpose, Chicago Region, 2007



Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average.

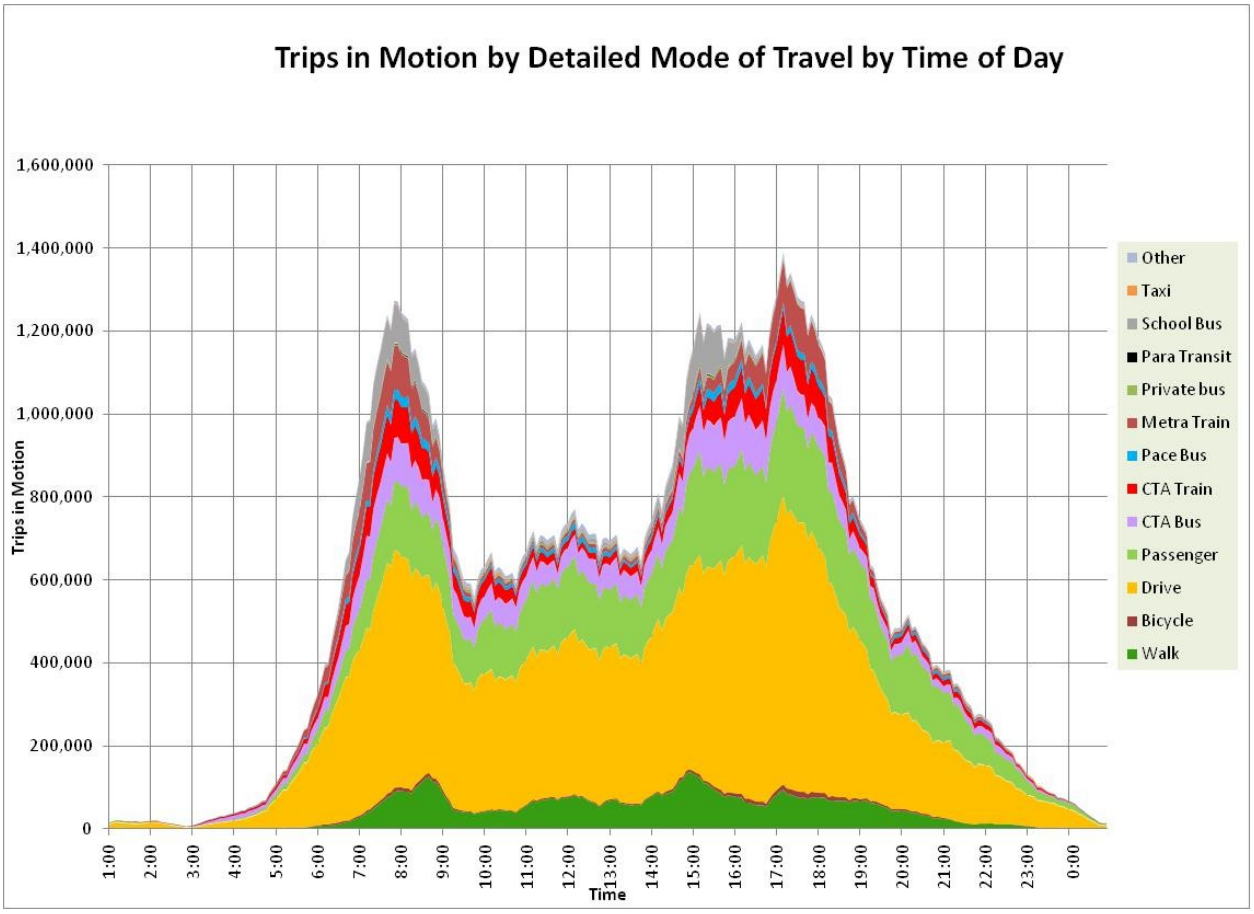
Trips in Motion by Detailed Mode of Travel

Figure 3 shows the estimated number of trips in motion by residents of Chicago region households by detailed mode of travel. Like in Figure 2, the data is shown cumulatively, or in stacked format, in Figure 3. Figure 3 breaks out the detailed travel modes from the mode classes depicted in Figure 1.

Information conveyed by this chart includes the following:

- Most of the non-motorized trips in the region are by walking, rather than bicycle. The daily peaks in non-motorized travel correspond to school travel and peak transit periods.
- A large share of automotive trips are in the passenger mode. Afternoon automotive passenger trips are greater in number than such morning trips.
- Among transit agencies, CTA buses and trains deal with a larger portion of midday and early afternoon peak travel than Metra rail services.
- School buses accommodate a discernable number of student travelers in the morning and early afternoon peak periods.

Figure 3. Trips in Motion by Detailed Mode of Travel, Chicago Region, 2007



Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average.

