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How People Use Their Vehicles: Statistics from the 2009 National Household Travel Survey

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ABSTRACT

The 2009 U.S. National Household Travel Survey (NHTS) contains detailed data on individual vehicle trips. This paper demonstrates several useful statistics from the NHTS concerning how people use their vehicles, such as how far they drive, where they go, how long they stay, and their sequence of destinations. These statistics, in turn, are potentially useful for vehicle design, vehicle use simulation, navigation algorithms, interpreting GPS data, and the placement of electric vehicle charging stations.

INTRODUCTION

To understand how people use their vehicles, it is important to know statistics about daily vehicle trips. This paper summarizes such statistics derived from the 2009 U.S. National Household Travel Survey (NHTS) [1]. The NHTS is conducted by the American Federal Highway Administration, and consists of phone surveys given to over 150 thousand U.S. households concerning a single travel day for each household. While deriving travel statistics from the NHTS is not uncommon, this paper is novel in that it concentrates on vehicle-centric statistics rather than person-centric or household-centric statistics. The paper shows statistics on the length of vehicle trips, the amount of daily driving, the popularity of different destination types, where vehicles go as a function of the time of day, destination sequences, and destination dwell times. The statistics are useful for vehicle design, vehicle use simulation, navigation algorithms, interpreting GPS data, and the placement of electric vehicle charging stations. An appendix gives the specific queries used in this paper for data mining the NHTS.

The next section describes the NHTS, followed by sections giving the details of specific vehicle use statistics derived from the survey.

THE 2009 NATIONAL HOUSEHOLD TRAVEL SURVEY

The 2009 NHTS is the latest in a sequence of such surveys, with another NHTS conducted in 2001 and National Personal Transportation Survey conducted in 1969, 1977, 1983, 1990, and 1995 [2]. The 2009 NHTS data and documentation are freely available on the NHTS Web site at http://nhts.ornl.gov. The 2009 NHTS includes data for 150,147 households in the U.S. Households were contacted based on randomly generated telephone numbers, and each participating household member filled out a travel survey for an assigned date for their household. In addition to data about the household's demographics and vehicles, the survey asked for specific trip data regarding all trips taken over a 24-hour period starting at 4 a.m. on the assigned day.

The NHTS has been used previously to assess vehicle accident risk [3], look at the travel patterns of older Americans [4], and analyze rural mobility [5].

The survey data is contained in four different, but related, database tables. Because this paper concentrates on vehicle trips, all the statistics presented here come from the “Travel Day Trip File”, which contains one record for each trip reported by each interviewed person on the household's assigned travel day. The other three tables give details on the households, people, and vehicles respectively.

While the survey covers all modes of transportation, including public transportation, this paper concentrates only on trips made in vehicles normally used for personal travel.

Specifically, the queries included only vehicle types in the set of {automobile/car/station wagon, van (mini, cargo, passenger), sports utility vehicle, pickup truck, other truck, recreational vehicle, motorcycle}, and excluded the other possible vehicle types {refused to answer, don't know, not ascertained, golf cart, other}. The Appendix gives the specific database queries used for deriving the statistics presented in this paper.

Since this paper concentrates on vehicles, as opposed to people or households, it was important to avoid double-counting the same trip reported by different people in the same household. For this reason, the statistics are based only trips that were reported by the vehicle's driver, on the assumption that there was only a single driver for each trip.

Each trip in the survey is accompanied by a numerical weight. These weights are intended to account for the inevitable unevenness in the spread of survey respondents over dates and geography. All the statistics reported in this paper make proper use of the weight variable associated with each trip record.

The following sections describe different vehicle use statistics derived from the NHTS, starting with statistics on driving durations and distances.

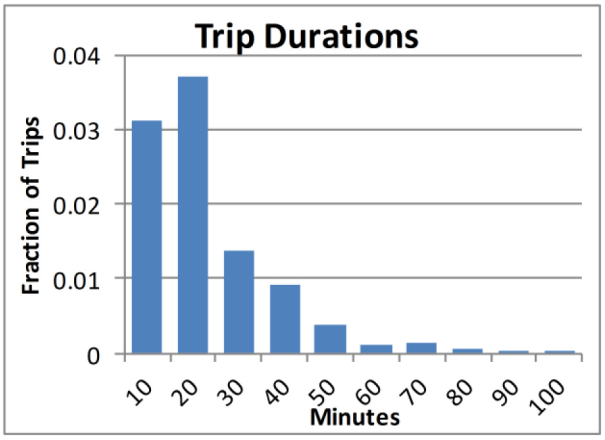


Figure 1. These are histograms of trip durations and distances. The horizontal axis labels give the maximum of each histogram bin.

