

Quality and Cost-Effectiveness in Recording a 24-Hour Travel Diary

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Abstract:

The current economic environment, together with an increasing sense of accountability, has meant that many authorities are searching for travel data which is not only cost-effective, but also retains the high quality required for planning and decision-making.

As part of a 1991 pre-pilot study for the Melbourne Area Personal Travel Survey, there was a detailed evaluation of different survey methods for collecting large-scale 24-hour travel data. One of the key objectives of this exercise was to design, implement, and recommend a methodology which gave high data quality, was cost efficient, and would be robust over an expected survey period of 5 years

Six different methods were tested. They included a version where a phone call was the initial contact, a series of methods where an introductory letter was the initial contact, and a personal interview approach. Other variations were the level of detail at which the travel data was collected (linked or unlinked trips) and the number of days over which the data was reported (one or two)

The results were interesting at a number of levels. The telephone contact method gave neither better quality data nor was it any cheaper than the other methods. A consideration of the client's requirements for data usage indicated that the collection of linked-trip travel data would be inappropriate. Finally, while there were some relative cost savings in collecting two day's data from the one household, the question of how much extra data are actually obtained from the extra day remains a subject of debate.

This paper provides detailed results in terms of actual and perceived quality of data and in terms of the cost of data collection, thereby making possible recommendations on cost-effectiveness of different survey methods.

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Introduction

Following a pre-pilot study for the Melbourne Area Personal Travel Survey (MAPTS), there was a detailed evaluation of different survey methods for collecting large scale 24-hour travel data. Since the data base was to be used for multiple purposes, one of the key objectives of this phase of the data collection exercise was to design, implement and recommend a methodology which gave high data quality, was cost efficient, and would be robust over an expected survey period of five years.

Instrument design procedures

To ensure that an appropriate decision on the survey method was possible, six different survey methods were tested in the pre-pilot. The methods were:

1. **Phone** as the initial contact
Mail out an **Unlinked¹-1 day** Household and Person Form
2. Mail a letter as initial contact
Mail out a **Linked²-1 day** Household and Person Form
3. Mail a letter as initial contact
Mail out a **Linked-2 day** Household and Person Form
4. Mail a letter as initial contact
Mail out an **Unlinked-1 day** Household and Person Form
5. Mail a letter as initial contact
Mail out an **Unlinked-2 day** Household and Person Form
6. Personal initial contact and interview - **Unlinked-2 day**

The six methods are essentially divided into those which use a self-administered design (Methods 1-5) and that which uses a personal interview technique (Method 6). The differences between Methods 1-5 are either of length of reporting (1 and 2 days) or of initial approach method (by phone in Method 1 and by mail in all other methods). The next two sections give more detailed information on the characteristics of the self-administered and the personal interview designs

The two-day method was piloted with the aim of gathering information on travel variability. The cross-correlations between two consecutive days do not make two days worth of data simply equal to twice the amount of data collected in one day.

¹An unlinked trip data base includes all legs of a trip as separate data items, e.g walk to the bus stop, bus to the next bus stop, and walk to the destination are each separate data records (3).

²A linked data base would include only 1 record for the above trip, i.e. a "journey" to the destination using the modes of walk and bus

The self-administered design

The self-administered design used was based on that originated in West Germany in the early 1970s (e.g. Brog et al. 1985). The original method was based on the collection of 1 day, linked trip data and is commonly referred to by its German name of KONIIV. This method was replicated almost exactly in Method 2 in this pre-pilot, while Method 3 was the simple extension of the same technique to 2 days. Methods 4 and 5 were developed after initial Technical Advisory Group (TAG) meetings when it became clear that most members felt that the most useful data would be unlinked.

The actual operational aspects for each of the self-administered methods were almost the same, so it is worth summarising these at the outset. There were 5 discreet phases

1. **Initial contact.** This stage is to introduce the respondents to the fact that they have been selected to participate in the survey and to legitimise it in some way. In the KONIIV method this was done by letter, but the Vic Roads brief, at the advice of the Melbourne Travel Survey Steering Committee (Taylor et al. 1989c) specified the use of telephone contact. This was correspondingly carried out for Method 1.

The first phone call was made one week prior to the Travel Day/s allocated to the household. Attempts were made to contact the household for four consecutive days at different times of the day. After that time no further attempts were made.

The initial contact letter (signed by the client) for Methods 2-5 was sent one week prior to the Travel Day/s allocated to the household.

