

Evaluation of Some Elements of Auto-Driver Trip Productions

F. E. COLEMAN, Connecticut Highway Department

• THERE are many characteristics that influence the number of trips made daily by motor vehicles. An attempt to determine the most predominant and influential elements of auto-driver trips was conducted by the Connecticut Highway Department in conjunction with Alan M. Voorhees.

The basic data were obtained in the Southeast Area Traffic Study (SEATS). The study area consists of 23 towns in southeastern Connecticut, covers a 750-sq mi area, and has a population in excess of 190,000.

A 2 percent sample of the dwelling units in the area was selected and a home-interview O-D survey was then conducted. The trip breakdown used in the survey categorized trips into twelve trip purposes. For the analysis of trip production rates, these twelve purposes were grouped into four trip types, work, long, short and non-home based. The long and short classifications were based on trip length characteristics, with the non-home based trips being defined as those trips made with neither origin nor destination at the home. A final consolidation of the four trip purposes was made into work and non-work trips in order to facilitate a comparison of the results to those obtained in the Hartford Area Traffic Study (HATS). Table 1 gives the trip purpose breakdown.

It has been pointed out in other studies (1), that family size and car ownership have a great bearing on the number of trips made by a motor vehicle. From the SEATS home-interview survey, the relationship between the number of persons per family, the number of cars per family, and the number of auto-driver trips made was found.

As family size increases to 9 persons, the number of auto-driver work trips for 1 and 2 car families increases 40 percent and 30 percent, respectively, while the number of work trips for 3 car families doubles (Fig. 1). The gradual increase in the number of work trips being made by one car families can be explained by the fact that the single car families are limited to the number of extra work trips that can be made. In 2 car families, the second car is commonly used by the housewife for transportation, and these trips fall into the non-work trip group.

Auto-driver non-work trips have patterns different from those of work trips (Fig. 2). These trips increase at a higher rate with an increase in family size and car ownership, and then decline

TABLE 1
AUTO-DRIVER TRIP PURPOSES

Category	Type	Purpose
Work	Work	Work
Non-work	Long	Related to business
		Medical-dental
		Shopping-shopping goods
		Social
		Recreational
Non-work	Short	Other
		Personal business
		Eat meal
		Educational
		Civic-religious
Non-home based	Non-home based	Shopping-convenience goods
		Non-home based

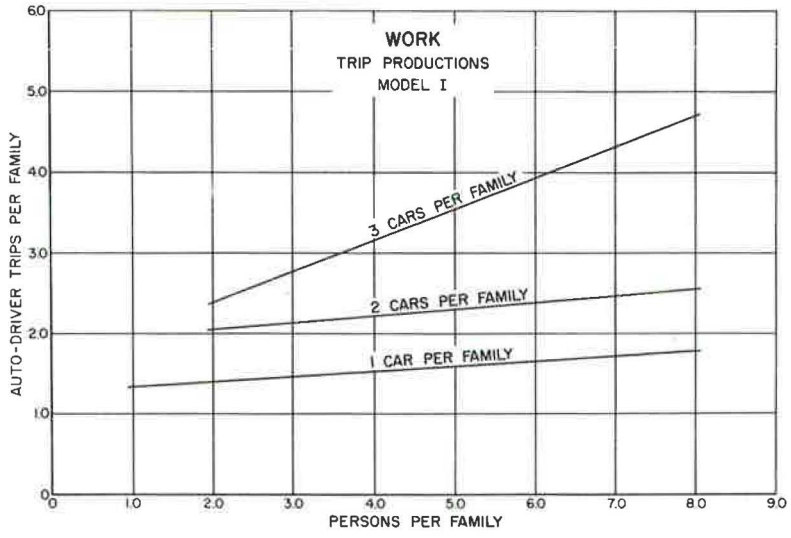


Figure 1.