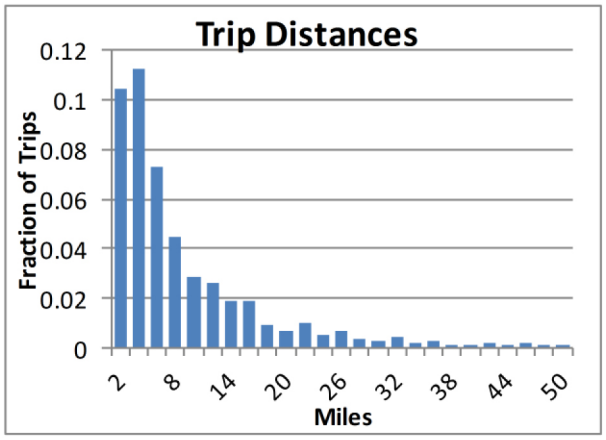
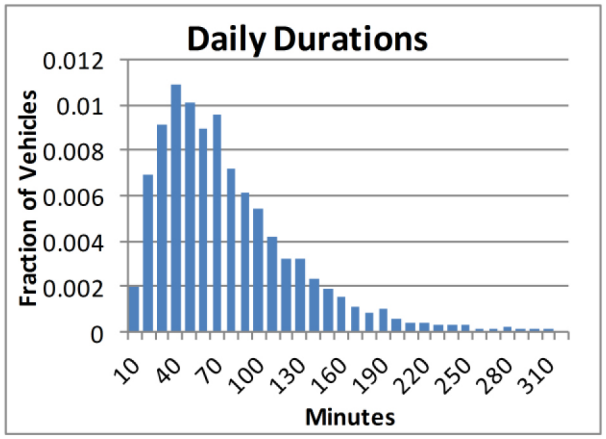


Figure 1 (cont.). These are histograms of trip durations and distances. The horizontal axis labels give the maximum of each histogram bin.



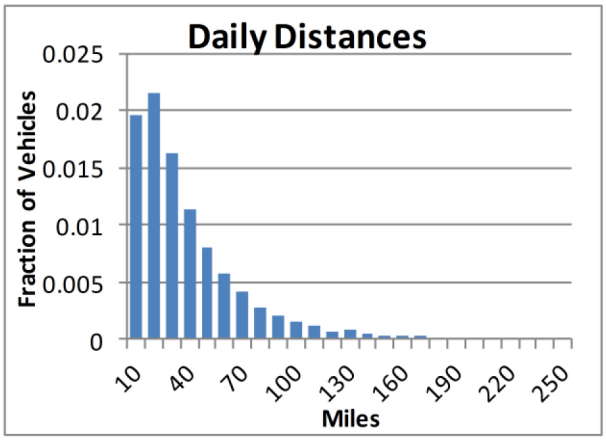


Figure 2. These are histograms of daily driving durations and distances for vehicles

DURATION AND DISTANCE DISTRIBUTIONS

The mean trip length over all the reported vehicles is 18.1 minutes and 9.3 miles. Daily, the mean driving length is 74.9 minutes and 38.4 miles. Histograms of trip durations and distances appear in Figure 1, and histograms of daily driving durations and distances appear in Figure 2. Note that all the histograms exhibit their maximum near, but not at, the left-most bin, followed by a smooth decay into a long tail as the duration or distance increases. For the trip distributions, this implies that slightly longer trips are more common than the shortest ones. A trip duration distribution, such as in Figure 1, is important for algorithms that predict a vehicle's destination in real time, because the distribution is used to compute a prior probability for each destination candidate [6].

The database query statements used to derive these statistics and histograms appear in the appendix as queries (1) and (2).

One interesting aspect of the trip duration reports from the NHTS is that a disproportionate number of them give the trip duration as a whole multiple of five minutes. In fact, according to query (3) in the Appendix, almost 72% of the reported trip durations are evenly divisible by five minutes. One would expect this fraction to be 20% instead (durations ending in zero and five) if the durations are random. This implies that drivers often estimate their trip duration to the nearest five minutes. This is one hazard of a self-reported study like the NHTS.

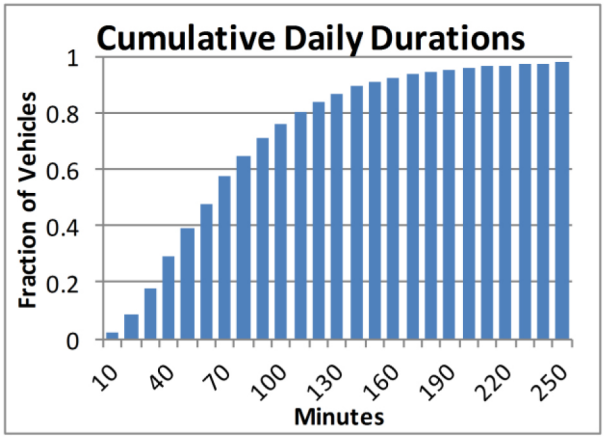


Figure 3. These are cumulative histograms of daily driving durations and distances for vehicles.

