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**Preparation and pilot survey
for a national household survey on mobility**

Summary of final report

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PR. PHILIPPE TOINT, ERIC CORNELIS,
PHILIPPE BARETTE AND ISABELLE REGINSTER
FACULTES UNIVERSITAIRES NOTRE-DAME DE LA PAIX
GROUPE DE RECHERCHE SUR LES TRANSPORTS
REMPART DE LA VIERGE, 8
5000 NAMUR
(CO-ORDINATOR)

PETER VANSEVENANT AND ELS HEYLEN
LANGZAAM VERKEER
J.P. MINCKELERSSTRAAT, 43A
3000 LEUVEN

SAMUËL SAELENS, CAROLE DURAND AND VERONIQUE ANDRE
INSTITUT WALLON DE DEVELOPPEMENT ECONOMIQUE ET SOCIAL ET
D'AMENAGEMENT DU TERRITOIRE
BOULEVARD FRERE ORBAN, 4
5000 NAMUR

PR. MICHEL MOUCHART AND ANDREA BARBIERI
UNIVERSITE CATHOLIQUE DE LOUVAIN
INSTITUT DE STATISTIQUE
VOIE DU ROMAN PAYS, 20
1348 LOUVAIN-LA-NEUVE

1. Introduction

It is generally recognised today, also in Belgium, that transport policies can no longer be oriented solely towards the provision of more infrastructure. It is becoming more and more important to curb the increasing demand of mobility. To be able to do that in an efficient and acceptable way, this demand has to be understood as well as possible. One widely used way to obtain mobility (related) information is via a travel survey. A number of western European countries, as well as the USA, have had nation-wide travel surveys for several years to support the analysis of the evolution of passenger transport in their country. This is not true of Belgium, where crucial and up-to-date information about the mobility of its inhabitants is lacking (Vansevenant, 1996). The only relevant national survey in this domain was a more general 'Energy Survey' held in 1986-1987 (Cornélis and Toint, 1994). More recently (1994-1995) there was a specific travel behaviour survey, but it only covered the Flemish region, the northern part of the country (Hajnal and Miermans, 1996). In recent years this lack of information for Belgium has become even more noticeable as more and more activities are being co-ordinated on a European Union level. Thus, awareness is growing in the country that a concerted national effort is necessary to meet the urgent and growing demand for data from the different organisations, research teams, companies and governmental services involved in transport and related fields such as urban and land use planning, environmental sciences and road safety.

A national travel survey is a large and costly operation and should be prepared carefully, all the more because there are no standard formulas for such surveys. What works well in one country or even region does not necessarily work in another, because of cultural, geographical and other differences (Axhausen, 1996). A pilot study was deemed necessary to determine the best survey method for Belgium, to develop the survey material, and to prepare the methodological and computing framework to support a full-scale nation-wide travel survey.

It was determined that a Belgian travel survey should not only yield information regarding the mobility of individuals, but also mobility related information on a household level, since, for example, a person's journeys and means of transport are often dependent on the travel needs of his/her family members and their place of residence. The travel survey should thus consist of two parts, one about the respondents' mobility in general and their journeys on specific days, and the second about the respondents' household and the vehicles available to them.

2 Survey Design and Methodology

2.1 The survey sample

The survey objectives, i.e. the mobility behaviour of Belgians and their households, determined our target population. Because of these two levels of interest, the individual and the household, the target population consisted of two distinct sets of entities: the whole set of individuals, and the whole set of households resident in Belgium at a given time. This population was narrowed down to all residents/household members over the age of 5. We imposed this age limitation because children younger than that hardly ever make trips on their own.

First 800 individuals¹ - the maximum size compatible with the budget - were drawn from the National Register, a database with several variables for all individual residents in Belgium. Then, all the other members of their household older than 5 were retrieved from the National Register and incorporated in the sample. This procedure yielded both a sample of households (n=800) and of individuals (n=2278).

The sampling method that was chosen for the pilot survey was a stratified random sampling based on province. This criterion was chosen because this project has a federal character, and so the different regions of the country, which are themselves subdivided into provinces, had to be represented fairly. Therefore each province was represented in the sample in proportion to its size, expressed in terms of residential population. We have considered more detailed stratification levels as well, but the sample size was insufficient for such further refinement.

