

A New Method of Obtaining Origin And Destination Data

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• THE PURPOSE of this paper is to compare household trip behavior obtained in the conventional manner, by means of a household survey based on an area probability sample, with similar data obtained by interviewing persons as they renewed their driver's licenses in the police station. This experiment was made in Battle Creek, Mich., in the summer of 1961. The Michigan State Highway Department conducted the conventional O-D survey, and the Detroit Area Traffic Study of Wayne State University carried out the driver's license type of interviewing.

Inasmuch as the conventional O-D survey procedure is both familiar and time-tested, its features need not be redescribed here. However, the driver's license procedure is new; therefore, a brief description of its theoretical basis and practical procedure is in order.

The procedure substitutes a sample based on a universe of licensed drivers for a sample based on a universe of households. Every licensed driver in the State of Michigan must apply in person for license renewal on or about his or her birthday every third year. Because birthdays are randomly distributed in the population, this means that each day 1/1,095 (365 days a year for 3 years) of all drivers must report to the nearest licensing office (the police station or sheriff's office) to have their licenses renewed. Pursuing this relationship it is seen that every week 0.64 percent of all drivers experience birthdays and must report for license renewals during the five to six days the office is open. The number of interviews obtained each week is related to the size of the total population of drivers.

Does the sample obtained in this manner meet the criterion of randomness? If the universe is considered to be all drivers, it does. First, the list is totally inclusive, inasmuch as all drivers must have a license. Second, calling in renewals by birthday is either so close to random that small differences can be ignored, or controlled if that is desired because the universe parameters are known. The small deviation from pure chance arises from the possibility that birth patterns by month may vary in population groups whose driving habits vary. These differences, if they exist, are likely to be small. A recent study of racial and economic differentials in birth by season has indicated differences of between 3 and 7 percent, depending on the time of year (1).

Even at a maximum, this chance of error becomes insignificant compared with the error inherent in a household survey, when the "not-at-homes" and refusals are considered. Furthermore, if the period of interviewing renewal applicants is of sufficient length (say, twenty weeks) any differences related to month of birth would tend to disappear. A third point is that, at least for drivers born after 1920, adequate birth records exist, and the sample can be stratified accordingly if desired. The differential month-of-birth patterns can be calculated if necessary.

If it is granted for the moment that the theory is sound, the question then arises as to whether the driver's license procedure has any advantages over the area probability sample which would justify its general or even occasional use. Conversely, does it have disadvantages that preclude its use in any or all situations? These contentions were tested by making the two types of surveys at the same time and in the same place.

RESULTS

The principle question is whether the two survey techniques yielded similar results in the Battle Creek experiment, or put another way, whether the driver's license renewal method is an adequate substitute for the household survey. The answer to this question is summarized in Table 1.

This brief resume' contains two essential findings. First, the driver's license survey did not obtain as many trips as the household survey. The difference was about 5 percent less for the license survey. In the strict interpretations of sampling error inherent in both surveys, this is not necessarily a real difference. That is, if both surveys were to be repeated the results might be diametrically opposite, and still might be equally correct or incorrect, as the case might be. However, because the license renewal survey is, in a sense, the "challenger," and the household interview survey the "champion," a defensive posture, will be assumed and an attempt made to explain why the driver's license survey found fewer trips per household.

Before attempting a detailed analysis as to specifically why the driver's license survey failed to get as many trips as the household survey, it should be pointed out that the distributions by trip mode, trip purpose, and trip distribution make it clear that the pattern of trip behavior as obtained in the two surveys is essentially the same. This is the major point to be made in this paper. If the origins and destinations of trips as obtained in each survey are compared, as they are in detail in Table 2, an extremely

TABLE 1

COMPARATIVE TRIP DATA—DETROIT AREA TRAFFIC STUDY, DRIVER'S
LICENSE RENEWAL O-D SURVEY, AND MICHIGAN STATE HIGHWAY
DEPARTMENT AREA PROBABILITY SAMPLE O-D SURVEY

