AUTOMOTIVE XPRIZE

AXP COURSE DESIGN – BASELINE DRIVING STATISTICS

The following data was provided by the Federal Highway Administration (FHWA) and by Oak Ridge National Laboratory based on the 2001 National Household Travel Survey that was conducted by the FHWA..

National Household Travel Survey

Data Summary for XPrize

March 2007

U.S. Department of Transportation
Federal Highway Administration
Office of Highway Policy Information
& Oak Ridge National Laboratory

The data shown in this summary are from the 2001 National Household Travel Survey (NHTS). This study is conducted by the FHWA Office of Highway Policy Information. New data collection will begin in January 2008.

Overall, American households have more than one vehicle per licensed driver, and those vehicles are highly used. On average vehicles are driven for 3.37 trips per weekday (a trip is from one address to another), but more than one out of ten vehicles are driven for 7 trips or more each day. On the other hand, more than a third of all personal vehicles sit idle in an average day—and more on weekends (36% and 45% respectively).

TRIP LENGTH

The average trip length per vehicle is 9.5 miles, including short and long trips and travel on weekdays and weekends. Table 1 and Figure 1 show the distribution of trips and miles by trip length category. The first distribution (Column A) is a straight summary of all reported trips by the trip length. Most of the trips are very short (61 percent of all trips in an average day are less than five miles in length).

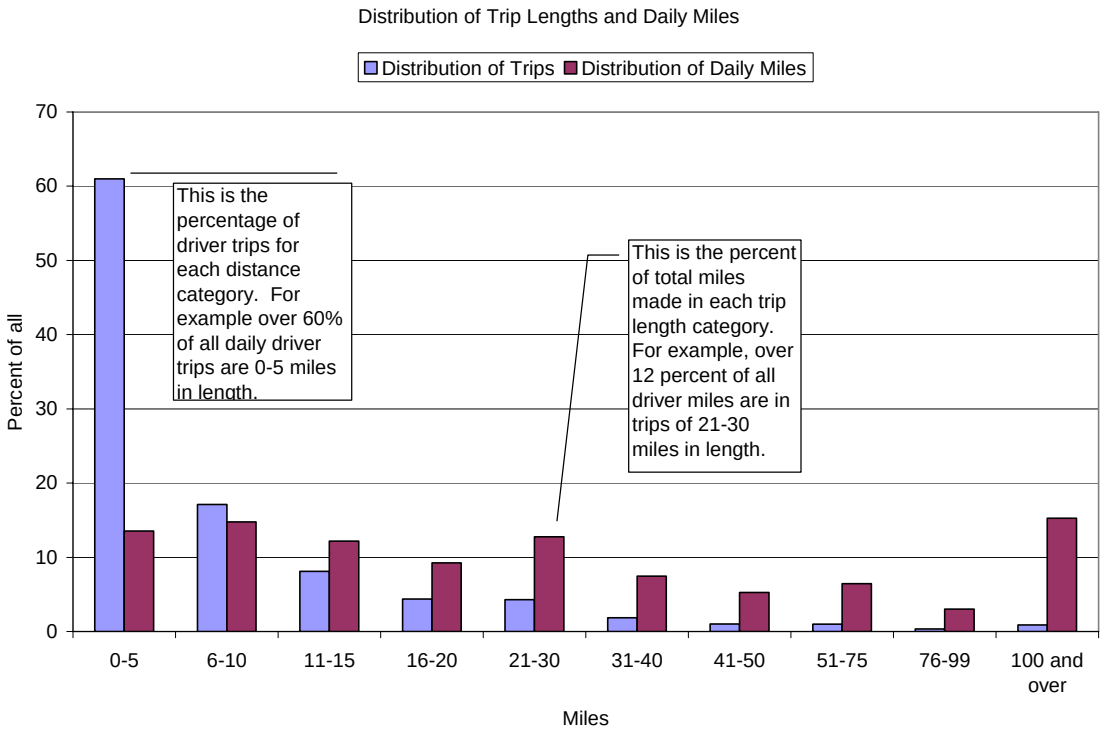
Table 1 – Distribution of Trips and Miles by Trip Lengths