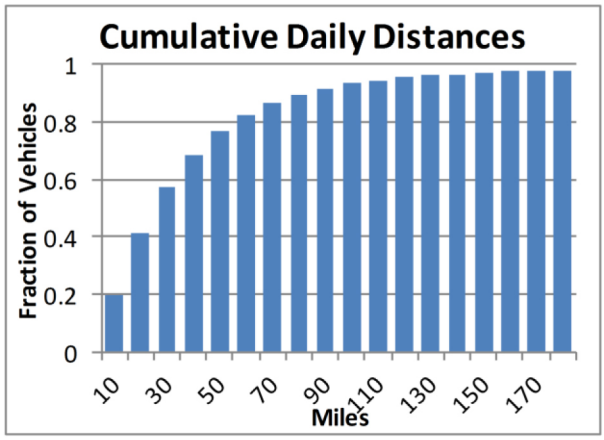


Figure 3 (cont.). These are cumulative histograms of daily driving durations and distances for vehicles.

For vehicles with limited range, such as electrics, the cumulative daily driving lengths are important. These are shown in Figure 3 for both daily durations and daily distances. From the cumulative distance distribution, it is apparent that a vehicle with a 60-mile range would be adequate replacement for about 83% of vehicles in the survey, assuming a daily recharge. A range of about 80 miles would suffice for about 90% of the vehicles, and a range of 120 miles would suffice for 95%.

DESTINATIONS

For each trip, the NHTS gives a "WHYTO" field that gives the purpose or destination of the trip. Destination statistics are important for simulating trips and for predicting a vehicle's trajectory. This section of the paper contains an analysis of trip destinations based on the 2009 NHTS.

DESTINATION POPULARITY

Certain types of destinations are more popular than others. The list of 35 destination types in the 2009 NHTS, sorted by popularity, appears in Table 1. The most popular destination is "Home", which accounts for about 34% of all trips. This is followed by "Buy goods: groceries/clothing/hardware store", which accounts for an additional 12% of trips. In third place is "Go to work", accounting for 11%. The three least popular trips, in order of decreasing popularity are "Transport someone", "Go to library: school related", and "OS - Day care". There is also a category in the NHTS called "Work", which was attached to only one trip out of all 1,167,321 trips reported in the survey. This appears to be a coding mistake, so it is omitted in this paper's analysis. The SQL query associated with this table is number (4) in the appendix.

Table 1. These are the relative popularities of different destination types for driving trips.

Destination	Proportion
Home	0.34438
Buy goods: groceries/clothing/hardware store	0.12029
Go to work	0.11231
Get/eat meal	0.04799
Drop someone off	0.03915
Pick up someone	0.03741
Visit friends/relatives	0.03699
Buy services: video rentals/dry cleaner/post office/car service/bank	0.03469
Other work related	0.02618
Buy gas	0.02140
Shopping/errands	0.01904
Go to gym/exercise/play sports	0.01792
Return to work	0.01770
Medical/dental services	0.01612
Go to religious activity	0.01446
Go out/hang out: entertainment/theater/sports event/go to bar	0.01327
Family personal business/obligations	0.01200
Go to school as student	0.01004
Coffee/ice cream/snacks	0.00796
Social/recreational	0.00744
Social event	0.00533
Rest or relaxation/vacation	0.00486
Attend meeting: PTA/home owners association/local government	0.00483
Use personal services: grooming/haircut/nails	0.00476
Take and wait	0.00340
Use professional services: attorney/accountant	0.00339
Visit public place: historical site/museum/park/library	0.00336
Attend business meeting/trip	0.00300
Pet care: walk the dog/vet visits	0.00270
School/religious activity	0.00207
Meals	0.00193
Attend funeral/wedding	0.00138
Transport someone	0.00076
Go to library: school related	0.00075
OS - Day care	0.00070

DESTINATION DISTANCES AND DRIVING TIMES

The average distance to different types of destinations varies with the destination type. Table 2 shows the average duration and average distance to the 35 different destination types. Generally, trips that are frequently in other towns or cities are the longest, with the first three being “rest or relaxation/ vacation”, “attend funeral/wedding”, and “attend business meeting/trip”. The shortest trips are to “coffee/ice cream/ snacks”, places that are almost commodity-sellers where nearness is likely a high priority. The SQL query associated with this table is number (5) in the appendix.

Table 2. These are the average driving times and driving distances to different destination types.

