

A Comparative Study of Origin and Destination Data Obtained by Home Interview and Controlled Post Card Methods

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● THE OHIO DEPARTMENT OF HIGHWAYS in cooperation with the U. S. Bureau of Public Roads contracted, in 1954, with the City of Cincinnati to conduct a comprehensive traffic survey of Hamilton County. Hamilton County has an area of 415 sq mi, a population of 779 thousand people, and contained 228,000 resident vehicles at the time of the study.

The "controlled post card" method was selected for procuring the internal traffic movements within the study area.

This method differs from the home interview method in that internal trip data is obtained by sending a questionnaire post card to all motor vehicle registrants in the survey area asking them to list their vehicle trips for a specified week day. All other features are the same as in the home interview study. Post card returns usually range from 35 percent to 60 percent of the automobile registration according to the acuteness of the local traffic problem and the amount of publicity accorded the survey.

In the field of conducting origin-and-destination (O-D) traffic studies by accepted sampling methods various unanswerable questions have arisen, such as:

(1) How accurately do people report their trips?

(2) Do they suppress trips?

(3) Do they magnify their travel?

(4) What is the minimum effective sample?

(5) Does the post card survey yield acceptably accurate results in comparison with the home interview method?

(6) What is the effect of migration on the accuracy of post card trip expansion?

(7) How does the lack of vehicle ownership in poorer areas influence the home interview sample?

(8) What is the geographical distribution of post card returns?

(9) Do both survey methods produce the same trip patterns?

The Hamilton County Survey appeared to present an ideal opportunity to resolve or at least clarify these questions. Accordingly, in cooperation with the U. S. Bureau of Public Roads, a manual of procedure was developed for a research study within the traffic survey.

The study was designed not only to compare the relative accuracy of the trip information and the results obtained by the post card and home interview methods, but also to test the adequacy of different size samples of the home interview survey. Furthermore, it provided a means to test the basic assumption in the home interview method that the dwelling occupancy pattern can be applied to the car ownership pattern in an area. It also provided a means of determining the effect of economic status upon car usage and the influence of migration upon the accuracy of expansion in the post card survey.

Briefly, the procedure for the study consisted of selecting a portion of two of the residential zones within the City of Cincinnati which had been delimited for the purpose of the Hamilton County Survey. Zone 537 was considered to be slightly above average in property valuation and living standards. It contained 1,427 dwelling units and 1,404 resident passenger cars. Zone 506 was considered to be slightly "over age" in property conditions and below average in living standards. It is somewhat smaller than

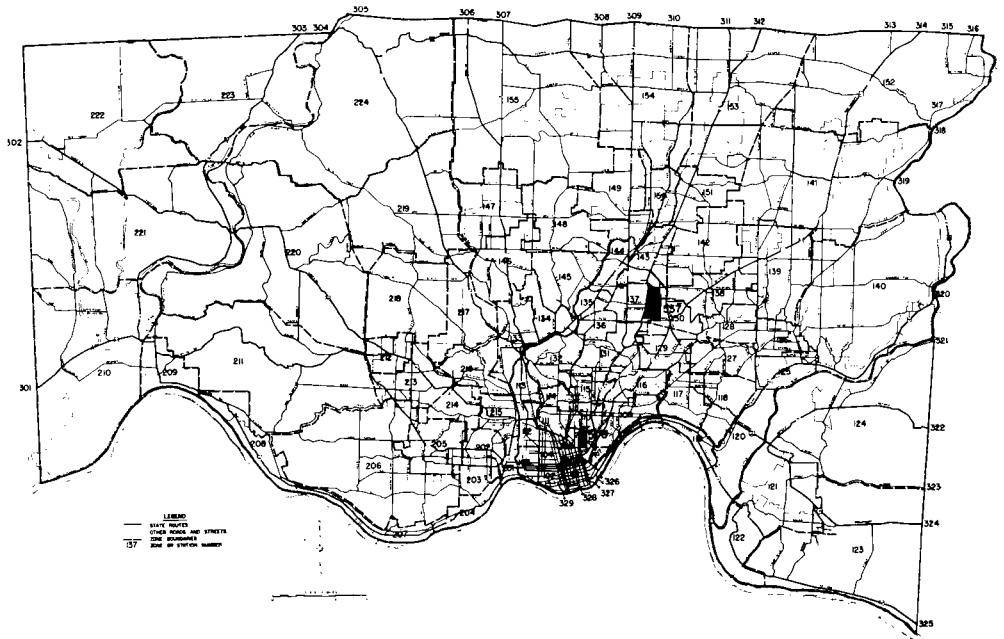


Figure 1. Internal zones and external stations of Hamilton County.

the first zone and contained 1,184 dwelling units and 640 resident passenger cars.

Neither of these areas contained a business district although Zone 506 was on the fringe of the central business district.