2. **First mailing.** The first mailing for all of Methods 1-5 included the following items: (Note that respondents to Methods 1 and 4 received the same first mailing except for the covering letter.)
 - A follow-up covering letter (again from the client)
 - A household form
 - Six person forms (five sets numbered for persons 1-5, and one set blank for use by a sixth person or by people who made more trips than fitted on to the first five sets.
 - A person form with an example completed on it
 - A return envelope (with stamp)

This and all mailings were sent in a letter with a stamp to make the letter seem more personal since this had been previously shown to have a positive effect on response rate (Brog 1977). The letters were sent so that they would arrive two working days prior to the Travel Day/s

3. **First reminder.** This took the form of a postcard which not only reminded respondents to return the questionnaire but also allocated them a new travel date/s (one week after the initial one/s) in case the forms had not yet been filled in. It was signed by the Survey Director of the research firm.

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4. **Second reminder.** The second reminder was a letter which was sent in an ordinary business shaped envelope, again signed by the research firm. The reason for the different packaging was to encourage people to open the letter and not to treat it as repetitive junk mail. Once again, new travel date/s were suggested for those people who had not yet filled in the forms.
5. **Third reminder.** This reminder contained all things sent in the first mailing with the addition of a cover letter from the research firm stressing the importance of returning the forms. Again, new travel date/s were proposed.
6. **Fourth reminder.** For this reminder a postcard was again used (as for the 1st reminder) although a different colour was selected. New travel dates were again listed.

The personal interview design

The personal interview design was based on a well-developed methodology (Ampt 1981) using a verbal activity recall framework to ensure that maximum travel data is captured during the interviewing process. It can be described in three distinct stages:

1. **Pre-contact letter.** This letter was sent from the client informing the respondent of the survey and legitimising it, in the same way as was done for the self-administered methods. To add to its authority, the name of the interviewer was also written on each letter.
2. **Pre-contact interview.** At this initial contact the interviewer gains information on household including the structure type, the number of household members and the number and type of registered vehicles "usually parked here overnight whether private or company owned". A very structured method of interviewing is used.

In addition to asking the above information, interviewers also leave Memory Joggers for each person in the household. These Joggers are personalised, diary-like notepads on which respondents keep track of all travel at the level of detail described to them by the interviewer (all unlinked trips and their detailed addresses). Finally, appointments are made to speak with each household member over 9 years of age personally at an appointment after the travel day/s

3. **Main interview/s.** The final stage of the personal interview takes place when the interviewer returns to carry out interviews with each household member after the travel day/s. Again, it is a structured survey form. This means that the Memory Joggers are used by respondents only for the purpose their name implies. It is not necessary for the interviewer to collect them.

While it is essential that people of 10 years of age or more answer the questionnaires in person, proxy interviews are allowed for children 9 years of age and less.

Each household was allocated a specific travel date/s. Interviewers are instructed to begin attempting pre-contact interviews four days prior to the day/s. They have to visit the household on five different occasions at different times of the day before the household can be described as "non-contactable".

Response rates

Response rates for each of the six methods were considered to be the first vital indicator of the quality of the data being collected. They are calculated in the following way. From the *gross sample* size for each method is subtracted those forms of *sample loss* which do not affect the quality of the sample (e.g. vacant or demolished dwellings). These are sometimes said to be quality neutral. The resultant number is the *new sample size*. Then the number of total responses is taken as a percentage of this new sample size. The response rates for each method were as follows (Table 1):

Table 1 Response rates

Method 1	Phone Pre-Contact (Unlinked, 1 day)			
Total			63	
No phone	11			
Refused on phone	29			
Mailed out	23			
Returned	19	(4 blank)	15/63	23.8%
Method 2	Linked, 1 Day			
Total			63	
Returned	48	(6 blank)	42/63	66.7%
Method 3	Linked, 2 Days			
Total			63	
Vacant, Deceased			6	
New Total			57	
Returned	37	(6 blank)	31/57	54.4%
Method 4	Unlinked, 1 Day			
Total			63	
Returned	38	(5 blank)	33/63	52.4%
Method 5	Unlinked, 2 Days			
Total			63	
Vacant, Overseas			6	
New Total			57	
Returned	36	(7 blank)	29/57	50.9%
Method 6	Personal Interview, Unlinked, 2 days			
Total			63	
Sample loss			5	
New Total			58	
Response			38/58	65.6%

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There are several important comments which relate to Table 1.