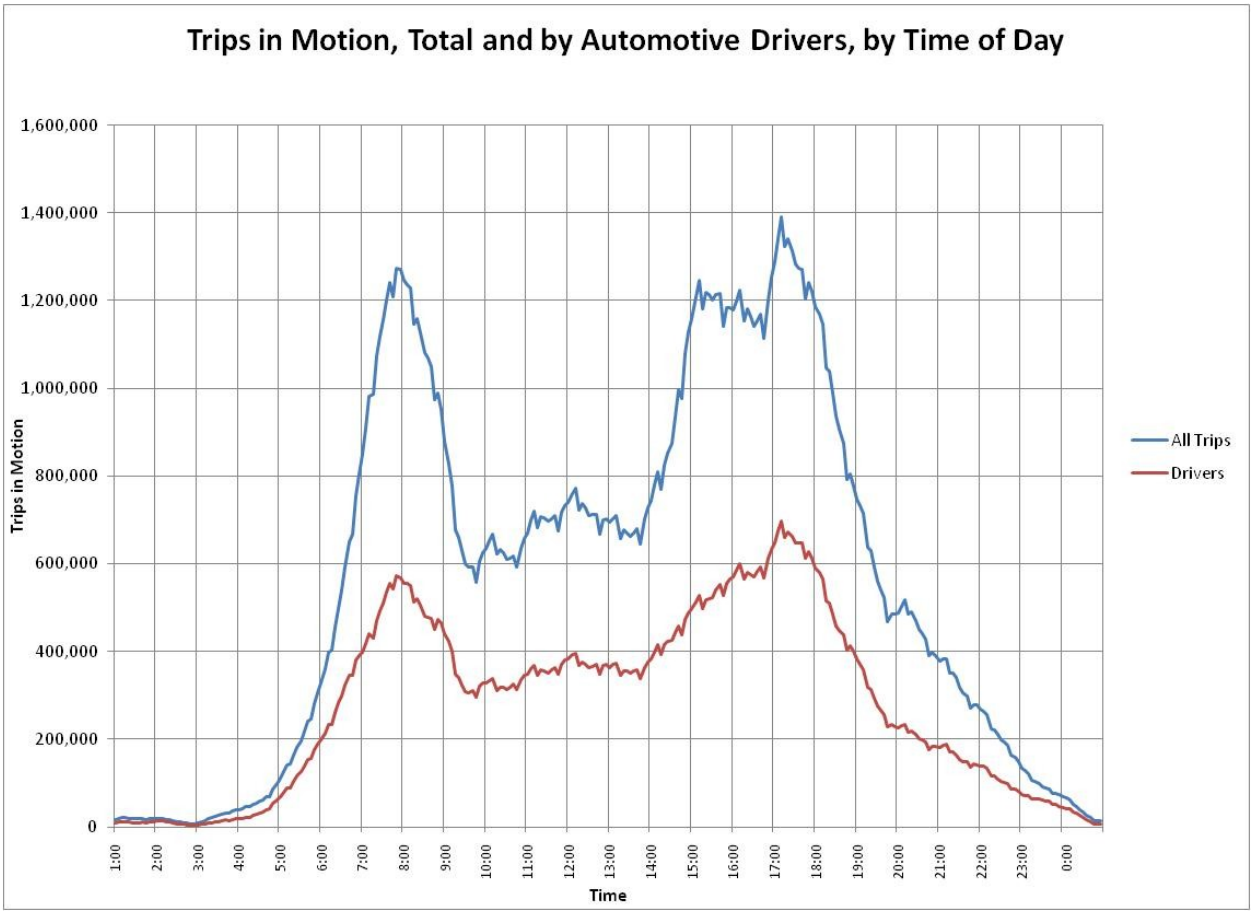
Trips in Motion by Automotive Drivers

Figure 4 shows the estimated total number of trips in motion and trips in motion by automotive drivers by residents of Chicago region households by time of day.

We noted the following from this chart:

- The chart shows that, among the region's household residents that are traveling in the peak periods, slightly less than half of those traveling are driving.
- The ratio of those driving to total travelers rises slightly in the mid-day and in the evening shoulder period relative to the peak period.
- Driving does not have the extreme peak levels relative to mid-day travel activity levels that are discernable in total travel peaks. Thus, alternatives to driving appear to accommodate a large part of the increased travel in peak periods.