The post card survey was scheduled and publicized as a single day's record of travel performed by each vehicle on Tuesday, September 21, 1954. All of the post card questionnaires mailed to the vehicle owners in these two zones were pin-pricked in code to identify the respondents by addresses and vehicle license numbers.

Two weeks following "T-Day," a 100 percent home interview survey was begun in each zone. Each zone was also subjected to two continuous 24-hour cordon volume counts in which the vehicle license numbers were recorded chronologically in five minute increments to isolate through trips from the internal to external trips.

The cordon counts were scheduled so that the better class zone was covered on T-Day and also on a day of the home

interview survey. The cordon count coverage of the lower class zone occurred two days after T-day and one day during the home interview survey, because of the lack of manpower.

In accordance with the Bureau of Public Roads' Manual of Procedure, home interview samples of 5, 6 2/3, 8 1/3, 10, 12 1/2 and 20 percent were selected from the 100 percent home interview survey.

All pertinent data obtained from the two surveys and the cordon counts were punched into business machine cards which were then sorted and tabulated for the purpose of making the following analyses:

- (1) Survey returns;
- (2) Reported trips;
- (3) Distribution of samples;
- (4) Accuracy of reported trips;
- (5) Cordon line check of expanded trips; and
- (6) Expanded interzone trips.

A more detailed paper has been prepared in the form of an interim report and is available for those desiring copies.

Plans provide for the publication of a formal report of this study within the next several months.

SURVEY RETURNS

An analysis and comparison of the returns from the post card and 100 percent home interview surveys together with the cordon license check revealed the extent to which the efficiency of the Post Office and the cooperative spirit, truthfulness, and interest of the respondents in each type of survey can affect the returns.

For example, the Post Office returned 108 cards as undeliverable, or 5.5 percent of the 1,978 cards mailed in the two zones. During the home interview survey, 14 of these registrants were found at the original mailing addresses indicating a 13 percent error in the postal service. Although the percentage of undelivered cards was higher in the poorer zone, the percentage of error in the latter zone amounted to only 8.3 percent as compared with the 22.2 percent in the better zone.

In the better zone, the cooperative spirit of the registrants produced a 42.5 percent return of the delivered cards as compared with only 26.0 percent in the poorer zone.

Of the remaining 57.5 percent of the registrants in the better zone who were contacted by mail, 45.6 percent were not sufficiently interested to respond on their own initiative but did respond to personal appeal in the home interview survey. Thus, 11.9 percent, or 153 of the cars registered in the zone, were not reported in either survey, although 43, or 28.1 percent of these cars were observed crossing the cordon line.

A small group of residents indicated antagonism to the study by refusing to give information in the home interview survey. This group amounted to 1.1 percent of the dwellings in the better zone and 1.4 percent in the poorer zone.

Ownership of a vehicle was denied by the owners of 23 cars registered in the better zone, although 10 of these cars were observed making cordon crossings.

For the poorer zone, 37 vehicles were observed in use out of 78 disclaimed vehicles.

A predetermination of the number of dwellings in each zone was made by field reconnaissance, Sanborn maps, city directory and telephone directory. This study yielded an estimate of 1,421 dwelling units in the better zone. The actual canvass of the area in conducting the home interview survey disclosed that four of the preselected dwellings did not exist, while an additional ten dwellings were discovered for a net increase of six, or an error of only 0.42 percent. In the poorer zone, this error was found to be 3.0 percent.

A review of vehicles registered in the better zone which did not report in either type survey and which were not observed crossing the cordon line indicates an exodus of 138 cars (or 10.4 percent) between the automobile registration date in April and the survey date of mid-September. Conversely, a review of resident vehicles found in the zone indicates an immigration of 221, or 16.7 percent, of the original complement of vehicles.

REPORTED TRIPS

The post cards returned from the better zone yielded a total of 2,707 passenger car trips, or 4.95 trips per vehicle. The 100 percent home interview survey yielded 4,756 passenger car trips, or 3.59 trips per vehicle. This discrepancy of 1.36 trips per vehicle was thoroughly investigated.

In the post card survey, 96.2 percent of the trips were within Hamilton County. For the home interview survey, this figure was 95.7 percent.

The percentage of passenger cars by their reported trip frequency for the two types of survey are as follows:

	Post Card %	Home Interview %
0 trips	16.1	19.5
1 trip	0.6	0.8
2 trips	15.9	30.4
3 trips	5.5	8.0
4 trips	12.3	13.8
5 or more trips	49.6	27.5