Destination	Average Minutes	Average Miles
Rest or relaxation/vacation	44.7	34.8
Attend funeral/wedding	36.5	24.4
Attend business meeting/trip	34.9	24.8
Visit friends/relatives	25.4	16.4
Other work related	24.4	13.3
Go to work	22.7	12.4
Go out/hang out: entertainment/theater/sports event/go to bar	22.3	11.9
Medical/dental services	21.7	10.0
Family personal business/obligations	21.7	11.5
Go to school as student	21.6	10.9
Social event	21.0	11.3
Social/recreational	21.0	11.1
Take and wait	20.3	10.2
Visit public place: historical site/museum/park/library	19.2	8.7
Home	18.7	9.1
Attend meeting: PTA/home owners association/local government	18.2	8.2
Use personal services: grooming/haircut/nails	17.0	7.5
Buy gas	16.2	9.5
Transport someone	16.1	7.8
Use professional services: attorney/accountant	16.1	7.6
Pet care: walk the dog/vet visits	15.7	6.7
School/religious activity	15.3	6.5
OS - Day care	15.2	7.0
Go to gym/exercise/play sports	15.2	8.7
Pick up someone	14.9	6.9
Shopping/errands	14.8	6.7
Drop someone off	14.3	6.4
Go to religious activity	14.2	6.3
Get/eat meal	14.1	6.3
Meals	13.6	6.1
Go to library: school related	13.5	4.7
Buy goods: groceries/clothing/hardware store	13.4	5.4
Buy services: video rentals/dry cleaner/post office/car service/bank	12.1	4.8
Return to work	11.4	4.6
Coffee/ice cream/snacks	10.4	4.5

DESTINATIONS VS. TIME OF DAY

It is expected that the popularity of destination types will vary throughout the day. This effect is shown in Figure 4, which shows the relative popularity of different destination types as a function of the time of day on weekdays. The overall height of each bar is proportional to the (weighted) number of trips at that time of day, and the color components of the bar represent the different destination types. From the height of the bars, it is clear that weekday trips have a peak in the morning between 7 a.m. and 8 a.m., mostly due to “Go to work”, and another in the evening, mostly due to “Home”. These are likely commuters driving from home to work and back. There is also a fairly significant number of trips over working hours to “Buy goods: groceries/clothing/hardware store”. There is the expected dearth of trips from 1 a.m. to 4 a.m.

On weekends, shown in Figure 5, the first peak occurs around noon. There are many fewer trips labeled “Go to work”. There are more “Buy goods: groceries/clothing/hardware store” during the day, and there are relatively more trips around the midnight hour than on weekdays.

