

A middle-ground approach would be to use data on building permits. Although a considerable number of building permits can be issued yearly even in small regions, a recent study by the Baltimore Regional Planning Council showed that in 1975 commercial permits accounted for only 2 percent of all permits issued in Baltimore. Furthermore, since building permits are themselves measures of change, such a system could be initiated in 1980, just in time to identify buildings opened after the census. The 1980 base data would be assumed to be reflected in the census data.

SUMMARY

A census is a major undertaking. The collection of travel data planned for the 1980 census will require a monumental effort in data reporting, checking, coding, and processing in order to deliver a useful product to transportation planners. However, as discussed in this paper, even the highest-quality census output will fall short of the needs of transportation planners. Not only is the coverage restricted to commuting, which represents a minority of the daily trip making of households, but there are also gaps in the types of work-trip data commonly used by planners. Certain of these missing data items could be supplied by a limited survey of employers; others would require a direct survey of commuters. Nonwork travel data, if desired, must be obtained through locally sponsored surveys.

The main opportunity presented by the census seems to be that of establishing a foundation for a continuing data base on commuting. By using the 1980 census journey-to-work data to estimate home-to-work interchanges by mode for each zone in a region, the most expensive part of such a data base can be minimized. Identifying change in work locations after 1980 at the local level and surveying workers at these new sites can provide an affordable method of detecting change since 1980,

which will make it possible to keep the census data up to date.

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Workplace Interviews as an Efficient Source of Travel Survey Data

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In recent years, personal surveys have become increasingly expensive. At the same time, doubt about their reliability has increased. In addition to cost increases, a problem shared by most other service industries, other problems in personal surveys include the increased difficulty of finding adults at home and higher nonresponse rates because of privacy and security problems. The results of two recent travel surveys conducted through employers in the Washington, D.C., area indicate that such a sampling frame may solve many of these problems. With the cooperation of slightly more than 400 employers, 10 000 questionnaires were distributed. The response rate compared quite favorably with that of personal surveys on similar subjects, and the costs were a mere fraction of the cost to conduct such a survey in person. The general applicability of this technique, as well as its potential application for private survey research firms rather than government agencies, is discussed.

The increased difficulties of obtaining survey data from

individuals have become so widespread that they have now become a concern not only to survey researchers but also to the public at large (1). The two principal problems are a dramatic decrease in the probability of finding people at home during the day and a marked increase in the nonresponse rate. These two problems also contribute to excessive increases in the cost of surveys.

A possible solution in those surveys that collect information only on the employed labor force is to interview workers on the job rather than at home. This virtually ensures that a contact will be made with a respondent within a reasonable number of calls. It also makes it more likely that the survey will be completed by respondents, especially if the employer's approval is given, since the questionnaire can then be

Table 1. Sample design for travel survey.

Number of Employees	Establishments	Establishment Sample Rate (%)	Samples	Number of Employees ^a	Employee Sample	
					Rate (%)	Yield
≥250	90	100	90	59 751	10	5 975
50-249	571	20	114	56 376	50	5 700
10-49	2 570	5	129	53 275	100	2 664
1-9	7 096	1	71	24 287	100	243
Total	10 327		404	193 689		14 582

^a All firms.

Table 2. Rate of employer cooperation.

Type of Business	Number of Employers	Cooperating Employers by Number of Employees (%)				
		0-9	10-49	50-249	≥ 250	All
Service	167	45	85	95	84	78
Trade	83	31	50	50	71	46
Finance, insurance, real estate	38	60	92	100	86	84
Transportation, communication, utilities	30	100	100	75	100	93
Industrial	14	50	71	-	100	71
Total						
Before survey	332	43	76	81	88	72
After survey	315	64	70	81	89	72

completed in the employee's office or work station, which may be a more convenient environment than the chaos that occasionally exists in the home when the interviewer calls. Moreover, intrusions on the privacy of the office are not felt to be as much of an invasion as those on the privacy of the home. Finally, the ability to fill out the form on the employer's time rather than on one's own time is an extra incentive, especially for busy people.

All of these factors point to the desirability of a workplace survey. When the Metropolitan Washington Council of Governments (COG) was investigating alternatives for surveying commuters to measure the impact of the Metro rail rapid transit system, it was decided that a workplace survey was the only feasible means of collecting the information. The results described in this paper summarize COG's experience with two such surveys—one conducted in the early summer of 1977 and referred to as the "before" survey and one conducted during the fall of 1978 and referred to as the "after" survey. These results indicate that such a survey is a major improvement over more traditional techniques.