Item	Detroit Area Traffic Study	Michigan State Highway Department
Total number of interviews	1,147	1,147
Number of completed interviews	1,138	1,062
Refusals	9	85
Average trips per household	6.76	7.17
Mode (%):		
Auto drivers	65.3	62.8
Auto passengers	33.0	33.8
Other	1.7	3.4
Total	100.0	100.0
Purpose (%):		
Home	40.7	37.5
Work	18.1	14.5
Shopping	7.5	10.0
Social recreation	17.6	18.7
Serve passenger	9.5	8.8
Other	6.6	10.5
Total	100.0	100.0
Summary trip distribution (destination):		
In city	82.1	84.1
Outside city	17.9	15.9
Outside MSHD study area	(7.5)	(5.5)
Total	100.0	100.0

TABLE 2

PERCENT TRIP DISTRIBUTION BY TRAFFIC ANALYSIS TRACT, DETROIT
AREA TRAFFIC STUDY AND MICHIGAN STATE HIGHWAY DEPARTMENT
SURVEYS, BATTLE CREEK, MICHIGAN, 1961

Tract	Distribution of Trips							
	By Tract of Origin				By Tract of Destination			
	MSHD		DATS		MSHD		DATS	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
City:								
1	347	4.2	354	4.6	351	4.3	348	4.5
2	663	8.1	618	8.0	648	7.9	615	7.9
3	314	3.8	331	4.3	319	3.9	334	4.3
4	421	5.1	448	5.8	416	5.1	457	5.9
11	552	6.7	429	5.5	521	6.3	432	5.6
12	1,472	17.9	1,194	15.4	1,514	18.4	1,222	15.8
13	948	11.5	792	10.2	945	11.5	803	10.4
14	1,109	13.5	768	9.9	1,108	13.5	783	10.1
15	424	5.2	509	6.6	421	5.1	505	6.5
16	179	2.2	203	2.6	176	2.1	203	2.6
17	489	5.9	661	8.5	499	6.1	656	8.5
In remainder of MSHD								
Study area:								
21	15	0.2	7	0.1	15	0.2	7	0.1
22	52	0.6	100	1.3	51	0.6	98	1.3
23	29	0.4	7	0.1	35	0.4	7	0.1
24	32	0.4	22	0.3	32	0.4	23	0.3
25	17	0.2	7	0.1	16	0.2	7	0.1
26	102	1.2	77	1.0	101	1.2	77	1.0
27	8	0.1	13	0.2	7	0.1	13	0.2
31	33	0.4	34	0.4	35	0.4	35	0.4
32	33	0.4	36	0.5	33	0.4	37	0.5
33	35	0.4	17	0.2	35	0.4	16	0.2
34	269	3.4	313	4.0	268	3.4	315	4.0
35	72	0.9	77	1.0	72	0.9	79	1.0
36	132	1.6	89	1.1	131	1.5	88	1.1
37	19	0.2	7	0.1	19	0.2	7	0.1
Outside study area	455	5.5	635	8.2	453	5.5	581	7.5
Total	8,221	100.0	7,748	100.0	8,221	100.0	7,748	100.0

close correspondence is found; that is, the trip pattern obtained in the two surveys is similar. In fact, it is just as close as if two conventional household O-D surveys were done simultaneously and then compared. In general, the driver's license technique can be employed as an instrument to obtain origin-and-destination data. This is a necessary but not sufficient condition for recommending the use of a driver's license O-D procedure. It is necessary to know further what its actual limitations are as they worked out in practice; also, what its advantages are. Unless it has particular advantages, there is no reason to employ it instead of the time-tried home interview.

LIMITATION OF DRIVER'S LICENSE METHOD

Theoretically, there were at least five limitations to this procedure. The actual experience proved the following with regard to these limitations:

1. A problem in using this technique is the fact that it does not cover all travel behavior. The inability to include the travel behavior of families without a licensed driver might prove a serious disadvantage in a larger city, but in Battle Creek it was a minimal disadvantage as shown in Table 1, where distribution by mode of travel was given. Because in the MSHD survey only 3.4 percent of all trips were in buses or taxis, and thus includes public transportation trips of persons and households with driver's licenses, it is apparent that this factor had little or no effect in assessing travel behavior in Battle Creek. Nevertheless, it remains as a possible disadvantage in larger cities.