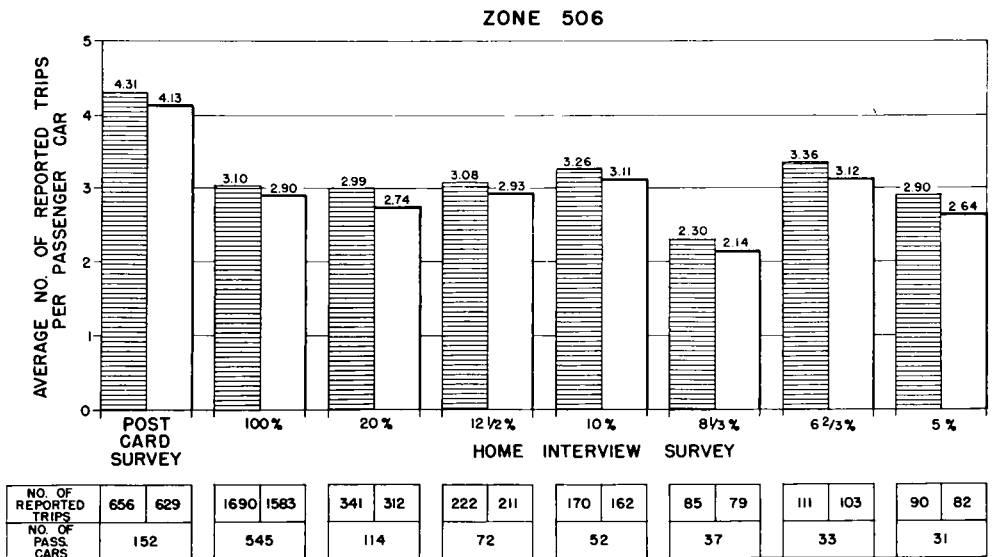
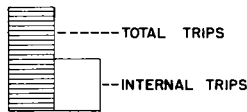
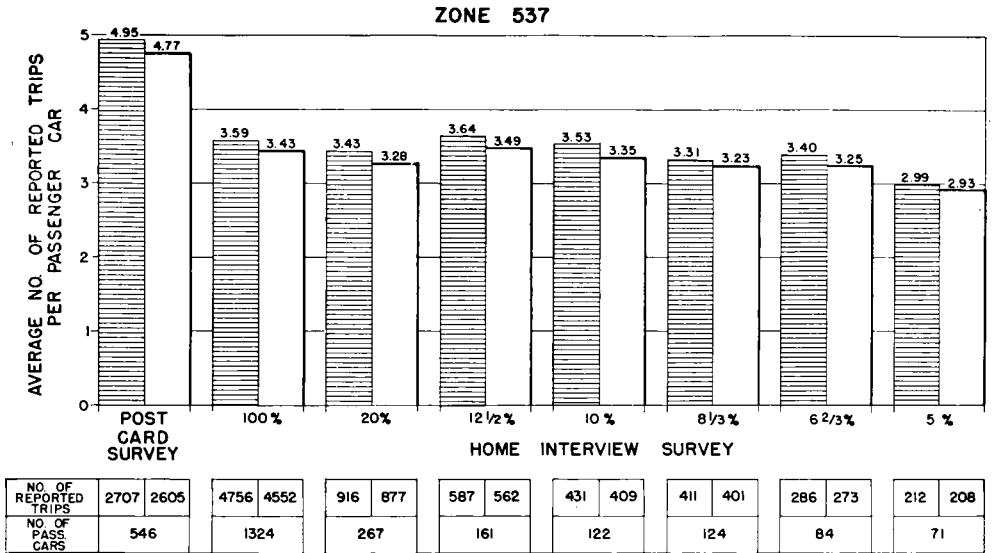


Figure 2. Reported trips per passenger car.

Those vehicles which were reported in both surveys were isolated in a search for a possible explanation for the 1.36

additional trips per car in the post card survey. In the better zone this collation yielded 509 passenger cars reporting