SAMPLING DESIGN

The three principal employment components in the central area of Washington, D.C., and adjacent northern Virginia are the private sector, the federal government, and the municipal (District of Columbia) government. In the surveys of the federal and municipal sectors, which were handled as separate surveys, a sample of employees was selected from an employee roster. Government workers received questionnaires through the normal distribution channels of their agencies. The private-sector survey required a distribution through each separate company location. Questionnaires were mailed back to COG in the before survey and collected by the survey staff in the after survey.

The most important advantage COG had in preparation for this survey was a file that represented a virtual census of employment for the metropolitan area. This file, the Regional Employment Census, is based on records from state employment security files (2). This

made it possible to estimate the universe with greater accuracy, draw a random sample of employees, and expand the results to represent the universe.

The summary of the universe and the sample for the before survey given in Table 1 shows that, while the vast majority of the central-area establishments are small employers with fewer than 10 workers, most of the jobs are concentrated in a relatively few large firms. This suggests a stratified sampling plan that samples businesses in proportion to their number of employees. Such a plan also makes it possible to economize by yielding more responses per employer contact. It was decided to stratify private employers by four size groups as shown and use a declining sample rate from the largest to the smallest firms. Because of the number of employees involved in some of the larger businesses, it was decided to further sample a percentage of employees in these groups. Such a technique minimized the burden on large firms (those with more than 250 employees) by interviewing only 1 out of every 10 employees. In the next smaller size group, half of all employees were sampled. In groups below that size, questionnaires were distributed to all workers. In cases in which a sample of workers was required, the employer was given a procedure for selecting every "nth" employee from the roster after a random start.

The sampling plan for the after survey was similar except that large firms were given the option of selecting a sample of employees or distributing to everyone, which was sometimes easier.

EMPLOYER COOPERATION

The cooperation of employers in this survey was excellent. The definition of cooperation includes only employers who both agreed to participate in the survey and were able to elicit some response from their employees. As the data given in Table 2 show, almost three out of every four establishments that received questionnaires had at least some employees who responded. It is assumed that, in the remainder of the establishments, the employer either failed to distribute the questionnaires or did not sufficiently encourage employees to participate.

Table 3. Rate of employee response.

Type of Business	Number of Employees	Employer Response by Number of Employees (%)				
		0-9	10-49	50-249	> 250	All
Service	4877	55	40	36	43	40
Transportation, communication, utilities	1915	22	30	21	42	38
Trade	1555	29	19	26	26	25
Finance, insurance, real estate	989	43	44	46	54	48
Industrial	512	38	26	-	37	34
Total						
Before survey	9848	43	36	34	41	37
After survey		77	49	39	33	38

When employers in the before survey were classified by five major industry types, only the trade category showed a response that was below average—46 percent, or slightly less than a majority. The highest response rate—93 percent—occurred among transportation, communication, and utility (TCU) firms. TCU firms may feel obligated to cooperate because most of them are government regulated. The second highest rate of employer cooperation—84 percent—occurred in the finance, insurance, and real estate group. This group is also regulated by the government but not to the same extent as the TCU group. Seventy-eight percent of service establishments, which account for almost half of all private business locations in central Washington, cooperated in the survey. Finally, industrial employers, who are relatively rare in the central area, cooperated in the survey at about the same rate as that for all employers combined.

If these findings have general applicability, it appears that most establishments of the office type are very willing to cooperate in such a workplace survey. The lowest response rate was among retailers, whose employees do not have the same type of permanent work status as office workers. In addition, their salary scales are rather low, and they may employ illegal aliens or people who are not supposed to be working because they receive some form of government benefits. Finally, because of the number of business forms used in stores, retail employers may prefer not to have large numbers of survey forms circulating around.

Analysis of employer cooperation by size of establishment in the before survey showed a clear distinction between small firms (those with fewer than 10 employees) and larger firms. Although small firms had only a 43 percent rate of participation, more than 3 out of every 4 with 10 or more employees cooperated. Within this group of larger firms, there was a generally increasing participation rate as the size of firms increased; 88 percent of all the largest employers cooperated in the before survey and 89 percent in the after survey. The pattern of cooperation in the after survey was almost identical except for a significantly higher level of cooperation among small firms. Apparently, the fact that a member of the survey team scheduled an appointment to pick up the completed questionnaires was a subtle inducement to cooperate. In the before survey, questionnaires were returned directly to COG and no further visit was made to the site.

The relationship of participation rates by firm size within a given industry category (Table 2) confirms the patterns identified above for the before survey. Cooperation rates vary among industries, but within a given industry they are generally higher for larger businesses.