Trip Length	Column A Distribution of Trips	Column B Distribution of Daily Miles
0-5	61.0%	13.5%
6-10	17.1%	14.8%
11-15	8.1%	12.2%
16-20	4.4%	9.3%
21-30	4.3%	12.8%
31-40	1.9%	7.5%
41-50	1.0%	5.3%
51-75	1.0%	6.5%
76-99	0.3%	3.0%
100 and over	0.9%	15.3%
Total	100.0%	100.2%

Source: 2001 National Household Travel Survey
Note: Totals may not sum to 100 percent due to rounding

The second distribution (Column B) uses the total miles of passenger travel in an average day (2.3 trillion miles of passenger travel) and the distribution of those miles by trip length. This is a more even distribution—for example, 13.5 percent of all daily miles are in trips of five miles or less and 15.3 percent of all daily miles are in trips of 100 miles or more. Table 1 and Figure 1 show these data.

Figure 1 – Distribution of Trips and Miles by Trip Lengths



Source: 2001 National Household Travel Survey

Interestingly, when the total daily miles for an average driver are summed for all travel in a day, the distribution is much different. Table 2 and Figure 2 show the mileage accrued in an average day by all U.S. drivers, and by urban and rural drivers. Overall, 56 percent of U.S. drivers report 30 miles or less of total travel in an average day, and 75 percent report less than 75 miles in a day.

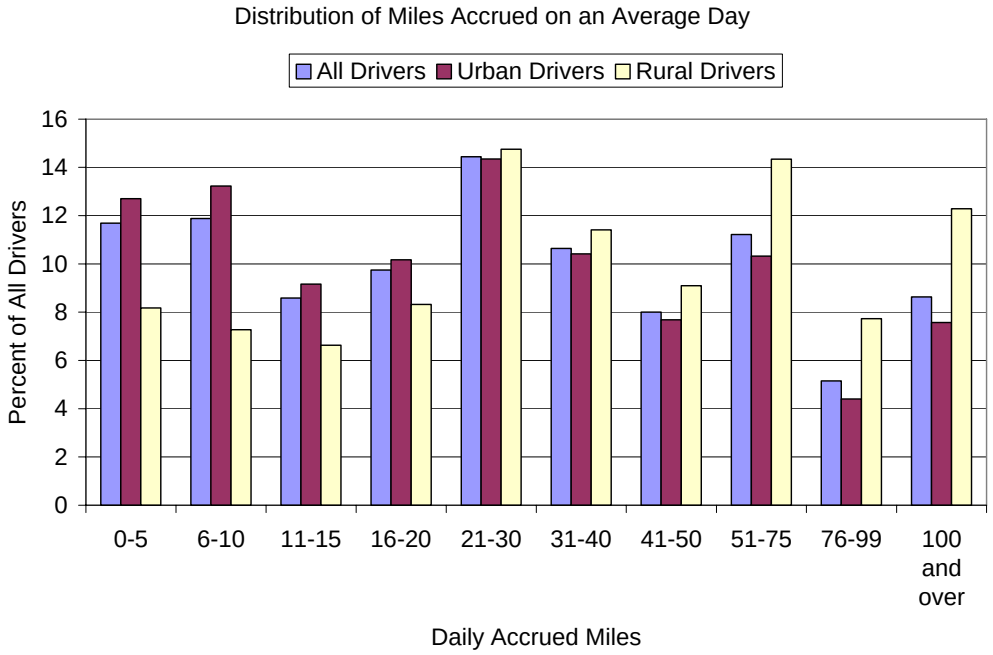
Table 2 – Daily Accrued Miles per Driver