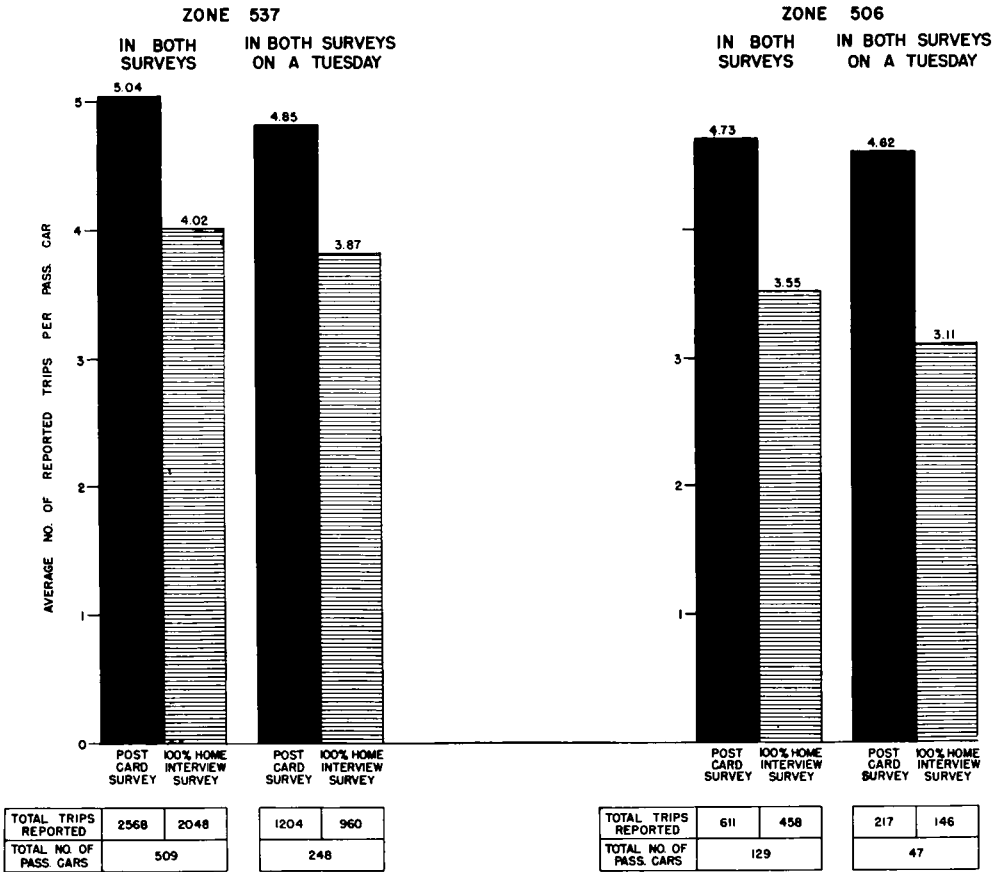


Figure 3. Total reported trips for the cars in Figure 2.

2,568 trips by post card and 2,048 trips in the home interview survey. This produced trip frequencies of 5.04 and 4.02 per vehicle, respectively, or an excess of 1.02 trips per car for the post card survey.

Continuing the analysis of vehicles reported in both surveys, the 509 cars in the better zone and the 129 cars in the poorer zone were further reduced to obtain identical vehicles reporting on the same week day. This collation provided 248 and 47 cars in each of the respective zones.

In the better zone, the 248 cars were reported making 1,204 Tuesday trips in the post card survey and 960 Tuesday trips in the home interview survey for

an average of 4.85 and 3.87 trips per car, respectively.

By sub-classification of these trips into three categories, a logical explanation was found for the one extra trip per vehicle reported in the post card survey. The sub-classifications are as follows:

1. Resident vehicle trips with origins and destinations within the resident zone;
2. Resident vehicle trips which crossed the zone cordon line; and
3. Resident vehicle trips with both origin and destination outside the resident zone.

Outside the resident area, it was found

that, in the better zone, the post card survey reported an average of 2.27 such trips per vehicle while the home interview survey reported only 1.19 such trips per vehicle or a difference of 1.08 additional trips per car in the post card survey with both origin and destination outside the resident zone.

The inference is that people neglect, or forget, to report intermediate planned stops to the interviewer. The design of the post card questionnaire is such that

respondents are encouraged to report intermediate stops as separate trips.

A further analysis of these cars reporting on a Tuesday in the better area showed only 23 percent reported the same number of trips in each survey; 48 percent reported fewer trips and 29 percent reported more trips in the home interview survey. The same general trend was noted in the poorer zone although the trend was more erratic.

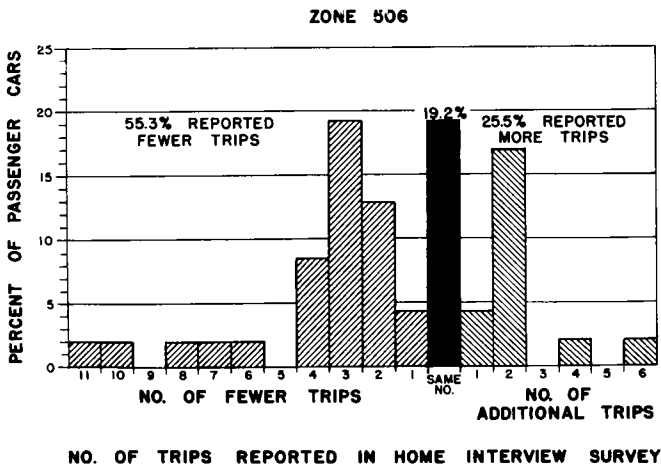
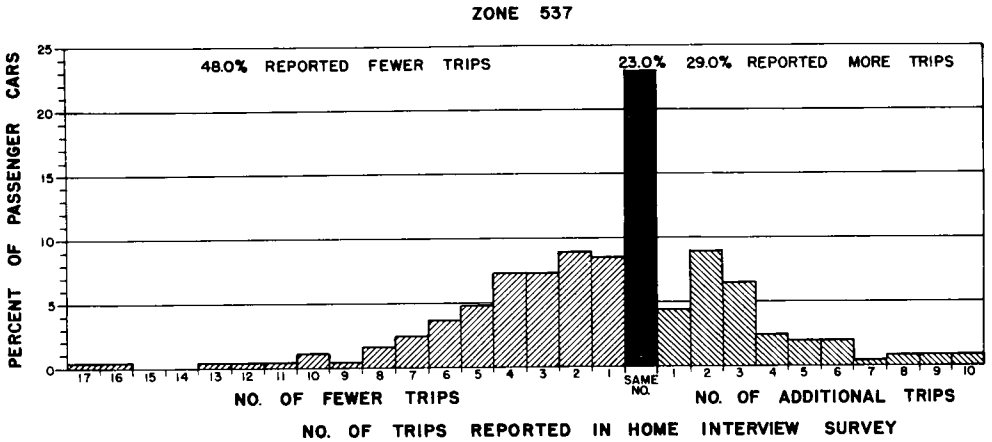