2. The second problem of the licensing procedure can be called the "Monday problem." In the customary O-D survey, interviews are randomized over the days of the week with Monday excluded. Because in the licensing procedure the interviewees come to the interviewer, not only do they come in on Monday, but Monday is by far the busiest day. However, it is necessary to know their weekday travel, not their travel on the preceding day (Sunday). The question is whether the travel characteristics of people who come in on Monday differs in their weekday travel behavior from those who come in during the remainder of the week.

Persons reporting on Monday were listed and then interviewed at home, with the travel day being randomized over the days of the week in the usual manner. Their travel behavior proved much like that of persons reporting during the remaining days of the week. The average number of trips of the Monday people was 7.1 compared with 6.8 for the regular sample. (As explained later, these persons were interviewed at home, and consequently their average number of trips was higher.) They reported 61 percent combined home and work purposes compared with 61 percent for the other group. Fifty-nine percent of them were auto drivers compared with 65 percent in the regular sample. The Monday sample yielded 76 of all trips made within the City of Battle Creek compared with 82 percent in the regular sample. These differentials are all within the range of sampling error. Thus, evidence so far indicates that either the Monday persons can be interviewed at home, or that the study can be done on a Tuesday to Saturday basis and the people reporting on Monday can be dropped, because Monday persons are no different from persons reporting for renewal on the other days of the week.

3. The third problem was whether second, third, and fourth members of the same household would appear to have their licenses renewed causing duplications of households. According to sampling theory, duplication would occur in 5 percent of the cases. In Battle Creek it actually occurred in approximately 4 percent of the cases bearing out the theoretical calculation. This simply means that only 4 percent of the interviews had to be discarded because they duplicated households. This amount of wastage is not significant.

4. A fourth possible complicating factor is that persons are legally required to renew their driver's license in their birthday month. Some neglect to do this. The question then becomes whether persons who are late have different trip characteristics than those who renew their licenses within the stipulated time period. It was found that 14 percent of all renewals were late renewals. Using mean trips as a rough index of travel behavior, it was found that the mean number of trips for the late group was 6.5 as compared with 6.8 for the total sample. This difference was well within the range of sampling error. A further breakdown by month of birth revealed a distribution of mean trips greatly similar to those found in the total sample. At this point there is no reason to believe that lateness in renewing a driver's license is necessarily associated with a differing pattern of trip behavior.

5. The final problem concerned the possibility of some persons living in Battle Creek obtaining their license renewal elsewhere in the State; something they legally can do. No quantitative information on this subject was obtainable because of the nature of the State's filing system. However, the Secretary of State's Office was confident that this favor was negligible and could be disregarded. In addition, the number of out-of-area licenses issued in the Battle Creek offices was checked. Less than 1 percent of the licenses were issued to people from outside the area. There is no reason to suspect that residents of Battle Creek would behave any differently and hence there is no residence-occurrence problem.

This concludes the listing of theoretical questions concerning the capability of the driver's license survey. All questions were answered to the authors' satisfaction. The most severe problem was none of these, but arose out of the practical problem of interviewing in the police station. In the beginning, it was assumed that this procedure would be more efficient. Because a higher percentage of principal tripmakers (working males) was being interviewed it was assumed that a larger total number of trips would be obtained than in the conventional O-D procedure. As has already been mentioned 473 (or five percent) fewer trips were actually obtained. The details of the analysis are too complex to present in this brief space, but in essence it was found that the DATS study overreported work and home trips, and the MSHD overreported all other trip purposes. This means that the police station interview did not capture, as well as it should, the trips of the other household members. The average number of trips made with the licensee at his home, was then examined and an average of 8.4 trips per household, compared with the 7.7 trip average obtained in the MSHD home interview, and an average of 6.6 in the police station was found.

Each of the two interviewers who interviewed both in the police station and at home obtained a higher trip average in the home interview situation; therefore, it was evidently a function of the interviewing situation, not of the interviewer. When the police station interviewing procedure, was re-examined it was decided that one factor could have been improved. The interviewers were too hurried, taking on the average about 18 minutes per interview. The presence of more interviewers would have improved this. There was no problem of cooperation; the respondents would have stayed longer but there was no interview time to give them.