Figure 4. Trips in Motion, Total and Automotive Drivers, Chicago Region, 2007



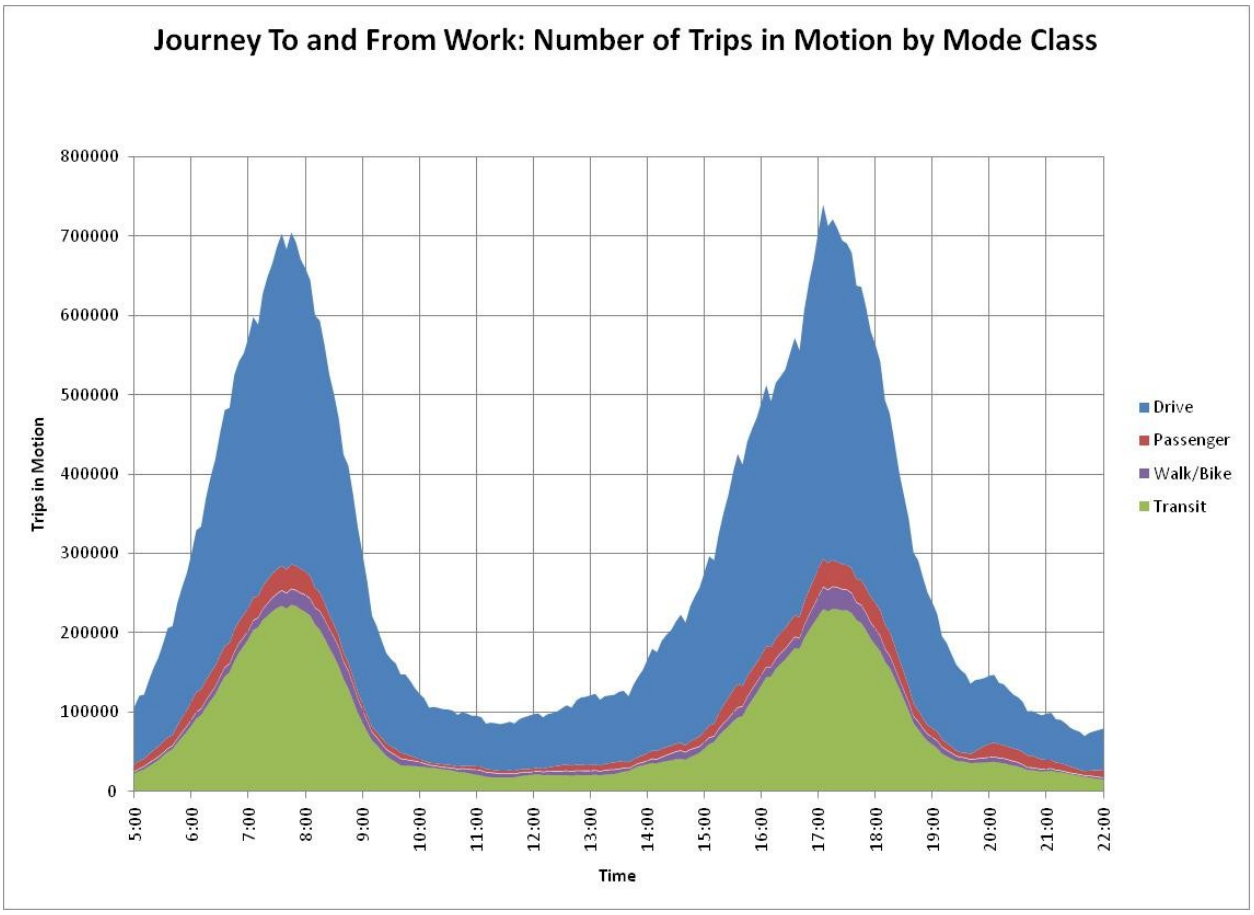
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average.

Trips in Motion by Travel Mode Class for the Journey to and from Work

Figure 5 shows the number of trips underway that are part of the journey to work by residents of Chicago region households by generalized mode of travel. The data is shown cumulatively, or in stacked format, in Figure 5. Here is key information related to this chart:

- Unlike total travel as charted in previous figures, afternoon work trips peak in a pronounced way. Afternoon work-trip peak travel is greater, but comparable to morning work-trip peak travel in duration and extent.
- The journey to work is dominated by driving an automobile. In peak periods, from 55% to 60% of work trips underway are estimated to be by drivers, rising to more than 70% in mid-day off-peak periods.
- Transit is also a major mode of travel for the journey to work, accounting for about 35% of work trips in motion in peak periods, dropping to around 20% during the mid-day period.
- Other alternatives to driving, like walking and ridesharing, do not play a large role in travel to and from work, and are typically about 10% of trips underway.