Figure 4. Additional or fewer trips on a Tuesday.

DISTRIBUTION OF SAMPLES

The home interview sampling technique is based upon the premise that the travel characteristics of an individual are habitual and that the travel habits of different individuals within the same area are quite similar with regard to working, shopping, recreation and other travel. According to the theory, a representative sample must be distributed geographically throughout the study area.

Because of the procedure in following the manual in selecting the representative dwellings for each size sample and because the returns provided the exact locations of those dwellings with automotive units in the area, it was possible to test the geographical distribution of those dwellings reporting effective information in each size sample.

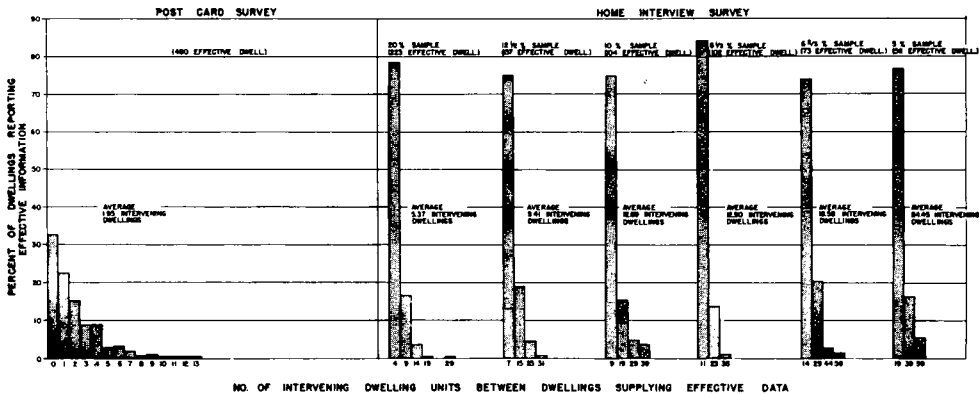
Platted graphically, the better zone shows a very good distribution with 74 percent to 84 percent of the dwellings in the various home interview samples staying within the required pattern of uniformity. In the poorer zone, the distribution pattern did not hold up as well. The distribution of effective samples in the post card survey cannot be guided by selection as in the home interview survey.

ACCURACY OF REPORTED TRIPS

To test the accuracy of reported trips in both the post card survey and the 100 percent home interview survey, the cards which reported trips for the days covered by the manual cordon counts were sorted.

In the better zone, a 483 passenger car deck for the post card survey and a 179 car deck for the home interview sur-

ZONE 537



ZONE 506

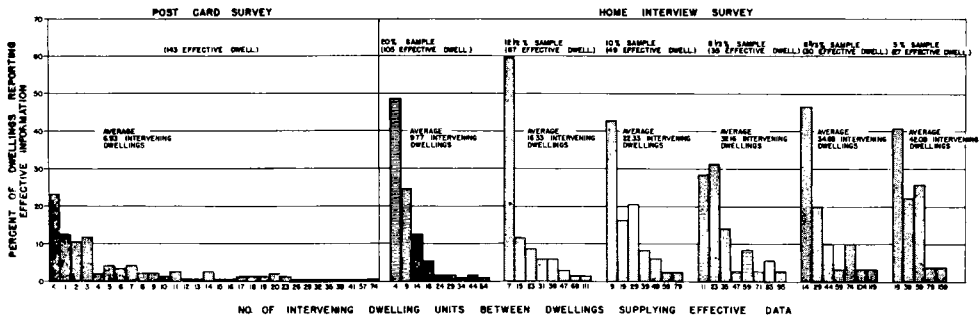


Figure 5. Frequency of dwelling units between those reporting effective information.