2.2 Survey method: rationale

2.2.1. Contact procedure

A very important aim of the pilot study was the determination of the best survey method. The traditional, 'unimodal' survey methods were all rejected. A pure mail survey was rejected because of its generally low response rates for surveys targeted at the general population (Dillman, 1977). Face-to-face interviews would simply be too expensive for a full-scale, nation-wide survey, and so this method was rejected as well. A pure telephone survey, which usually results in good response rates at an affordable price (Ettema *et al*, 1996) was nevertheless dismissed too, out of concern for the quality of certain data. Part of a travel survey is a detailed description (travel times, distances, purpose, ...) of all one's trips on a given day (the 'diary day'), and we believed this could not be done accurately and within acceptable time limits over the telephone alone. It has been done in Denmark (Danish ministry of transport, 1994) and Switzerland (Office fédéral de la statistique, 1996) but in both cases the approach was retrospective: the diary day was not announced on beforehand to the respondents, who were phoned the day after and had to provide all their trip details about the previous day unprepared. Instead a prospective approach was favoured, in which the respondents do know on beforehand their diary day and the kind of details that will be asked, and can thus pay extra attention to these details during the diary day, which should result in more accurate data (Ettema *et al*, 1996).

All in all, a combination of mail and telephone seemed the best solution. Several combinations are possible and actually used in travel surveys abroad (Kurth, 1986; Vansevenant, 1996), and we decided to test two that did produce good results in other countries before. The first method selected for testing was inspired by the so-called 'new Kontiv design' (Brög, 1996), which has already proved its value in Germany and Austria (Brög 1996; Spiegel, 1997). Furthermore, the Dutch Central Bureau of Statistics is replacing its own travel survey method, which it has used continuously since 1986, with this new Kontiv design as well (Moritz, 1997). So also for the sake of comparability of results, a real concern at the EU level, such a method seemed well worth testing. According to this method, all questions are asked in self-completion, mail-back questionnaires, but the respondents are also contacted by telephone right before the diary day to motivate them to participate, and again after the diary day to remind them to send back the questionnaires. With this

¹ henceforth referred to as 'the persons selected for the sample'

method usually not only the person actually drawn for the sample is questioned, but everybody belonging to his/her household (within certain age limits), increasing the pool of individuals and trips, and allowing a study of the interrelationships between household members' travel patterns. In this survey everybody in the household above the age of 5 (with the help of a parent if necessary) was asked to participate.

While the first method was predominantly mail, the second method tested was predominantly telephonic. All data were collected during a computer assisted telephone interview (CATI), but with the aid of a postal 'memory jogger', i.e. a diary sent to the respondents shortly before their diary day, in which they were asked to note the details of the trips of that day, in order not to forget them and to make the actual telephone interview afterwards much easier. In that interview general mobility questions were asked too. With this method only the person selected for the sample and the head of the household were interviewed - about his/her mobility behaviour and household characteristics respectively - since it was not thought feasible to question all household members over the telephone one by one. If the respondent was younger than 14, the head of the household was asked to respond for the child. This method was selected for testing because of the already mentioned positive results in Denmark (Danish ministry of transport, 1994) and Switzerland (Office fédéral de statistique, 1996) with the pure CATI method and in smaller surveys in the USA with the CATI + memory jogger (e.g. Anderson *et al*, 1986). An additional reason was to assess the potential advantages of a computer assisted method over paper-and-pencil methods, i.e. immediate data coding, more possibilities for control (consistency and range checks, etc.) and the possibility of randomisation (Ettema *et al*, 1996).

2.2.2. Trip vs. activity diary

Besides the actual contact and interviewing method, there are also debates in the travel survey research world about the travel diary itself (Ettema *et al*, 1996). Most travel surveys use a trip-based diary, in which a number of details are asked about all the trips made on a given day. Some surveys, however, use an activity-based diary, which asks not about trips but about the out-of-home activities done that day, including details of how, when, etc. one travelled to the place where the activity was carried out. Essentially the same information is gathered with the two kinds of diaries, but they have a different focus. Some of the studies in which an activity-based diary was used report better results, i.e. a higher number of trips reported per day, than with the traditional, trip-based diaries (Stopher, 1992), presumably because the activity-based diary's way of probing for travel information corresponds better with the way information is stored in memory and the planning of activities (Clarke *et al*, 1981). It was therefore decided to also compare these two kinds of diaries in this pilot study.