Figure 5. Trips in Motion by Travel Mode Class, Trips To and From Work,



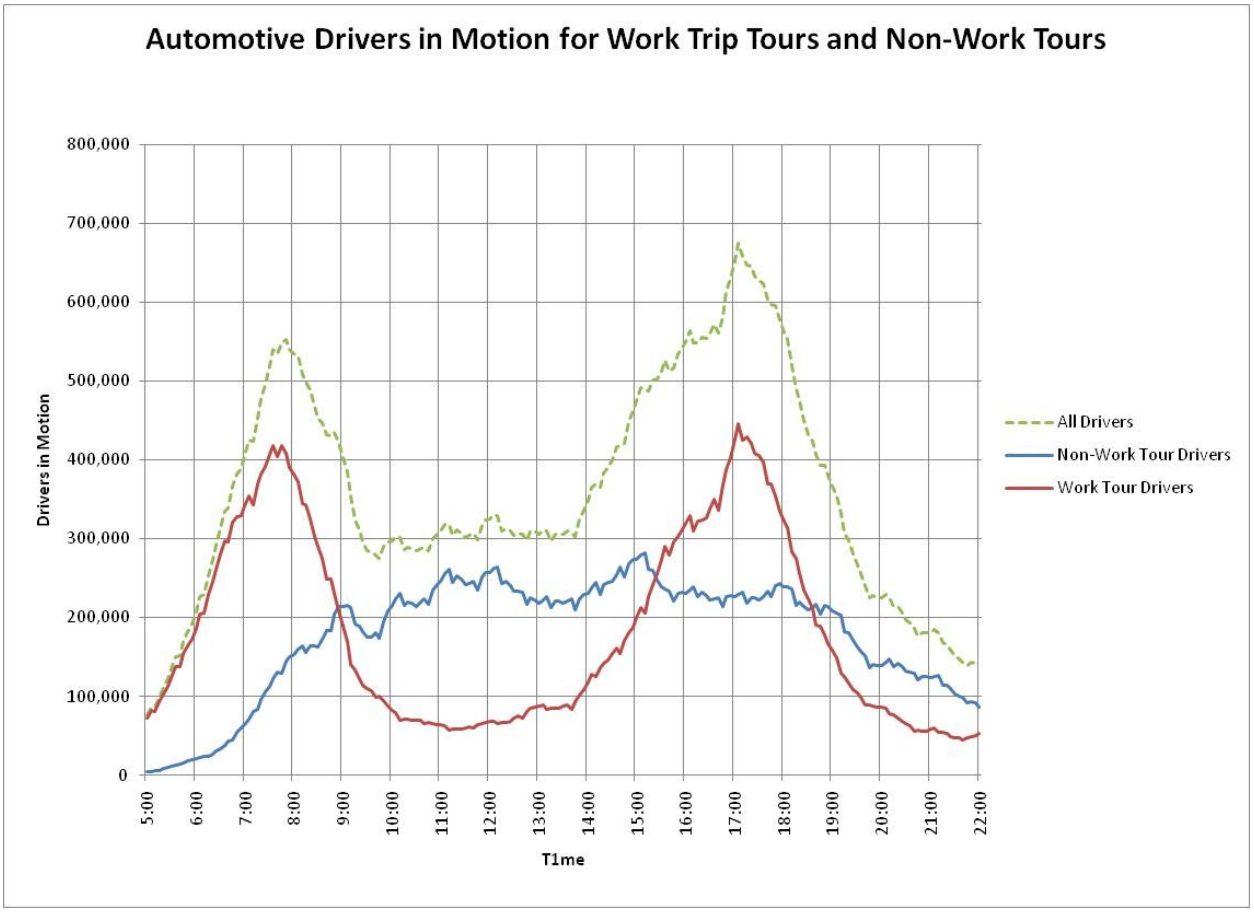
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown here for times from 5 a.m. to 10 p.m.

Drivers in Motion, Work-Trip Tours, and Non-Work-Trip Tours, by Time of Day

Figure 6 shows the estimated number of drivers in motion among residents of Chicago region households by whether the trip is part of a work trip tour. Here are some observations from this chart:

- Non-work-trip tours for automotive drivers do not peak in the same way that work-trip tours peak.
- Non-work-trip tours tend to be greater in the afternoon peak than in the morning peak period, particularly in the early part of the morning peak period. Thus, the total number of drivers on the road in the afternoon peak period is substantially higher in the region than in the morning peak period.

Figure 6. Automotive Drivers in Motion for Work-Trip Tours and Non-Work-Trip Tours, Chicago Region, 2007