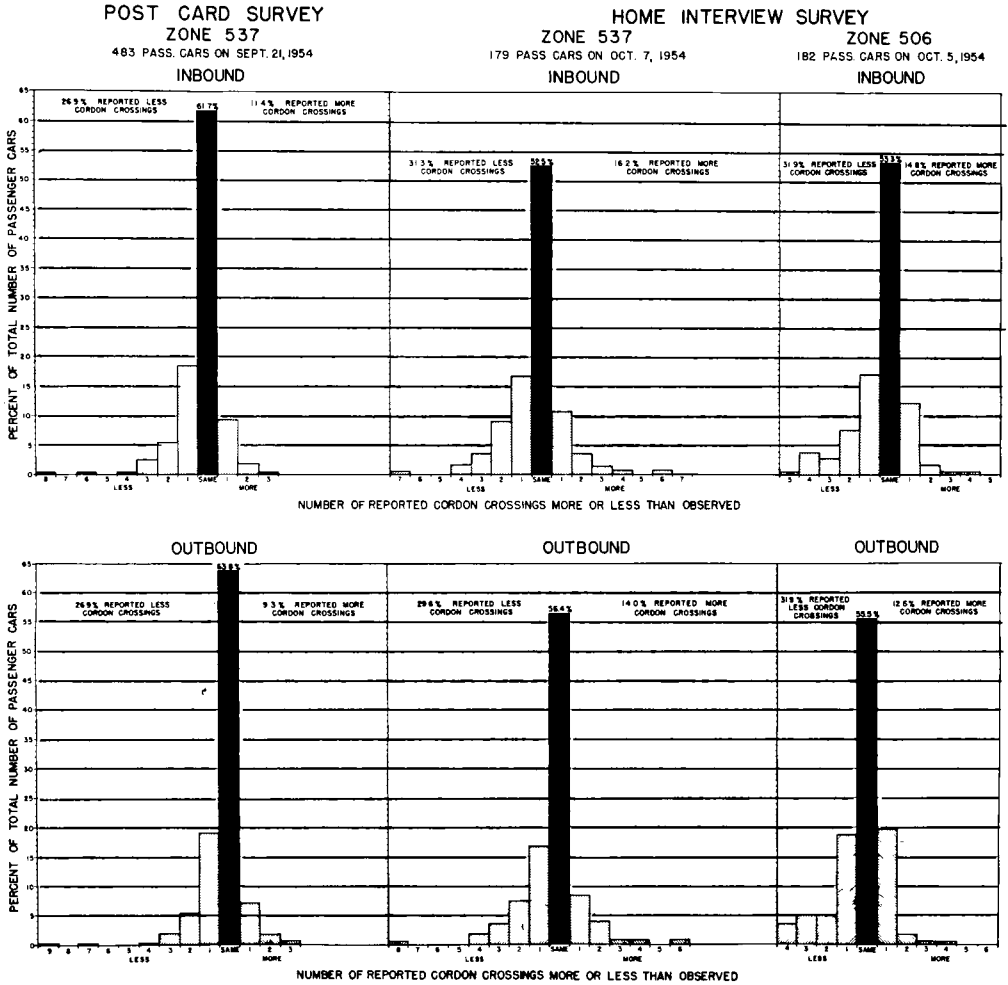


Figure 6. Comparison of reported cordon crossings more or less than observed.

vey were obtained. For the poorer zone, there were no samples for the post card survey because that cordon was not operative on T Day. However, a 182 car deck for the 100 percent home interview survey was obtained.

In the post card survey, about 62½ percent reported the same number of cordon crossings in both directions as observed, 10½ percent reported more trips than observed, and 27 percent reported fewer trips than observed. For the same zone in the home interview survey, percentages of 54½, 15 and 30½

were found. In the poorer zone, the home interview survey produced percentages almost identical with those of the better zone. In both types of survey, the greatest accuracy was observed for the groups of vehicles reporting no trips.

In the post card survey for the better zone 88 such returns were made. Of those 88 cars, 22 were observed making one or more cordon crossings for an accuracy index of 75 percent. The accuracy index for the better zone in the home interview survey was 57 percent, and the index for the poorer zone was 83 percent.