EMPLOYEE RESPONSE

After all employers from whom no response was received were eliminated, it was possible to calculate a true response rate as the ratio of questionnaires returned to questionnaires distributed to cooperating employers. The overall average in the before survey was 37 percent. Although this is only half the rate of employer cooperation, it is excellent for such a mail-back survey. The response rate in the after survey was an almost identical 38 percent. Like the rate of employer cooperation, the response rate in the before survey was lowest in trade establishments, where only one employee in four participated. In addition to the reasons for this cited above, many retail employees receive commissions, which means that spending time filling out forms could affect their wages. The highest response rate came from workers in the finance, insurance, and real estate sector, probably because these people are the most oriented to filling out forms. The other three industrial groups had response rates that were clustered in the 34-40 percent range.

Analysis of the response rate by size of establishment shows a different pattern from that described above (see Table 3). In fact, the highest rate of response was found among people who work for small businesses: Forty-three percent responded to the before survey and an impressive 77 percent to the after survey. This substantial increase in response appears to be the result of personal visits made to the site by the survey team in the after survey described above. In a small firm, a personal follow-up is very close to a personal survey since most employees are located in the same general work area. In fact, about half of the small firms in the after survey yielded a 100 percent response.

Response rates for larger firms dropped substantially in both surveys although they were consistently higher in the after survey for each firm size. Apparently, communications become somewhat more difficult in larger firms, which makes it more difficult to communicate survey goals effectively and thereby lowers the response. A possible solution would be to sample smaller operating units within large organizations.

The response rate for the next two largest categories dropped to 36 and 34 percent, respectively. It increased to 41 percent for large employers. The high response among people in small businesses may reflect the close proximity of the staff and, therefore, better communication of the survey goals. Although small firms may cooperate less frequently than larger firms, the actual response rate from the sampled employees is similar. This is a very important point because it has been indicated above that one of the goals of this technique was to minimize the

types of selection bias frequently encountered in surveying private residences.

COSTS

One of the other major advantages claimed for this technique is the cost advantage over more traditional techniques. Since much of the cost of such a survey is borne by the cooperating employer and workers, the cost to COG was very low. The average employer distributed 35 questionnaires to employees, who on the average mailed back 11 completed forms. Because many of these employers were clustered within walking distance of each other, transportation costs were less than \$0.50/site. More important, interviewer productivity was high: The initial employer contact could be completed in an hour, and frequently two businesses per hour could be visited. The salary cost per interview was about \$1.25, an order of magnitude lower than the cost of obtaining the same data through personal interview.

SUMMARY

This paper has reported the experience from two large travel surveys of downtown workers conducted through the cooperation of employers. The results indicate that this technique has some major advantages over more traditional home-based interviews. Small businesses and retailers showed a lower rate of cooperation than other firms if there was no follow-up, but they were almost as cooperative as other businesses when they were told that a call-back visit would be made to pick up completed questionnaires. Once employers received the questionnaires, the response rate of workers in small businesses was actually much higher than that in larger firms. An important measure that seems to in-

crease the response rate is to make the employer responsible for collecting completed questionnaires. This approach was not taken in the before survey because of the possibility that respondents would fear the disclosure of confidential information to their employer. However, use of this technique in the after survey caused no major problems. A similar survey conducted in the San Francisco area (which did not collect as much confidential household data) produced an excellent response rate of 58 percent by collecting the questionnaires through the employers (3). Finally, because much of the cost of this type of survey is absorbed by the employer, the survey cost to the sponsor is relatively low.

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Design of Small-Sample Home-Interview Travel Surveys

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Procedures for use in designing small-sample home-interview travel surveys are described. The following steps are addressed: (a) Decide on the purpose of the survey, (b) decide which variables should be measured to fulfill the purpose, (c) decide whether a home-interview travel survey can adequately measure the variables in question, (d) determine the coefficients of variation of the variables in question, (e) decide on a level of accuracy and a confidence limit, and (f) based on steps d and e, compute the sample size. Methods for using stratified sample frames are also discussed. The techniques are illustrated by using composite data from several urban areas. These data indicate that travel demand models can be developed from a survey of less than 1000 households.

The first step in any data collection is to decide on the purpose for collecting the data. If this decision is not made with the utmost care, there is a real danger that the survey will fail to produce the desired results. In the past, most origin-destination surveys of the home-

interview type were conducted to replicate travel patterns in an urban area. Great care was taken to ensure that the survey instrument—i.e., the household questionnaire—was designed to extract just the right data. However, the sample sizes were not usually based on their ability to produce desired statistics within a specified accuracy. Usually 1 out of 10 or 1 out of 20 households was interviewed, on the basis of past experience or judgment, to duplicate travel patterns in the area (1). As a result, large sums of money were spent, and a large number of data were collected. The relations developed from these data have resulted in increased knowledge about the structure and interdependence of variables appropriate for travel demand forecasting. This increased knowledge should allow the development of procedures for determining sample-size requirements by statistical means.

The purpose of this paper is twofold: (a) to provide