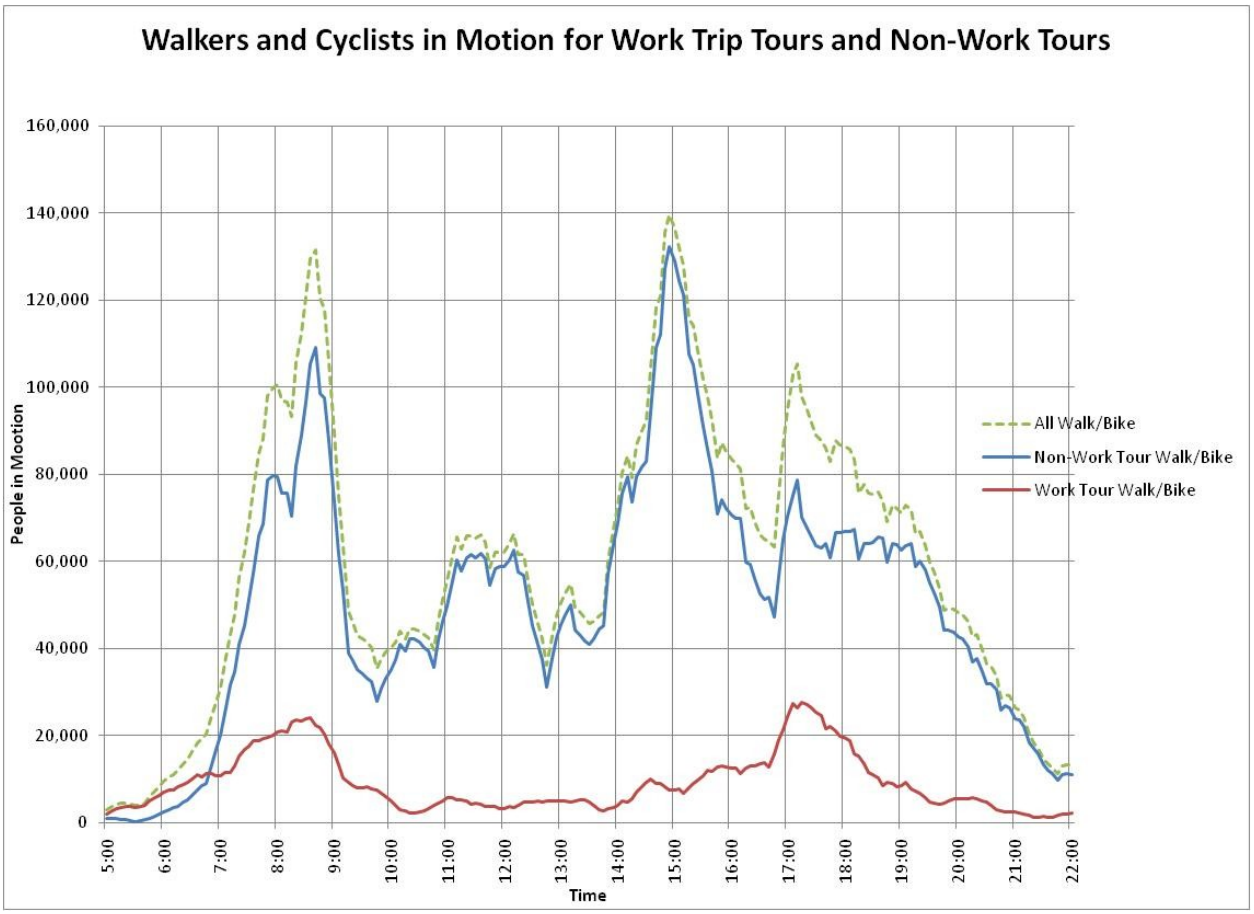
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown here for times from 5 a.m to 10 p.m.

Walkers and Cyclists in Motion, Work-Trip Tours, and Non-Work Tours, by Time of Day

Figure 7 shows the estimated number of non-motorized travelers in motion among residents of Chicago region households by whether the trip is part of a work-trip tour. Figure 7 shows that:

- Most non-motorized trips underway are not part of work trip tours, except very early in the morning.
- Non-work-trip tours for walkers and cyclists peak in a way consistent with substantial numbers of such trips being to and from school.
- Walking and cycling trips part of work-trip tours have a twice-daily peak, with the greatest number of travelers in motion shortly after 5:00 p.m., consistent with other commute patterns.
- A large number of non-motorized non-work-trip tours are underway in the late morning and in the early evening.

Figure 7. Walkers and Cyclists in Motion for Work Trip Tours and Non-Work Trip Tours, Chicago Region, 2007