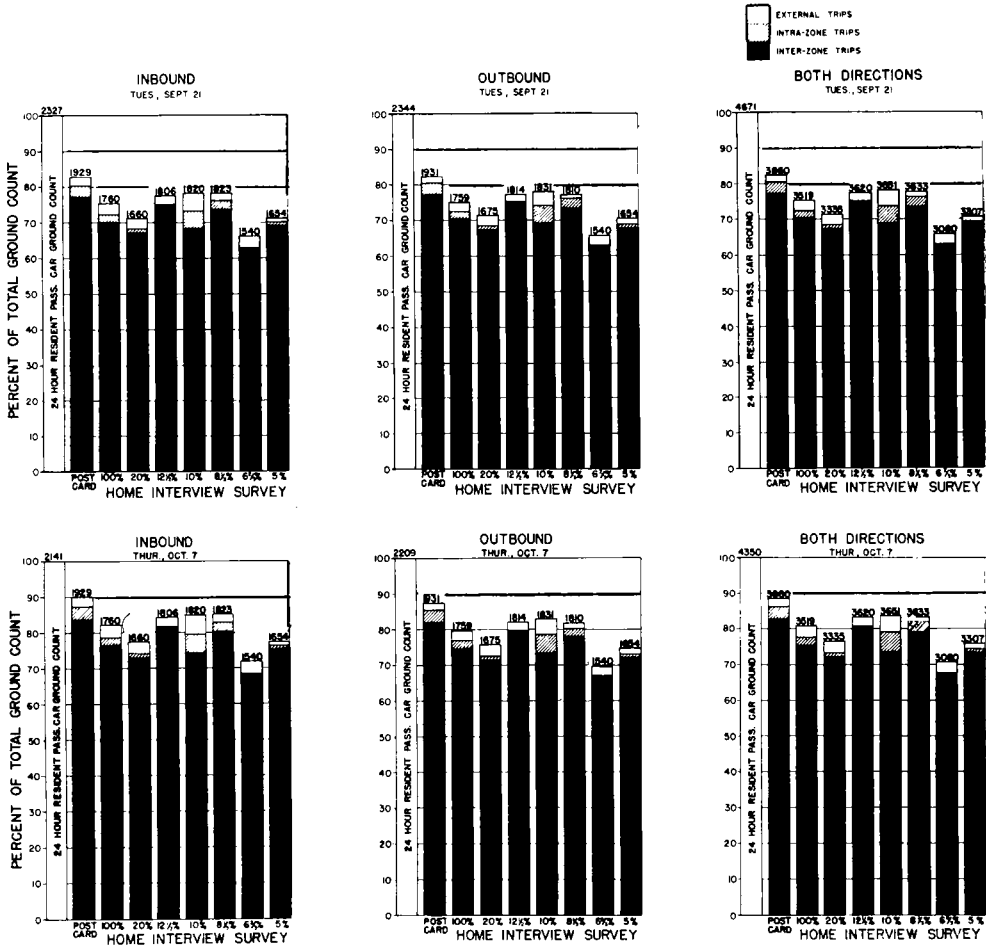


Figure 7. Cordon line check of expanded trips, Zone 537.

CORDON LINE CHECK OF EXPANDED TRIPS

In both types of O-D surveys, it is customary to check the accuracy and completeness of the expanded trips by means of a screen line check. In this study the cordon line counts were used for that purpose.

In the post card survey in the better zone, the expanded crossings of the screen line in both directions was 3,860. Observed crossings, September 21, of resident passenger cars were 4,671, giving an accuracy index of 82.6 percent. The 100 percent home interview survey produced 3,519 cordon crossings in both

directions for an accuracy index of 75.3 percent.

Using the October 7 cordon count of this zone, when 4,350 crossings were observed in both directions, accuracy indexes of 88.7 percent and 80.9 percent, respectively, were obtained for the post card and home interview surveys.

In the poorer zone, the September 23 post card check produced an accuracy index of 92.4 percent; and the home interview check, an accuracy index of 69.4 percent.