Combining the two survey methods selected to be tested with the two kinds of diaries, results in the methodological design depicted in figure 1 (n= size of household subsample for each combination).

Figure 1: Methodological design of the pilot travel survey.

survey method	TELEPHONE INTERVIEW + mail memory jogger (trip information of 1 person in the household)	MAIL QUESTIONNAIRE + telephone support (trip information of all persons in the household)
TRIP-BASED	n = 200	n = 200
ACTIVITY-BASED	n = 200	n = 200

2.2.3. Additional surveys

Both of the survey methods described rely on the use of the telephone. This means one cannot reach the people in the sample who do not have a telephone connection, or who have a private number. But these people cannot simply be disregarded, at least not before it has been shown that their mobility behaviour does not significantly differ from that of people with an accessible phone number. If it does differ and a survey method relying on the telephone is used, the information thus gathered has to be weighed for the 'no-telephone' people in order to be representative for the whole population. *Therefore, the people in the sample for whom no telephone number was found, were personally contacted at home by an interviewer, who left behind a self-completion individual questionnaire for the person selected for the sample and a household questionnaire for the head of his/her household.* A second visit was made a few days later to collect the questionnaires. Only the trip diary version of the individual questionnaire was used, since these interviews were only intended to provide a base for the comparison with the rest of the sample.

The representativeness issue just mentioned also applies to the people who were contacted for the survey but refused to take part, who never sent their mail questionnaires back or who never answered the phone. To find out who they are and how their mobility compares to that of the people who did participate, *face-to-face interviews with all the non-respondents* of the main survey were set up. Besides general mobility questions, the non-respondents were also asked why they had refused to participate in the survey. This information should help maximise the response rate in the future, to the extent, of course, that the reasons for refusal are controllable by the survey designers.

Finally, also *validation interviews* were held with a random subsample of people who did respond to our survey. Again the purpose was double. The first purpose was an evaluation of the survey by the respondents and their reasons for participation. This information could be very useful to improve the survey methods used and therefore also the response rate and the quality of the data obtained with these methods. The second purpose was a validation of the respondents' answers to the diary questions, more particularly to see whether they had not forgotten to report any trips/activities. This information is important when comparing the different methods and diaries tested. These validation interviews were done by telephone. In order to limit respondent burden only one person per household was interviewed.

2.3 Survey method: the protocols²

The CATI and mail survey protocols consisted of the same steps. The contents of the steps, however, differed for the two methods. An overview of the protocols is given in figure 2.

Figure 2: Summary of the survey protocols of the telephone and mail survey.

TIME	TELEPHONE SURVEY + mail memory jogger	MAIL SURVEY + telephone support
Sample available	 official announcement of the survey	 official announcement of the survey
Dday-7*	 announcement of diary day +  1 memory jogger	 announcement of diary day +  1 household questionnaire +    ... individual questionnaires (incl. diary) +  pre-addressed and postage paid
Dday-2 or Dday-1	 reminder of diary day (+ household questionnaire)	 reminder of diary day
Dday	 completion of the memory jogger	   ... completion of the diaries**
Dday+1 or Dday+2	 individual questionnaire (including diary) (+ household questionnaire)	 verification of completion and mail-back of questionnaires
Dday+7		if questionnaires not received:  verification of mail-back of questionnaires

* Dday = diary day.

** The rest of the individual questionnaire and the household questionnaire could be filled in at any moment.

2.4. The contents of the pilot travel survey

Two main questionnaires were developed. The first one was a household questionnaire, containing the household and vehicle characteristics, and to be answered by the head of the household. The second one was an individual questionnaire, consisting of 2 parts, and to be answered by either each member of the household (new Kontiv-based, mail method), or by the person selected for the sample (telephone method). The first part contained questions about transport use in general and personal characteristics. The second part was the diary. As already mentioned we developed two

² In this summary we only discuss the protocols for the ‘main survey’, i.e. the actual pilot travel survey. For details on the protocols for the additional face-to-face, non-response and validation interviews, see final report.

versions, a trip-based diary, in which the respondent had to note all the trips made on the diary day, and an activity-based diary, for all out-of-the-home activities on the diary day.