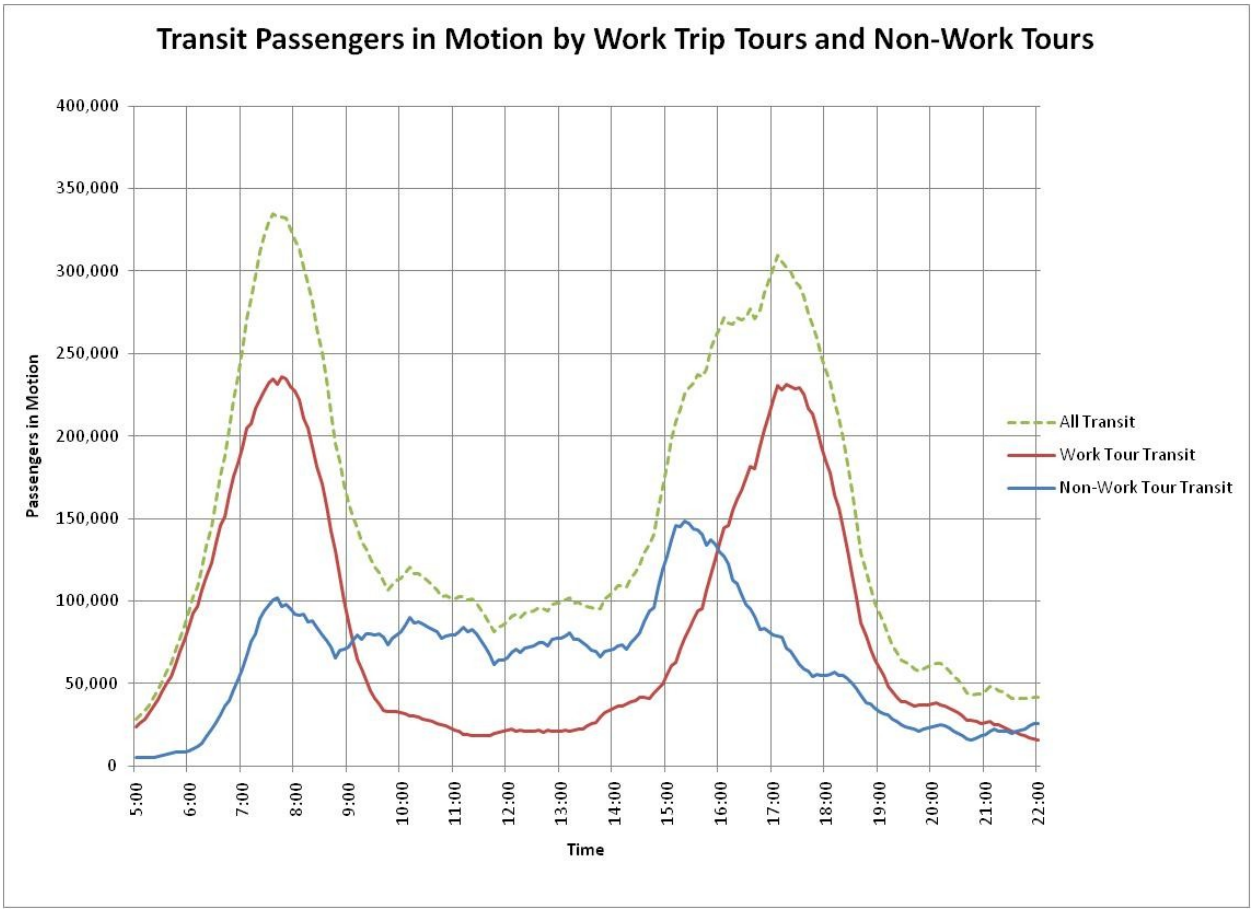
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown here for times from 5 a.m. to 10 p.m.

Transit Passengers in Motion, Work-Trip Tours, and Non-Work Tours, by Time of Day

Figure 8 shows the estimated number of transit passengers in motion among residents of Chicago region households by whether the trip is part of a work-trip tour. Figure 8 demonstrates the following:

- Transit passenger work trips underway have a twice-daily pattern similar to other commute patterns, with peaks before 8:00 a.m. and after 5:00 p.m.
- Transit passenger non-work trips underway peak during school-trip periods.
- Substantial non-work mid-day travel takes place, but early morning and evening non-work trips in motion trail off to lower levels.
- As noted in Figure 5, the mid-day work trips in motion by transit passengers are not particularly large in number.

Figure 8. Transit Passengers in Motion for Work Trip Tours and Non-Work Trip Tours, Chicago Region, 2007