Daily Miles	All Drivers	Urban Drivers	Rural Drivers
0-5	11.7%	12.7%	8.2%
6-10	11.9%	13.2%	7.3%
11-15	8.6%	9.2%	6.6%
16-20	9.8%	10.2%	8.3%
21-30	14.4%	14.4%	14.8%
31-40	10.6%	10.4%	11.4%
41-50	8.0%	7.7%	9.1%
51-75	11.2%	10.3%	14.3%
76-99	5.2%	4.4%	7.7%
100 and over	8.6%	7.8%	12.3%
Total	100.0%	100.3%	100.0%

Source: 2001 National Household Travel Survey
Note: Totals may not sum to 100 percent due to rounding

The table shows that rural drivers typically accrue more miles than other drivers in an average day. For example, 25.0 percent of all drivers travel more than 50 miles in a typical day. In contrast, 34.3 percent of rural drivers but only 22.5 percent of urban drivers accrue more than 50 miles in a day. The difference becomes more pronounced at the lower and higher mileage levels. Note that 77.5 percent of all drivers live in urban areas compared to 22.5 percent of drivers who live in rural areas.

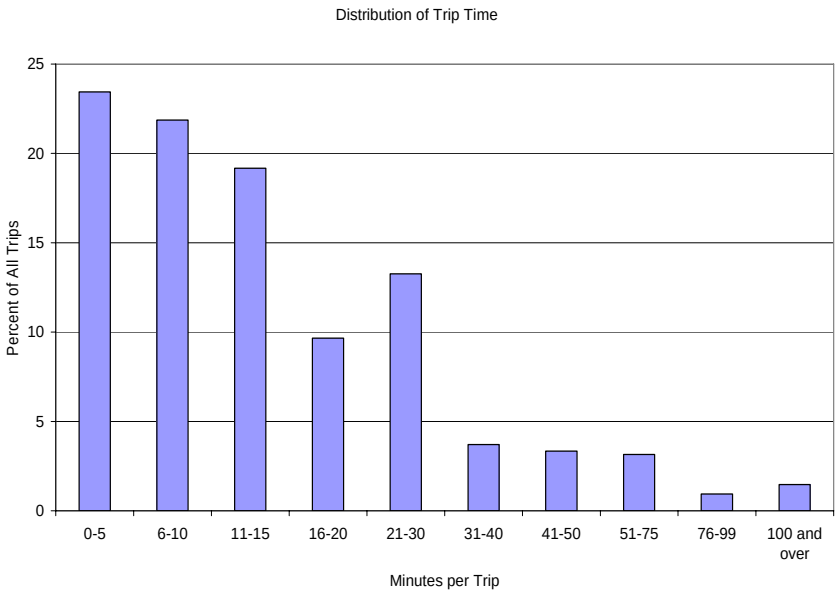
Figure 2 – Daily Accrued Miles per Driver



Source: 2001 National Household Travel Survey

Figure 3 shows the distribution of trip lengths in minutes. The vast majority of trips (75 percent) are less than 20 minutes duration.

Figure 3 – Distribution of Trip Lengths (in minutes)



Source: 2001 National Household Travel Survey

TRIP SPEEDS

The NHTS uses reported travel time and distance to estimate speeds. Table 3 shows the distribution of speed is shown in percentiles, or the percent of all trips that fall at or below that speed. Seventy-five percent of trips are 36 miles per hour or less. The mean speed for all trips is 25.7 miles per hour, the mode (the most reported time/distance category) is 12.0 mph, while the median (exactly half are faster and half are slower) is 24 mph.