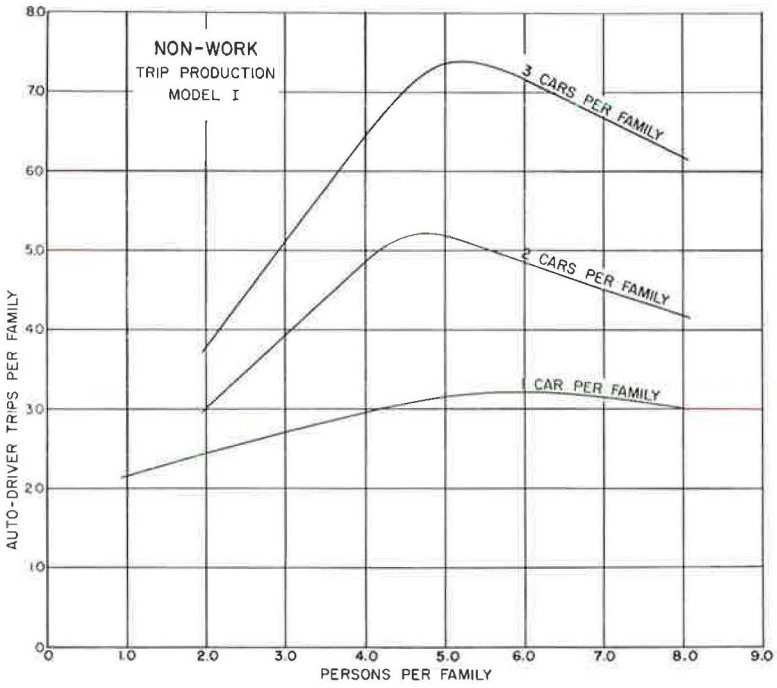


Figure 2.

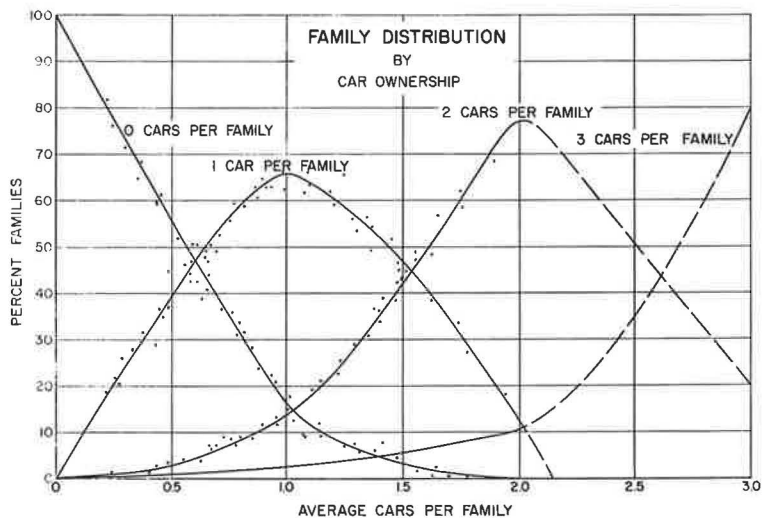


Figure 3.

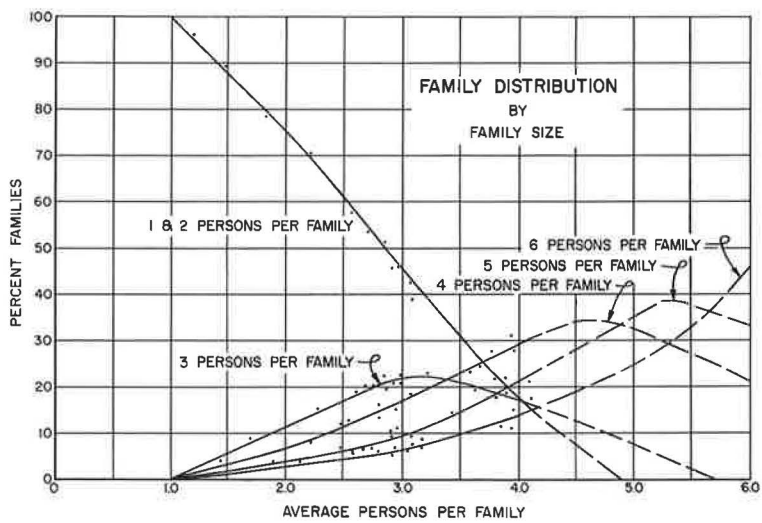


Figure 4.