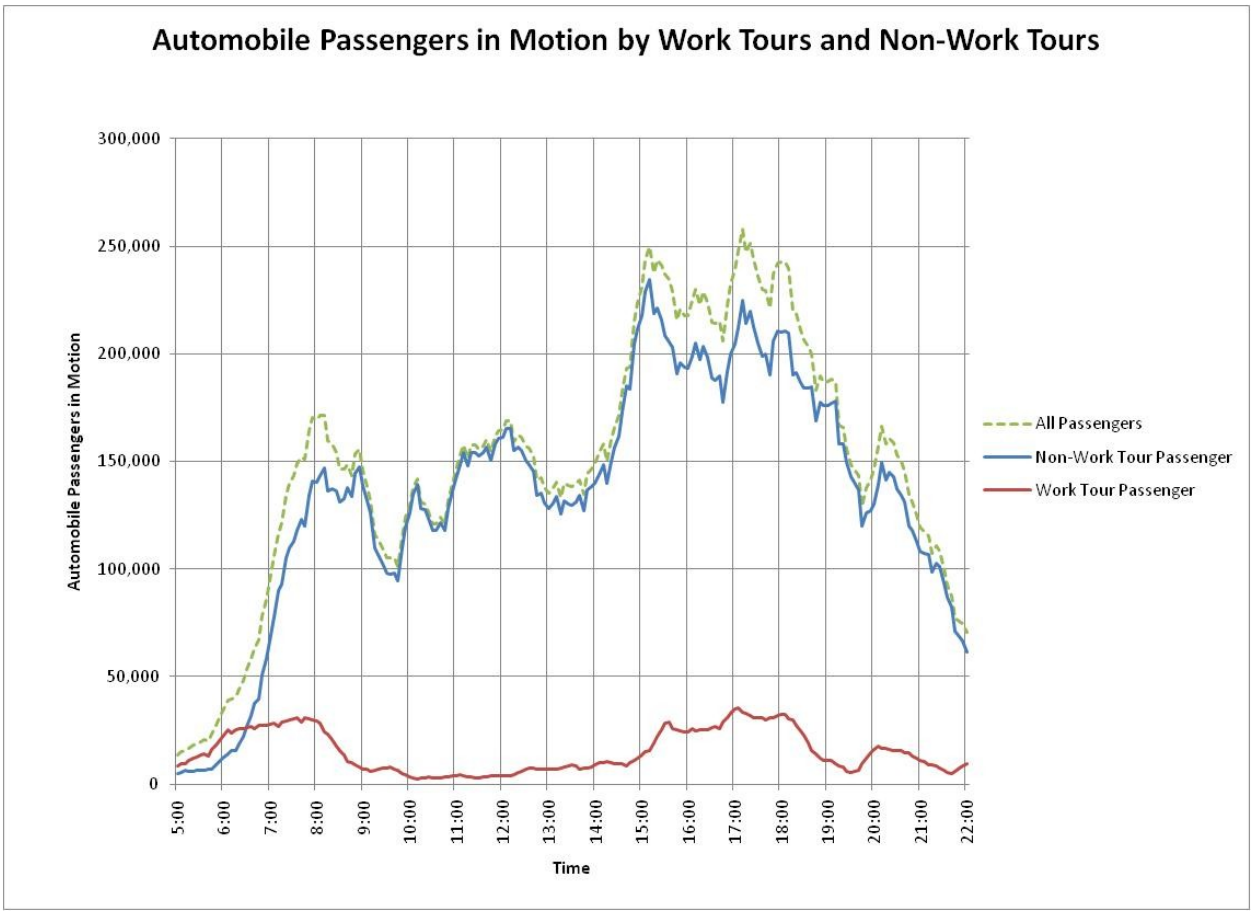
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown for times from 5 a.m. to 10 p.m., and includes school buses.

Automobile Passengers in Motion, Work Trip Tours, and Non-Work Tours, by Time of Day

Figure 9 shows the estimated number of automobile passengers in motion among residents of Chicago region households by whether the trip is part of a work trip tour. Note that, for the purposes of this paper, automobile passengers are differentiated from automobile drivers. Here is key information regarding Figure 9:

- Automobile passengers in motion are much greater for non-work trips than for work trips. Analyses of these data indicate that work-trip automobile occupancy is typically 1.1 for morning and afternoon peak commuting periods, and slightly less during shoulder periods preceding these peaks. Non-work-trip automobile vehicle occupancy ranges for 1.4 to 1.6 for the morning commute and mid-day periods, then increases to range between 1.7 to as high as 1.9 for the afternoon commute and evening time periods.
- While there are discernable peak periods for non-work travel by automobile passengers in motion after 8:00 a.m. and after noon, the greatest number of such travelers in motion occur in the late afternoon and evening hours, with the greatest peak after 3:00 p.m.

Figure 9. Automobile Passengers in Motion for Work Trip Tours and Non-Work Trip Tours, Chicago Region, 2007