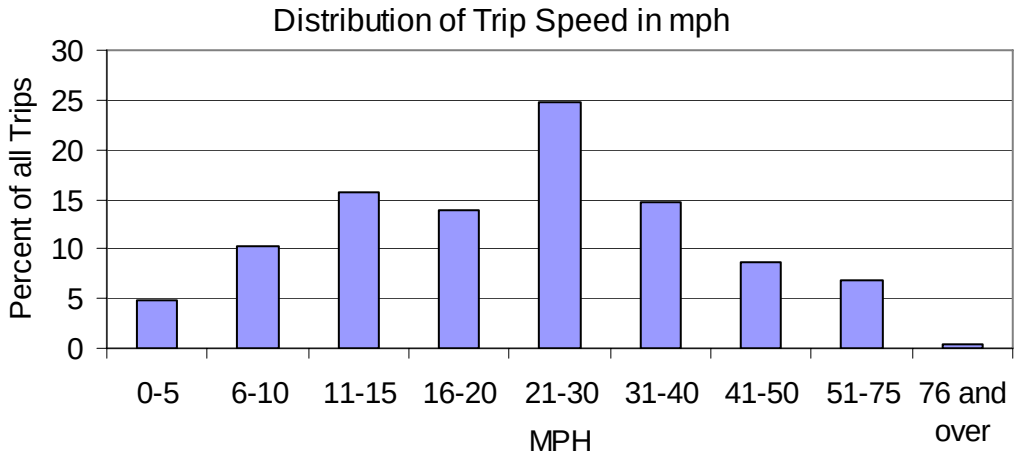
Table 3 – Distribution of Travel Speeds (Percentiles)

Percentile	Miles per Hour
99th	70 mph
95th	57 mph
90th	48 mph
75th (Third quartile)	36 mph
50th (Median)	24 mph
25th (First quartile)	12 mph
10th	7.5 mph
5th	6.0 mph

Source: 2001 National Household Travel Survey

Figure 4 shows the distribution of travel speed in categories. Almost one-quarter of all trips are made at speeds between 21 and 30 mph. Just under 5 percent of all trips are less than 5 mph and 7.3 percent of trips are 50 mph or faster. It is important to note that a *trip* can have many segments on many different road types, for example if a trip begins on a local street from home to the arterial avenue, then up the avenue to the highway, and once off the highway back on a local road to the destination.

Figure 4 – Percent of Trips by Speed of Travel



Source: 2001 National Household Travel Survey

DWELL TIME

The interval between trips is expressed as dwell time at a location. The distribution is wide, with many trips having a very short dwell time, such as trips to get gas or stop for coffee on the way to work, and many trips that have longer dwell times, such as the time a driver is at work. Table 4 shows the percentiles and Figure 5 shows the distribution in broad categories.

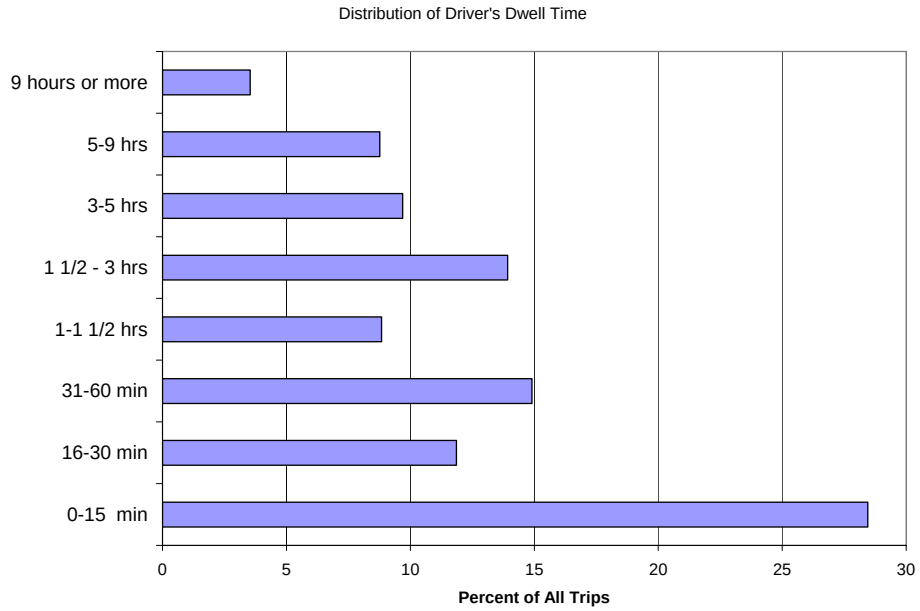
Table 4 – Distribution of Dwell Time (Percentiles)