rather sharply. The break point occurs between 5 and 6 persons per family for 1 car families and between 4 and 5 persons per family for 2 and 3 car families. In 1 car families the rate of increase and decrease is far more gradual than for 2 and 3 car families, indicating that in the former category these types of trips are kept at a minimum. This apparently is a result of a combination of factors. The work trip takes priority and idles the car for at least one-third of the day. Also, single car families are probably lower on the income scale. If this is not the case, and the family is of the type that needs to make extra trips, a second car would be present. A detailed analysis of the trips made by 2 car families seems to indicate this. For example, in families with 4 or more members the number of social trips being made falls off rapidly. Since this type of trip accounts for 20 percent of the total non-work trips, its impact is readily felt. Shopping trips also decline, and these account for 9 percent of the total non-work trips. This seems logical for as family size increases the influence of economic pressure is felt. Income data would have been useful to correlate these observations but were only available as median income by town. Trips made for educational and civic-religious purposes also decreased as family size increased, but it is difficult to deduce a reason for this.

As would be expected, convenience shopping trips increased slightly. This type of trip accounted for 22 percent of the total non-work trips. Related business trips increased sharply in comparison to convenience shopping, but this is understandable since these types of trips are actually supplemental to work trips.

Those trips classified as personal business, eat meal, recreation and medical-dental remained fairly constant as family size increased. It would seem reasonable to assume that as social trips declined with an increase in family size that recreation trips would also. However, the observed data did not corroborate this theory. Possibly visiting other people becomes a chore while family type trips for recreational purposes do not.

It must be kept in mind that these curves are a direct product of individual observations. In using these relationships to predict auto-driver trips it was apparent that some adjustment should be made to reflect the average conditions of the traffic zones. These zones are the units for which trip production will be considered.

To develop a set of curves that would predict travel on an average basis, family size and car ownership were investigated. From census data of tracted areas in Connecticut (Hartford, Bridgeport, New Haven, Waterbury, Stamford) the relationship between the average number of persons per family and the percent of families having 1, 2, 3, etc., members was established. This relationship proved to be consistent for the various areas that were tracted and the resulting curves had very little scatter (Fig. 3). The dashed portion of the curves were estimated to account for larger family sizes than were actually observed in the SEATS home interview.

The curves in Figure 4 were developed from the same census data to relate the average number of cars per family to the percent of families having 1, 2, 3, etc., cars per family. Again these data were very consistent for each of the tracted areas considered and resulted in very little scatter. The percent of families not owning cars rapidly decreases as family size increases, and it is felt that the predominant characteristic of no car families is retired couples who rely on mass transit for their transportation.

Having established the relationship in Figures 3 and 4, the framework was provided for converting Model I to an average persons per family and average cars per family basis for predicting auto-driver trip production. Trip production rates for various combinations of family size and car ownership were determined from Model I for work and non-work trips. These rates were then adjusted by applying the relationships of the percent of persons for a given average family and average number of cars in the family. The adjusted volumes were then plotted, resulting in Model II (Figs. 5 and 6).

With the new set of curves it was possible to compare the theoretical trip productions to the actual trips obtained from the home interview. This was done for each town in the study area by obtaining the average number of persons per family and the average number of cars per family. The trip production rates were then obtained from the Model II curves and expanded by the number of families. Retired families were not considered for auto-driver work trip productions for obvious reasons.

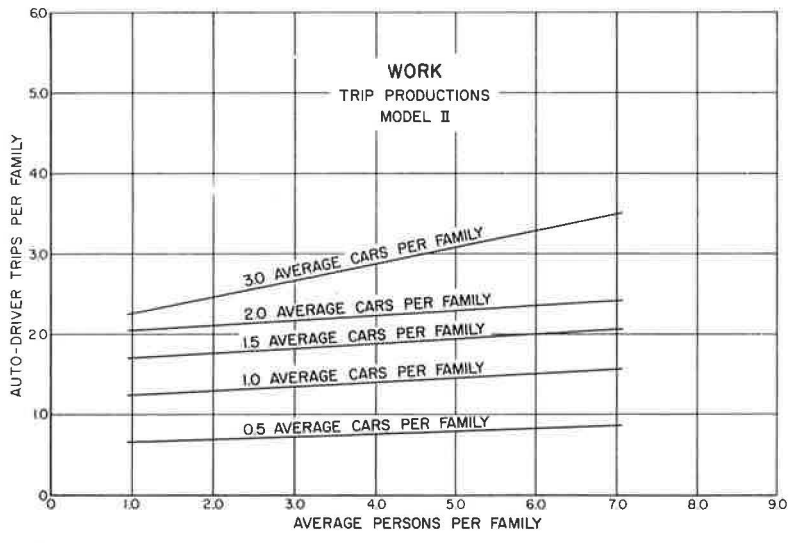


Figure 5.