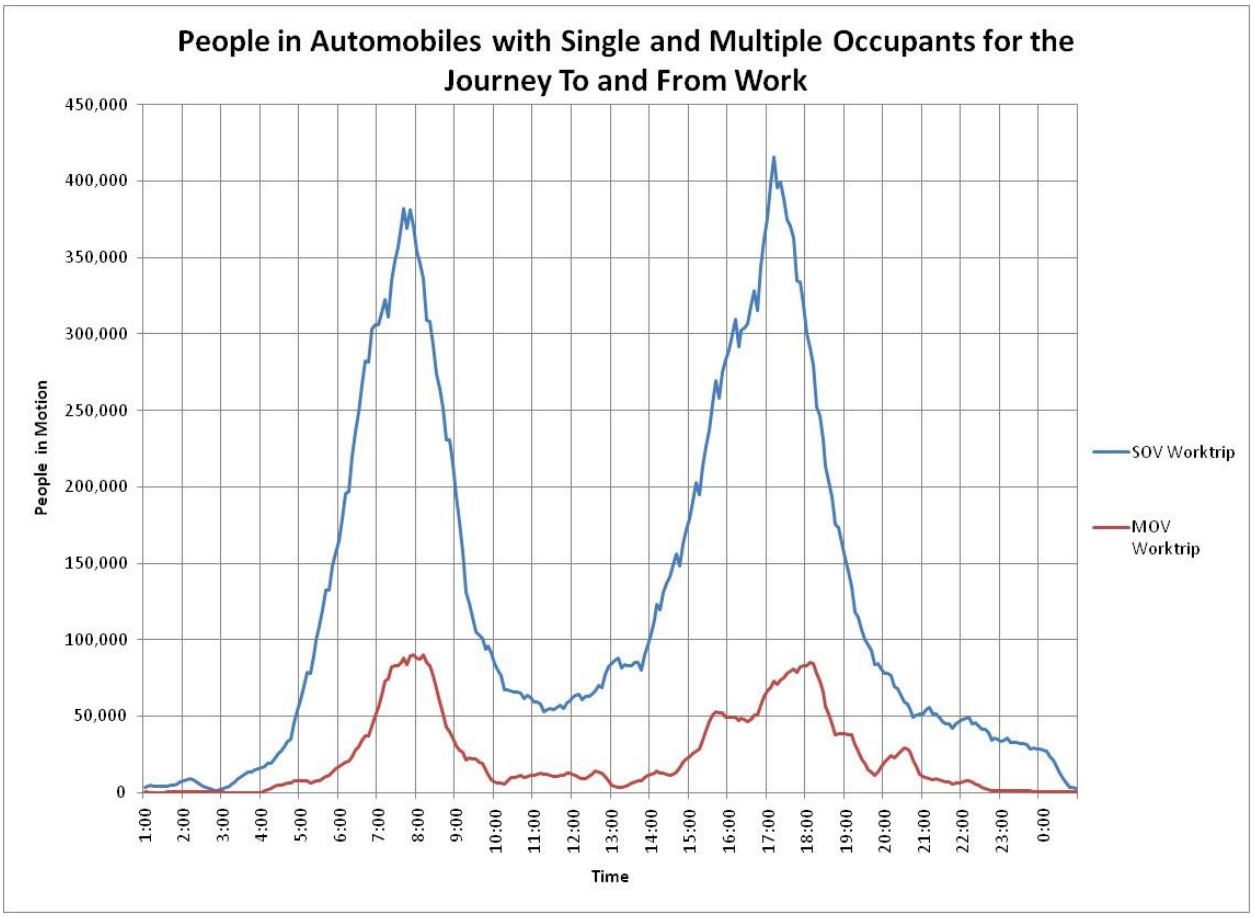
Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown for times from 5 a.m. to 10 p.m. Compare Figure 7.

People in Automobiles for Work Trip Tours, Single-Occupant and Multiple Occupant

Figure 10 shows the estimated number of people en route to or from work in automobiles among residents of Chicago region households by whether the vehicle is carrying passengers (MOV work trips) or not (SOV work trips). Note that, for the purposes of this paper, automobile passengers are differentiated from automobile drivers. Figure 10 supports a number of observations:

- The number of multiple-occupant work trips is much smaller than the number of single-occupant work trips among those using an automobile for the work trip.
- The peak period travel pattern for work trips in multiple-occupant vehicles is not so different from the work-trip travel pattern for single-occupant vehicles as to preclude the study of additional rideshare facilitation and promotion to reduce peak-period commute congestion.

Figure 10. People in Automobiles with Single and Multiple Occupants for Work Trip Tours, Chicago Region, 2007



Source: CMAP. Data represents travel by residents of Chicago region households on weekdays in 2007, depicted as a 25-minute moving average. This data is shown for times from 5 a.m. to 10 p.m.

Summary
Congestion Management Process

Summary
This paper used the 2007 *Travel Tracker* household travel inventory to compile weekday travel taking place by time of day in the Chicago region. The data was compiled by the mode and by the purpose of the trip. The results are a compilation of travel underway by time of day among Chicago region residents living in households, representing a substantial part of the travel taking place.

These charts help to illuminate the travel behavior in the Chicago region. The data demonstrates opportunities and challenges for transportation management to reduce highway traffic congestion.

CMAP Congestion Management Process
Chicago Metropolitan Agency for Planning (CMAP) was established in 2006 to integrate planning for transportation and land use in the seven metropolitan Chicago counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will. CMAP's transportation initiatives include a congestion management process that addresses highway congestion and transportation management among other highway performance issues and strategies.