Percentile	Minutes at a location
99th	655 min
95th	515 min
90th	360 min
75th (Third quartile)	160 min
50th (Median)	50 min
25th (First quartile)	15 min
10th	5 min
5th	1 min

Source: 2001 National Household Travel Survey

The mean dwell time is 2 hours, the median is 50 minutes and the mode is just 5 minutes. These do not include the amount of time overnight at home, since the travel day begins at 4:00 am and ends with the last trip of the day.

Figure 5 – Distribution of Dwell Time

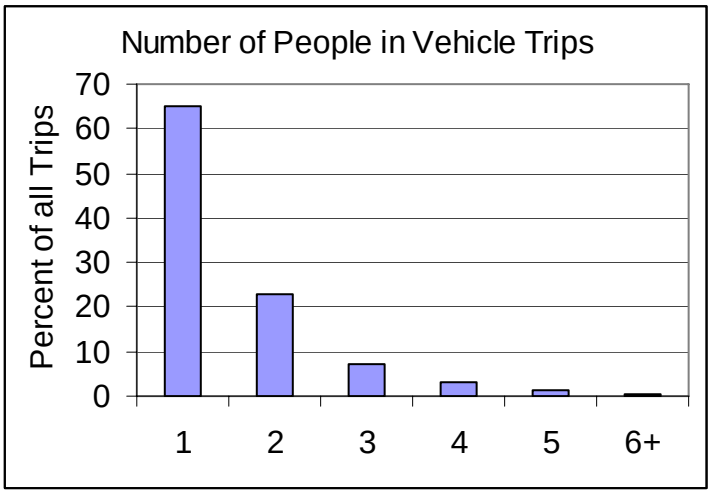


Source: 2001 National Household Travel Survey

NUMBER OF PASSENGERS

NHTS data show that in general, people are less likely to carpool for commuting, but more likely to share rides for social and recreational trips. For ALL trips involving a vehicle, about 35 percent are a shared ride (often with people from the same family). While carpooling for commute trips has been declining, overall vehicle occupancy for all trips has been pretty consistent since 1990 (about 1.5 persons per vehicle trip). Figure 6 shows the distribution of all trips by the number of passengers, including the driver.

Figure 6 – Distribution of Trips by Number of People



Source: 2001 National Household Travel Survey

NUMBER OF COLD STARTS

The average daily cold starts is 31.2% of all vehicle trips, including the first trip of the day (cite: Mohan Venigalla, et al. TRR no. 1472, "Transportation-Related Air Quality"). Once the vehicle is moving, only 16.7 percent of all starts are cold (after a dwell time of 505 seconds, or 8.5 minutes). The cold starts are highly linked to the time of day and trip purpose. Further analysis of emissions-related data will be conducted as needed.

ROAD GRADES

Total Daily Vehicle Miles Traveled (DVMT) for various classes of road grades are shown in the following table:

U.S. DAILY VEHICLE - MILES BY GRADE CLASS

	RURAL				URBAN				
GRADE CLASS	INTERSTATE	OTHER PRINCIPAL ARTERIAL	MINOR ARTERIAL	TOTAL	INTERSTATE	OTHER FREEWAYS AND EXPRESSWAYS	OTHER PRINCIPAL ARTERIAL	TOTAL	GRAND TOTAL
0.0-0.4%	371,468,721	342,035,307	231,390,314	944,894,342	661,559,049	340,539,276	850,638,456	1,852,736,782	2,797,631,124
0.5-2.4%	229,004,075	187,439,087	125,439,053	541,882,216	454,182,795	167,216,099	273,255,088	894,653,982	1,436,536,198
2.5-4.4%	78,059,905	63,342,545	54,186,977	195,589,426	143,701,655	59,556,866	90,743,811	294,002,331	489,591,757
4.5-6.4%	9,765,691	21,583,127	22,132,867	53,481,685	10,363,403	11,720,866	26,992,031	49,076,300	102,557,986
6.5-8.4%	844,571	5,485,122	8,110,462	14,440,155	948,742	1,525,121	8,795,364	11,269,228	25,709,383
8.5+%	448,441	1,050,483	1,470,708	2,969,632	470,601	290,970	3,076,261	3,837,832	6,807,463

ROAD ROUGHNESS

Total Daily Vehicle Miles Traveled (DVMT) for various levels of road roughness are shown in the following table. The measure is the International Roughness Index (inches per mile).

NATIONAL HIGHWAY SYSTEM TRAVEL - 2005

TOTAL DVMT BY MEASURED PAVEMENT ROUGHNESS

TYPE	INTERNATIONAL ROUGHNESS INDEX (IRI) in inches per mile									
	NOT REPORTED	< 60	60-94	95-119	120-144	145-170	171-194	195-220	> 220	TOTAL REPORTED
Rural	14,311,384	306,904,373	592,621,016	198,343,600	94,767,310	43,372,072	14,891,163	6,862,506	5,285,238	1,263,047,279
Urban	42,888,277	245,472,241	810,518,501	490,477,968	330,841,666	209,061,752	119,068,472	62,736,814	70,234,323	2,338,411,737

CONGESTION

Road congestion in terms of Total Daily Vehicle Miles Traveled (DVMT) is shown in the following table expressed as the volume surface raio. For multilane facilities volume-service flow ratio is determined by dividing the peak traffic in the peak direction by the capacity. For all other facilities the ratio is determined by dividing the peak traffic by the capacity.

U.S. TOTAL DVMT BY VOLUME - SERVICE FLOW RATIO - RURAL

	VOLUME-SERVICE FLOW RATIO (V/SF)						
	< 0.21	0.21-0.40	0.41-0.70	0.71-0.79	0.80-0.95	> 0.95	TOTAL
Interstate	56,867,866	203,253,085	283,009,745	54,225,691	64,688,595	39,079,305	701,124,286
Other Principal Arterial	166,839,777	265,479,327	145,046,992	18,090,919	19,980,972	18,299,251	633,737,239
Minor Arterial	154,687,464	193,885,701	77,579,223	7,230,197	7,296,553	8,448,629	449,127,766
Major Collector	325,275,128	144,457,860	42,633,453	4,022,038	5,791,550	4,974,390	527,154,418
Total Rural	703,670,234	807,075,973	548,269,413	83,568,845	97,757,670	70,801,574	2,311,143,709

U.S. TOTAL DVMT BY VOLUME - SERVICE FLOW RATIO - URBAN

	VOLUME-SERVICE FLOW RATIO (V/SF)						
	< 0.21	0.21-0.40	0.41-0.70	0.71-0.79	0.80-0.95	> 0.95	TOTAL
Interstate	12,534,986	53,927,362	281,869,172	146,612,266	320,485,212	509,384,872	1,324,813,869
Other Freeways & Expresswa	10,297,004	51,999,521	151,040,751	60,727,397	130,645,236	197,743,619	602,453,528
Other Principal Arterial	57,476,108	282,289,688	560,788,816	111,981,003	149,936,105	118,557,107	1,281,028,827
Minor Arterial	107,584,238	302,277,125	382,060,173	63,597,836	78,318,950	89,711,152	1,023,549,475
Collector	114,918,742	137,425,670	123,507,832	19,974,681	26,103,712	44,988,557	466,919,195
Total Urban	187,892,337	690,493,696	1,375,758,911	382,918,502	679,385,503	915,396,751	4,231,845,699