- It can be seen that the highest response rates were obtained by using the linked, 1-day method (traditional KONTIV, Method 2) and the personal interview method (Method 6).
- Method 1 using the telephone pre-contact obtained the lowest response.
- There was little significant variation in response between the other three methods.
- It should be noted that all methods would probably receive slightly higher response rates in a pilot survey. In the self-administered methods this would be because of more attention to printing and layout. The personal interview suffered a particularly poor response rate in one area where crime had been in the news recently and there were also some interviewer-specific response problems.

For the self-administered questionnaires, it is also interesting to look at the influence of the various reminders in generating response. This is done in two ways. First, in Table 2, responses are examined in terms of the *dates about which respondents replied*, i.e. if they responded after the 2nd reminder but the reported travel day is still that of allocated in the first mailing, they would be classified as responding *about* the first mailing

This suggests that a large majority of people respond about the initial travel day/s assigned to the household. Without further reflection, this could be taken to suggest that there is very limited value in the comprehensive programme of reminders.

It is, therefore, worth examining Table 3 which shows the responses which came in after (i.e. were generated by) each reminder, regardless of the travel date/s reported in the questionnaires.

Table 2 Percentage of respondents by reported travel date/s for self-administered methods

Method	1st mailing date	1st rem. date	2nd rem. date	3rd rem. date	4th rem. date
1	93.3	-	6.7	-	-
2	78.6	11.9	7.1	2.4	-
3	74.2	6.5	9.7	3.2	6.5
4	75.8	6.1	-	18.2	-
5	79.3	-	6.9	6.9	6.9

Table 3 Percentage of respondents by reminder after which response was received for self-administered methods

Method	1st mailing date	1st rem. date	2nd rem. date	3rd rem. date	4th rem. date
1	66.7	26.7	6.7	-	-
2	50.0	26.2	11.9	9.5	2.4
3	48.3	25.8	16.1	3.2	6.5
4	69.7	9.0	3.0	6.1	12.1
5	65.5	13.8	6.9	3.4	10.3

The implication of the two tables was as follows:

- some people responded as requested, i.e. to the most recent travel date/s;
- between 15% and 20% of respondents, however, were prompted by the reminders, but respond to a previous travel date. The easiest example to follow is for Method 1 where it is seen that 66.7% of people responded to the initial mailing dates immediately, while 26.7% responded to the same mailing dates, but only did so after the first reminder;
- with the exception of Method 1, each reminder is responsible for the generation of some responses;
- not seen from the table, but also important, is the fact that a lot of information on sample loss (e.g. vacant dwellings and deceased persons) was received from the 3rd and 4th reminders.

The most important implications from this phase of piloting stem from the second point. While it was possible that some respondents filled in the forms immediately subsequent to the initial travel day/s, left them lying around and then hurriedly mailed them on receipt of the next reminder, it was also possible that they filled in the forms retrospectively (in some cases this would have been 1-2 weeks later). Since no validation interviews were done during the pre-pilot, this information was not known at the time. Clearly, however, if there is a large number of people using a recall approach to reporting, the bias would be very significant. Subsequent research using validation interviews in the pilot study (Transport Research Centre 1992) showed that retrospective reporting was not a significant problem.

This raised a second area of interest which was not reflected in the simple response data reported here and which was not measured during the pre-pilot surveys. It related to who is filling in the questionnaires. In many cases it is obvious that the same handwriting has been used to complete each household member's form. If this is being done in the presence of the actual respondent, of course, there is no problem (e.g. a

parent asking a child about their behaviour) If, however, it is the self-administered questionnaire's parallel to the proxy response of the personal interview, there could be serious errors of non-response introduced into the data. This was not within the scope of the pre-pilot but has since been examined in some detail (Transport Research Centre 1992).

Assessment of data quality

Trip and travel data

In the following section, some basic data reports are presented for each of the six methods. Trip rates and the mobility of the respondents are used as indicators of the quality of the data.

Table 4 indicates two things:

- that between 80% and 94% of respondents reported travel on either of the travel days. This compares with 87% Sydney-wide in 1981 (State Transport Study Group 1982) and 85% for both Australia as a whole and for Victoria in 1985-86 (Socialdata Australia 1987);
- that there is not a significant difference between the percentage of people reporting trips on the first and second days in cases where two travel days were assigned. This is particularly important since it is often hypothesised that there is a fall-off in reporting on the second of two days.

Table 5 shows the number of trips reported per travel day. Methods 2 and 3 are highlighted to remind the reader that they are *linked trips*, while the remainder of figures in the table are *unlinked*.

Not surprisingly, the linked trip method gives the lowest number of trips both person and per traveller. The number of linked trips reported is somewhat lower than those reported for Australia in the 1985-86 data (Socialdata Australia 1987) when the same method was used. At that time the number of trips per person was 3.3 and per traveller was 3.9.