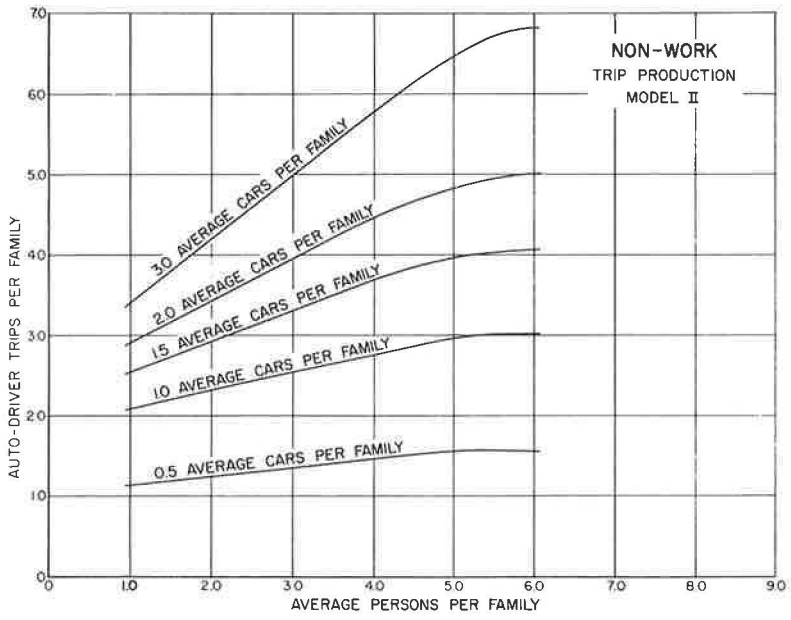


Figure 6.

TABLE 2
COMPARISON OF AUTO DRIVER TRIP PRODUCTIONS

	WORK TRIPS							NON-WORK TRIPS						
	ACTUAL	THEO. * MODEL I	A/T	THEO. * MODEL II	A/T	HATS METHOD	A/T	ACTUAL	THEO. * MODEL I	A/T	THEO. * MODEL II	A/T	HATS METHOD	A/T
REGION 1	246	246	1.00	232	1.06	246	1.00	524	489	1.07	477	1.10	499	1.05
REGION 2	161	138	1.16	129	1.25	134	1.20	215	269	0.80	255	0.85	269	0.80
REGION 3	345	330	1.04	311	1.11	339	1.05	563	707	0.80	667	0.85	684	0.83
REGION 4	221	219	1.01	207	1.06	232	0.96	492	454	1.08	437	1.12	468	1.05
REGION 5	383	401	0.96	374	1.02	400	0.96	923	829	1.11	802	1.15	807	1.14
REGION 6	534	469	1.14	414	1.20	483	1.10	975	961	1.01	918	1.06	974	1.00
REGION 7	177	202	0.87	197	0.90	226	0.79	478	441	1.08	409	1.17	461	1.03
TOTAL	2067	2005	1.03	1894	1.09	2060	1.01	4170	4150	1.01	3965	1.05	4162	1.00

* MODEL I-Curves developed from home interviews

* MODEL II-Home interview curves modified by average family size and average car ownership conditions

* HATS METHOD-Based on car ownership only

The comparison of trip productions from Models I and II, as well as the method used in HATS, which utilizes only SEATS car ownership, is given in Table 2. The results indicate that considering family size as related to average persons per family and average cars per family did not increase the accuracy of the study.

As mentioned previously, income level is a desired variable but was not available for SEATS. More work is planned in areas of the state for which this information is available.

The observed data revealed basic characteristics of travel patterns, namely that the number of trips do change as family size increases, and that this increase is influenced by car ownership. Although these basic elements are important in individual cases, they do not have too much effect on the total volume of trips made in an area.

REFERENCE

1. Shuldiner, P.W., "Trip Generation and the Home." Northwestern Univ., Dept of Civil Engineering.