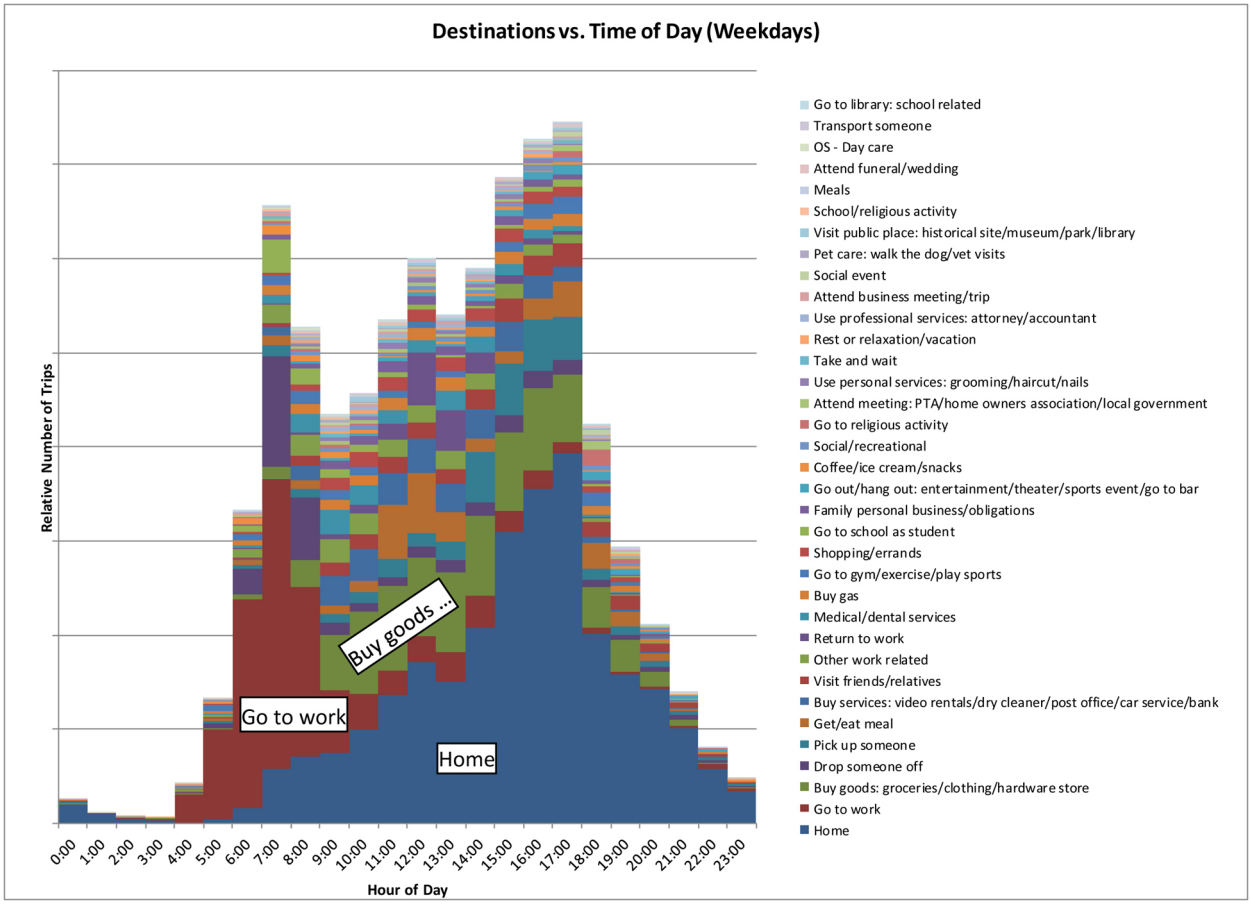


Figure 4. This shows the relative number of trips and their destination types as a function of the hour of the day on weekdays.

This type of analysis is important for making realistic simulations of a vehicle's daily trips and for helping to predict a vehicle's destination. It is also important for automatically interpreting GPS data: for example, an unknown destination that occurs repeatedly on weekday mornings is likely the driver's work place.

The query used to generate this data is query (6) in the appendix.

DESTINATION SEQUENCES

Vehicles visit destinations in sequence, and some sequences are more frequent than others. A faithful vehicle travel simulation would produce sequences that frequently match sequences from real vehicles. Table 3 shows the 10 most common 2-destination sequences for all vehicles from the NHTS. The most popular sequence, accounting for almost 9% of all 2-destination sequences is "Buy goods …" → "Home". Almost as popular is the second place sequence of "Go to work" → "Home". With 35 different destination types, there are $35^2 = 1225$ possible 2-destination sequences. If the sequences were uniformly distributed, each sequence's proportion would be $1/35^2 = 0.0816\%$. Thus, having two sequences whose proportion exceeds 8% indicates a strong skew toward certain sequences.

The results of a similar analysis for 3-destination sequences is shown in Table 4. There are $35^3 = 42.875$ possible 3-destination sequences, meaning that the proportion of each sequence would be 0.0023% if the sequences were uniformly distributed. Instead, the most common 3-destination sequence ("Home" → "Buy goods …" → "Home") occurs almost 3% of the time, which is over 1200 times the uniformly occurring rate.

The "Home" destination shows up quite frequently in the most popular sequences, confirming our intuition that home is an important base of operations for most drivers.

Query (7) in the appendix gives the SQL statements used to generate these sequence statistics.