Since an unlinked, self-administered method has not been tested prior to this pre-pilot, there is no comparative data available. There are figures for personal interviews, however, and these are generally slightly above five trips per person as is the case with this data.

Finally, Table 6 gives more detail on the comparison of trip rates between Days 1 and 2 in the three methods where 2-day data was collected. Consistent with Table 4, it can be seen that there is very little difference between the two days, suggesting little fall-off in trip reporting.

Table 4 Percentage of people who travelled on travel day/s

Method	Day 1	Day 2
1	87%	-
2	80%	-
3	82%	82%
4	81%	-
5	85%	81%
6	94%	96%

Table 5 Reported daily trip rates

Method	Per Person	Per Traveller
1	3.5	3.8
2	2.5	3.1
3	2.8	3.4
4	3.5	4.3
5	3.6	4.4
6	5.3	5.6

Table 6 The influence of 2-day reporting on trip rates

Method	Day 1	Day 2
Per Person		
3	2.8	2.8
5	3.6	3.5
6	5.2	5.4
Per Traveller		
3	3.4	3.4
5	4.4	4.4
6	5.5	5.6

Cost comparisons

This section presents a cost comparison for Methods 4, 5 and 6 since the validity of the other methods was rejected for the data needs of the MAPTS project. All set-up costs for printing (i.e. artwork and film-making) have been omitted in these calculations for all three methods. In the context of a major survey, these costs would be very small (less than \$1000 in all cases), but in the context of the pre-pilot reported here, they would affect the costs disproportionately, distorting the comparison between the methods.

The following costs have not been included in the costing of the **self-administered methods** (4 and 5):

1. All development costs (i.e. consulting time) and any costs relating to sampling.
2. Artwork and film (as mentioned above).
3. Recruitment and training of administrative personnel.
4. Employment of administrative staff.

Similarly, the following costs are not included in the costing of the **personal interview method** (6).

1. All development costs (i.e. consulting time) and any costs relating to sampling.
2. Artwork and film (as mentioned above).
3. Recruitment and training of interviewers.
4. On-going supervision of interviewers (c.5-10 hours/week), includes validation.
5. Data entry (about one full-time person).

Before beginning a review of the cost effectiveness of each method, it is appropriate to review some basic statistics relating to households, persons and trips (Table 7).

Table 7 Statistics on households, persons and trips

	Method 4	Method 5	Method 6
No. of households responding	33	29	38
Sample loss	-	6	5
	33	35	43
Response Rate	52%	51%	66%
No. of persons responding	96	76 x 2 days	100 x 2 days
No. of travellers D1	78	64	94
No. of travellers D2	-	60	96
No. of trips D1	333	276	519
No. of trips D2	-	263	536
Total trips - 2 days	-	539	1055
No. of "effective" trips	333	415 (=539/1.3)	812 (=1055/1.3)

Table 8 Estimate of costs vs. quality per household, person and trip

	Method 4	Method 5	Method 6
Per responding household	\$38	\$50	\$88
Response Rate	52%	51%	66%
Per person responding	\$13	\$23	\$37
Per traveller on D1	\$16	\$28	\$40
Per traveller on D2	-	\$29	\$39
Per trip on D1	\$3.80	\$6.40	\$7.30
Per trip on D2	-	\$6.70	\$7.05
Per trip (if D1 indep. of D2)		\$3.30	\$3.60
Per "effective" trip	\$3.80	\$4.25	\$4.66

Table 8 combines this statistical information (Table 7) with the cost data to give an estimate of the relative costs for each of the three methods. It shows cost calculations per household, per person, per traveller and for various trip definitions. Depending on the objectives of the overall survey, each of these costings may be relevant. For example, if the representation of households is important, the household data will be most relevant, while if trip data is the objective for a particular analysis, then the per trip data will be useful.

Note that the "effective trip" referred to in the table is that calculated by the method described by Richardson (1992).

It is important to note the following two points when considering the figures on costs and comparing them with the quality of data expected from a given method.

In Table 8, it is not appropriate to compare the \$3.80 per trip for Method 4 with any value other than the "effective" trip values. Comparing \$3.80 with the \$6.40 (Method 4), for example, is equivalent to assuming that there is no value in Day 2's trips. On the other hand, comparing the \$3.80 (per trip on Day 1) with the \$3.30 of Method 5, makes the assumption that two days worth of data is exactly twice the value of one (i.e. no correlation between days).

The response rate, and the likely associated non-response biases should always be considered.

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