EXPANDED INTERZONE TRIPS

The ultimate purpose of an O-D sur-

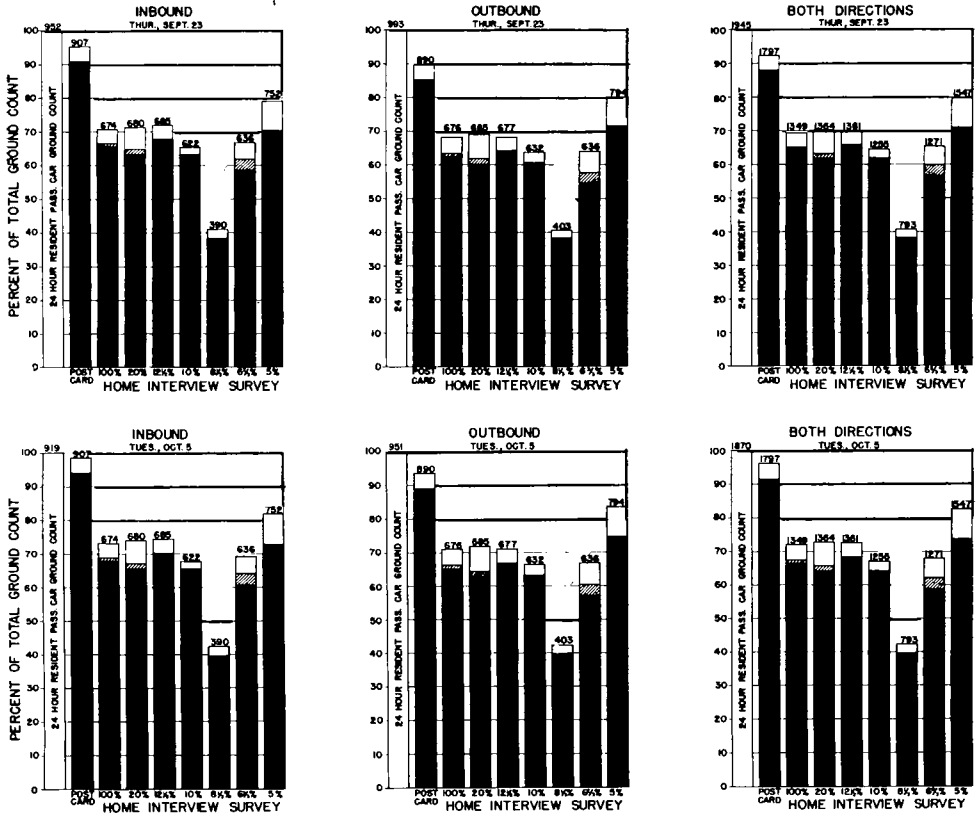


Figure 8. Cordon line check of expanded trips, Zone 506 (Key is same as for Fig. 7).

vey is to determine the pattern of trips so that the future highway needs of an area can be planned.

The total number of zone to zone movements reported in both surveys were expanded by appropriate factors as prescribed for each type of survey and origin and destination tables have been prepared showing the expanded zone to zone movements in both directions.

A discussion of the numerous comparisons which have been drawn cannot be presented; however, a few salient comparisons of the patterns indicated by the two types of survey can be made.

Examining the post card survey pattern of trips performed within Hamilton County, trips with either origin or destination, or both, within the resident zone constitute 60 percent of the travel for the better area. Trips performed en-

tirely outside the resident zone constituted 40 percent of the travel. For the 100 percent home interview study, these percentages were 72 and 28. Approximately the same relative differences were observed for the poorer area.

It is apparent that the primary difference in the two types of survey is in the greater number of secondary trips, or trips with neither origin nor destination in the residence zone, which were reported in the post card survey.

From a preliminary analysis of the completed O-D tables, the expanded zone to zone movements of the post card survey and the 100 percent home interview survey are substantially in agreement except for the secondary trip discussed above. However, this does not hold true for the expanded movements produced by the various size samples of the home

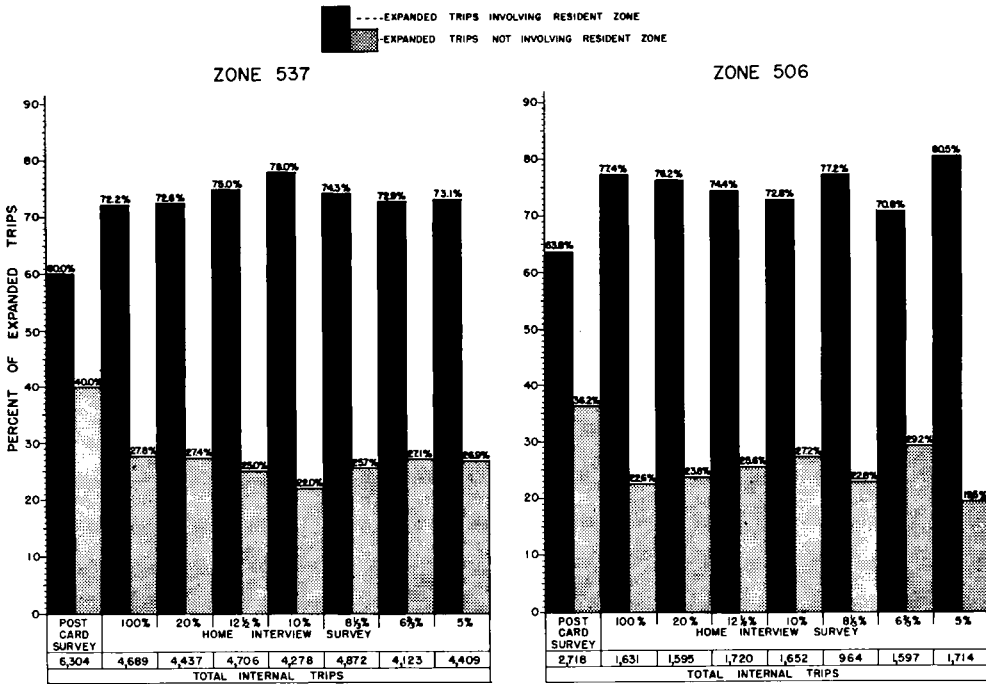


Figure 9. Expanded trips in Hamilton County by resident passenger cars.

interview survey. It appears that this discrepancy is partly attributable to the fact that the car ownership pattern did not maintain a constant ratio with the dwelling unit pattern.

In conclusion, both methods of survey contain errors when the accuracy of reported trips is measured against the

observed movements, and it is difficult to determine if these errors are inherent in the type of survey.

If these data can point the way to improving the accuracy of either or both types, the time and effort directed to this study will have been of value.