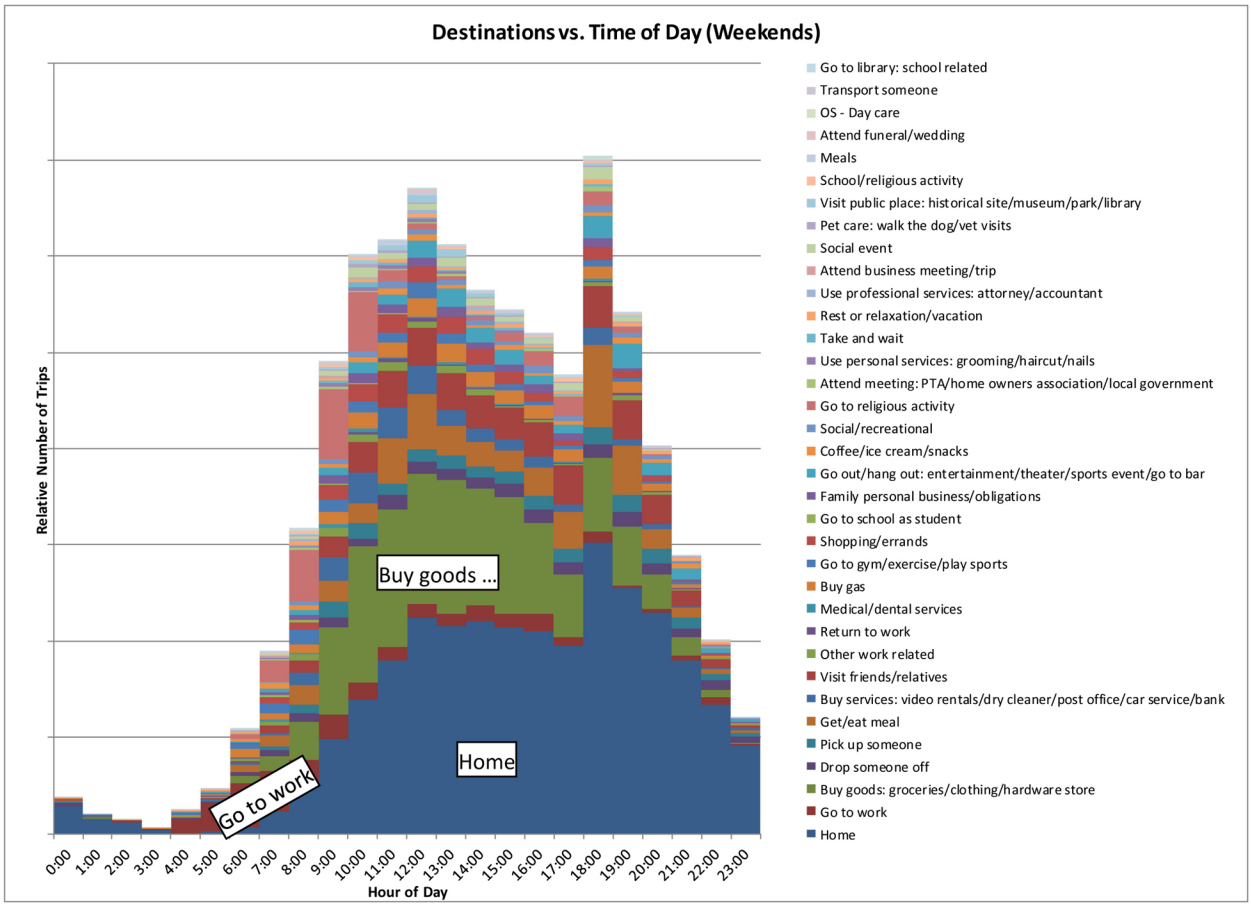


Figure 5. Relative number of trips and destinations types on weekends.

NEXT DESTINATION CONDITIONAL PROBABILITIES

Looking at destination sequences in a different way leads to conditional probabilities. Given a current destination, the NHTS can be used to estimate the probabilities of the next possible destination. This is shown in Table 5. It is clear that the most popular destination after any destination except "Home" is "Home". Vehicles are apparently driven home quite frequently no matter what the current destination is. Because of this uniformity, Table 5 also shows the second most likely destination for any given destination, where "Buy goods: groceries/clothing/hardware store" appears quite frequently. Probabilities like this are important for making realistic, yet random simulations of trip sequences as well as predicting a vehicle's next destination in real time.

These statistics were generated based on results from query (7) in the appendix.

DESTINATION DWELL TIMES

Another statistic derivable from sequences is the dwell time at each destination. Table 6 shows the weighted mean of the time each vehicle spent at each type of destination. As expected, dwells are longest at work and home. One interesting application of these dwell times is the choice of where to locate charging stations for electric vehicles. Charging can take a long time, and drivers may want to plug in while they are doing other things during the day. Based on Table 6, it would be unwise to put charging stations at destinations with short dwell times like video rental stores, dry cleaners, post offices, banks, coffee shops, ice cream stores, and snack outlets. In addition to the obvious places like home and work, charging stations would be useful at destinations with longer dwell times like theaters, sports events, bars, religious activities, gyms, and libraries.

The SQL statements to extract dwell times are given in query (8) in the appendix.

Table 3. The 10 most popular 2-destination sequences from the NHTS.

Sequence	Proportion
Buy goods: groceries/clothing/hardware store Home	0.0898
Go to work Home	0.0825
Get/eat meal Home	0.0296
Home Buy goods: groceries/clothing/hardware store	0.0293
Buy goods: groceries/clothing/hardware store Buy goods: groceries/clothing/hardware store	0.0290
Pick up someone Home	0.0260
Visit friends/relatives Home	0.0260
Drop someone off Home	0.0255
Home Pick up someone	0.0182
Buy services: video rentals/dry cleaner/post office/car service/bank Home	0.0177

Table 4. The 10 most popular 3-destination sequences from the NHTS.

Sequence	Proportion
Home Buy goods: groceries/clothing/hardware store Home	0.0293
Buy goods: groceries/clothing/hardware store Buy goods: groceries/clothing/hardware store Home	0.0219
Home Pick up someone Home	0.0164
Home Visit friends/relatives Home	0.0126
Home Get/eat meal Home	0.0124
Home Go to work Home	0.0108
Buy goods: groceries/clothing/hardware store Home Buy goods: groceries/clothing/hardware store	0.0104
Buy goods: groceries/clothing/hardware store Buy goods: groceries/clothing/hardware store Buy goods: groceries/clothing/hardware store	0.0100
Go to work Buy goods: groceries/clothing/hardware store Home	0.0086
Home Go to gym/exercise/play sports Home	0.0077

Table 5. Given a current destination, vehicles are most often next driven to "Home" unless the current destination is "Home". This table also shows the probability of the second most likely destination for any given current destination.