The major difficulty is that fewer housewives are interviewed in a license-renewal procedure. Thus fewer shopping, social recreation, and other non-work trips are reported. This is an inherent disadvantage. On the other hand, the home interview procedure results in fewer work trips being reported, and this is its inherent disadvantage. Because facilities are planned with the work trip principally in mind, the driver's license procedure may very well be the most valid of the two techniques for some traffic planning purposes.

SPECIFIC ADVANTAGES OF DRIVER'S LICENSE RENEWAL PROCEDURE

The principal advantage of the driver's license procedure over the household interview can be summarized in a single phrase—it saves money (Table 3). It was found that in the Battle Creek field operations, the costs ran about \$2.00 less per interview

TABLE 3

COMPARATIVE COSTS OF DETROIT AREA TRAFFIC STUDY, DRIVER'S LICENSE RENEWAL PROCEDURE, O-D AND MICHIGAN STATE HIGHWAY DEPARTMENT HOUSEHOLD INTERVIEW O-D, BATTLE CREEK, MICHIGAN, 1961

Phase	No. of Interviews		Cost per Interview (\$)		Battle Creek Survey Total Cost (\$)	
	MSHD	DATS	MSHD	DATS	MSHD	DATS
Sample Selection	1, 147	1, 147	0. 82	none	940. 54	none
Interviewing, coding, and check-coding (wages)	1, 147	1, 147	4. 62	3. 62	5, 299. 14	4, 152. 14
Interview-collection cost (mileage)	1, 147	1, 147/135 H. I.	0. 24	0. 05	275. 28	57. 35
Total	1, 147	1, 147	5. 68	3. 67	6, 514. 96	4, 209. 49
Difference in cost		Same		2. 01 less		2, 305. 47 less

or about 35 percent less for the entire survey. These differentials cannot be linearly extrapolated, because the relationship of the various cost elements is dependent on the geographic size and population of an area. A table of estimated costs based on population and geographic considerations has been prepared. Estimated comparative costs of collection of data by household interview O-D and driver's license O-D, for three levels of population size are given in Table 4.

Other advantages of the driver's license procedure are the following:

1. The sample selects itself, there are no errors in judgment or sampling techniques possible.

2. This method of obtaining the interviews is highly flexible as to time and place. The entire population is covered by interview stations; the respondent is obliged to report to the station with no effort on the interviewers' part; and no preliminary work is necessary because the sample is automatic. Thus, one can, make an O-D survey on very short notice and at any time of the year.

3. Because the interviews are established at a desk in the licensing office, and because only rarely will they be interviewing continuously throughout the day, the time remaining between interviews can be used to do practically all of the necessary coding. Thus, they are much more efficient than the home interviewer who wastes time on unproductive travel. A system of transporting finished interviews from busier to less busy interviewing stations for the purpose of coding can be worked out in the process of the survey, with a corresponding increase in efficiency.

SUMMARY

This single experience in comparing a conventional household interview O-D survey with obtaining similar information from licensed drivers at the time of license renewal has shown that the two types of surveys produce essentially the same distribution and behavioral pattern information. The driver's license O-D survey is deficient in that it produces somewhat fewer total trips, but at the same time work trips are better reported by the driver's license technique. Although there are some additional minor advantages of the driver's license technique, its principal advantage is that it costs from 38 percent to 57 percent less than the household interview O-D survey.

This paper is a brief abstract of a lengthy report now being prepared for the Michigan State Highway Department. Copies of the complete report giving full explanatory details will be available in the spring of 1962.

ACKNOWLEDGMENT

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REFERENCE

1. Pasamanick, B., Dinitz, S., and Knoblock, H., "Socio-Economic and Seasonal Variations in Birth Rates." *Milbank Memorial Fund Quar.*, 38: 248-254 (July 1960).

TABLE 4

Population of Area	Cost (dollars)		Percent Saving
	Household Interview O-D	Driver's License O-D	
40,000	6,500	4,000	38
400,000	60,000	28,000	53
4,000,000	300,000	130,000	57