Current Destination	Most Likely Next	Probability	Next Most Likely	Probability
Go to gym/exercise/play sports	Home	0.654	Buy goods: groceries/clothing/hardware store	0.085
Go to school as student	Home	0.646	Get/eat meal	0.048
Go to library: school related	Home	0.619	Get/eat meal	0.135
Social event	Home	0.616	Buy goods: groceries/clothing/hardware store	0.087
Go to religious activity	Home	0.615	Buy goods: groceries/clothing/hardware store	0.098
Visit friends/relatives	Home	0.608	Buy goods: groceries/clothing/hardware store	0.097
Go out/hang out: entertainment/theater/sports event/go to bar	Home	0.606	Buy goods: groceries/clothing/hardware store	0.089
Return to work	Home	0.599	Buy goods: groceries/clothing/hardware store	0.082
Go to work	Home	0.592	Buy goods: groceries/clothing/hardware store	0.074
School/religious activity	Home	0.583	Go to work	0.075
Pet care: walk the dog/vet visits	Home	0.579	Buy goods: groceries/clothing/hardware store	0.104
Take and wait	Home	0.575	Drop someone off	0.082
Buy goods: groceries/clothing/hardware store	Home	0.562	Buy goods: groceries/clothing/hardware store	0.182
Social/recreational	Home	0.557	Buy goods: groceries/clothing/hardware store	0.089
Use personal services: grooming/haircut/nails	Home	0.538	Buy goods: groceries/clothing/hardware store	0.181
Pick up someone	Home	0.533	Drop someone off	0.074
Attend meeting: PTA/home owners association/local government	Home	0.527	Buy goods: groceries/clothing/hardware store	0.097
Family personal business/obligations	Home	0.500	Buy goods: groceries/clothing/hardware store	0.135
Drop someone off	Home	0.498	Go to work	0.178
Visit public place: historical site/museum/park/library	Home	0.492	Buy goods: groceries/clothing/hardware store	0.143
Shopping/errands	Home	0.486	Buy goods: groceries/clothing/hardware store	0.119
Get/eat meal	Home	0.479	Return to work	0.111
Rest or relaxation/vacation	Home	0.471	Get/eat meal	0.105
Attend funeral/wedding	Home	0.464	Attend funeral/wedding	0.105
Buy gas	Home	0.457	Buy goods: groceries/clothing/hardware store	0.127
Medical/dental services	Home	0.441	Buy goods: groceries/clothing/hardware store	0.162
Meals	Home	0.435	Go to work	0.097
Transport someone	Home	0.408	Go to work	0.146
Coffee/ice cream/snacks	Home	0.387	Go to work	0.213
Buy services: video rentals/dry cleaner/post office/car service/bank	Home	0.387	Buy goods: groceries/clothing/hardware store	0.196
OS - Day care	Home	0.381	Go to work	0.173
Other work related	Home	0.380	Other work related	0.234
Use professional services: attorney/accountant	Home	0.343	Buy goods: groceries/clothing/hardware store	0.164
Attend business meeting/trip	Home	0.336	Go to work	0.119
Home	Buy goods: groceries/clothing/hardware store	0.174	Pick up someone	0.108

Table 6. This shows the average amount of time (hours) spent at each destination type. This can help determine where to locate charging stations for electric vehicles.

Destination	Average Dwell (hours)
Go to work	6.88
Go to school as student	4.29
Return to work	3.39
Home	2.51
Rest or relaxation/vacation	2.50
Go out/hang out: entertainment/theater/sports event/go to bar	2.39
Social event	2.32
Attend business meeting/trip	2.32
Visit friends/relatives	2.10
Go to religious activity	2.02
Attend funeral/wedding	1.98
Social/recreational	1.96
Other work related	1.95
School/religious activity	1.81
Go to gym/exercise/play sports	1.76
Go to library: school related	1.69
Attend meeting: PTA/home owners association/local government	1.65
Take and wait	1.45
Visit public place: historical site/museum/park/library	1.26
Family personal business/obligations	1.22
Medical/dental services	1.14
Use personal services: grooming/haircut/nails	1.11
OS - Day care	1.08
Meals	0.84
Shopping/errands	0.80
Get/eat meal	0.76
Use professional services: attorney/accountant	0.69
Buy goods: groceries/clothing/hardware store	0.60
Transport someone	0.59
Pet care: walk the dog/vet visits	0.54
Coffee/ice cream/snacks	0.33
Buy services: video rentals/dry cleaner/post office/car service/bank	0.31
Drop someone off	0.29
Pick up someone	0.29
Buy gas	0.16

SUMMARY

The 2009 NHTS is a valuable source of statistics for how vehicles are used. This paper shows how to extract many useful statistics concerning how much vehicles are used during the day, where they go, and how long they stay. The statistics have applications for designing vehicles, simulating their trip behavior, predicting where they go, and for the placement of charging stations.

For any of these statistics, the NHTS has more data that can be used to find other interesting relationships, such as how the statistics vary with the time of day, the day of the week, holidays, vehicle types, and the demographics of the drivers.

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APPENDIX

This appendix contains the structured query language (SQL) statements used in this paper to extract various statistics from the 2009 NHTS. These are provided to eliminate any ambiguity in how the statistics were derived. The SQL statements are for Microsoft SQL Server. The only table used was the "Travel Day Trip File", whose name is DAYV2PUB in the SQL statements. This table contains one record for each trip, and it was downloaded from http://nhts.ornl.gov/download.shtml.

1. Trip duration and distance. This looks at each trip of each vehicle in each household. The vehicle types are limited to automobile/car/station wagon, van (mini, cargo, passenger), sports utility vehicle, pickup truck, other truck, recreational vehicle, motorcycle}. The query takes only those trip records reported by the driver to avoid double-counting the same trip reported by a passenger. The query also ignores trips whose duration (TRVL_MIN) or distance (TRPMILES) was negative, indicating that the number was not available. The weight variable for each trip is WTTRDFIN.

```
SELECT HOUSEID, VEHID,
TRVL_MIN AS TripTravelMinutes,
TRPMILES AS TripTravelMiles,
WTTRDFIN AS Weight
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07')
AND TRVL_MIN >= 0
AND TRPMILES >= 0
```

2. Daily travel duration and distance. This looks at each vehicle in each household.

```
SELECT HOUSEID, VEHID,
SUM(TRVL_MIN) AS DailyTravelMinutes,
SUM(TRPMILES) AS DailyTravelMiles,
AVG(WTTRDFIN) AS WeightAverage
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
TRVL_MIN >= 0 AND
TRPMILES >= 0
GROUP BY HOUSEID, VEHID
```

3. Fraction of trips whose duration is a whole multiple of five minutes.

```
DECLARE @WeightMinutesOfAll FLOAT

SELECT @WeightMinutesOfAll =
(SELECT SUM(WTTRDFIN) AS Weight
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07'))

DECLARE @WeightMinutesOfFivers FLOAT
SELECT @WeightMinutesOfFivers =
(SELECT SUM(WTTRDFIN) AS Weight
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND

CAST(TRVL_MIN AS INT) % 5 = 0)

DECLARE @FractionMinutesFivers FLOAT
SELECT @FractionMinutesFivers = @WeightMinutesOfFivers/@WeightMinutesOfAll
SELECT @FractionMinutesFivers AS FractionOfFiversMinutes
```

4. Destination popularity. This gives a sorted list of destination types (WHYTO) by their accumulated weight. It omits WHYTO values that do not represent reported destinations, and it omits the WHYTO of '10', because this is a suspected coding error.

```
SELECT WHYTO, SUM(WTTRDFIN) AS WeightSum
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
WHYTO NOT IN ('-1','-7','-8','-9','97','10')
GROUP BY WHYTO
ORDER BY WeightSum DESC
```

5. Duration and distance to destination types. This query makes a list of the destination type (WHYTO), weight, travel time, and travel distance for each trip.

```
SELECT WHYTO, WTTRDFIN, TRVL_MIN, TRPMILES
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
WHYTO NOT IN ('-1','-7','-8','-9','97','10')
```

6. Destination types vs. time of day. This example query gets the destination types and associated weights for 10 a.m. to 11 a.m. on weekdays.

```
SELECT WHYTO, SUM(WTTRDFIN) AS WeightSum
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
WHYTO NOT IN ('-1','-7','-8','-9','97','10') AND
CAST(STRTTIME AS INT) >= 1000 AND
CAST(STRTTIME AS INT) < 1100 AND
TDWKND = '02'
GROUP BY WHYTO
```

7. Destination sequences. The first query finds the list of distinct (household, vehicle) pairs that have a sequence of at least some minimum length, which is three in this example. The second query finds the sequence of destinations for a given (household, vehicle) pair, which is (‘59179025’, ‘02’) in this example. The second query takes all destination types (WHYTO), even those that should be ignored. These WHYTO values are ignored in later code that splits the sequences into the desired lengths.

```
SELECT HOUSEID, VEHID, COUNT(*) AS NUM
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
WHYTO NOT IN ('-1','-7','-8','-9','97','10')
GROUP BY HOUSEID, VEHID
HAVING COUNT(*) >= 3

SELECT WHYTO, WTTRDFIN
FROM DAYV2PUB WHERE DRVR_FLG = '01' AND
HOUSEID = '59179025' AND
VEHID = '02'
ORDER BY STRTTIME
```

8. Destination dwell times. The first query gets a list of distinct (household, vehicle) pairs. The second query takes a (household, vehicle) pair, which is (‘40837631’, ‘02’) in this example, and extracts the sequence of destinations with the start and end time of each trip.

```
SELECT HOUSEID, VEHID

FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
VEHTYPE IN ('01', '02', '03', '04', '05', '06', '07') AND
WHYTO NOT IN ('-1','-7','-8','-9','97','10')
GROUP BY HOUSEID, VEHID

SELECT WHYTO, STRTTIME, ENDTIME, WTTRDFIN
FROM DAYV2PUB
WHERE DRVR_FLG = '01' AND
HOUSEID = '40837631' AND
VEHID = '02'
ORDER BY STRTTIME
```

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