The exact contents of the questionnaires were determined step by step after examining different transport surveys conducted in Europe and after consultation with several potential users of the data to be collected in the survey, brought together in a 'Users Group' especially established for this purpose. Furthermore, given the fact that the project was financed by the OSTC Programme for Sustainable Development, the survey had to gather information to support policy measures for sustainable mobility.

Special emphasis was placed on the possibilities to use the travel survey to gather information relevant for the following points:

- *Transport mode choice.* Several questions of the individual questionnaire gather information related to mode choice. Although the Users Group showed interest in the reasons for mode choice for various sorts of trips, questions about this topic were only included for the home to work/school trip.
- *The environmental impact of transport* (e.g. vehicle characteristics, rate of use of different transport modes, especially biking, walking and public transport). Data of this kind are necessary to support policy measures for sustainable mobility. For this purpose, environmental policy institutions asked for technical information on motorised vehicles, in order to calculate pollution data.
- *The relation between transport and land use planning* (e.g. origin/destination analyses). The urban and land use planners asked for information on the location of residence and work, in order to evaluate the relation between place of residence/work and the transport modes used and to find out more about the directionality of this relation.
- *The means of communication of the household*, which is important for substitution of trips by tele-activities (tele-working, ...) and to know through which channels to inform and convince people.
- *The relation between modal choice and road safety*, such as data on physical and material damage and exposure to accident risk, which can be calculated based on the travel information gathered.

Before launching the pilot survey, the layout and wording of the questionnaires have been extensively studied, worked on and pre-tested. The questionnaire was redesigned at least 4 times before achieving its final version. All questionnaires also had to be available in Dutch and French, the two main languages of Belgium.

3 Results of the Pilot Survey and Recommendations for a Large-Scale Travel Survey

3.1 Response rates

Table 1 below shows the response rates for the different surveys and diaries tested. For 19% of the households in the sample no telephone number was found. They were evenly distributed over the different combinations tested in this pilot.

Table 1: Response rates for the different surveys

	Response rate*		
	Total	Trip-based diary	Activity-based diary
TELEPHONE SURVEY	47%	51%	44%
MAIL SURVEY	53%	51%	56%
FACE-TO-FACE SURVEY	49%	49%	(n/a)
VALIDATION SURVEY	91%	(n/a)	(n/a)
NON-RESPONSE SURVEY	74%	(n/a)	(n/a)

* % of households from whom we had the household and at least one individual questionnaire

There were no significant differences, neither between the telephone and the mail method, nor between the trip-based and the activity-based diary.

For other detailed results we refer to the full final report. In this summary only the recommendations, based on these results will be reported.

3.2. Recommendations for a large-scale travel survey

3.2.1. Sampling and Survey Method

Weaknesses :

In the sampling method used for the pilot survey the number of people drawn from each province was proportional to the population of the province. This would be inadequate for a nation-wide survey, because the absolute number of responses from the more sparsely populated provinces would not be sufficient to allow for a comparison of provinces. The same would happen for a comparison between regions : also for Brussels the number of responses would be too low for a comparison with Flanders and Wallonia, especially since Brussels is characterised by a generally lower response rate for surveys.

For the telephone method, the response rate for the individual questionnaire was lower than for the household questionnaire, probably because the number of attempts to reach a respondent by phone after the diary day was insufficient. For the mail survey the validation interview showed that the respondents found the supporting telephone calls of little help for completing the questionnaires.

Non-response was higher among households of 1 person and among older people, who often state as reasons for their refusal to participate violations of privacy, lack of trips or level of difficulty of the questions. These results are found in many surveys, of all different kinds, and hence cannot be attributed to particular elements of our work.

Finally the face-to-face and non-response interviews indicated that if a national travel survey would only take the data from the 'normal respondents' (having a phone) into account, it would lead to an overestimation of the Belgian household mobility. Non-respondents generally appeared to be a little less mobile in the pilot survey.

Strengths

The National Register is an excellent sampling frame. It provides some demographic data, among which the number of household members. This makes it possible to send the right number of questionnaires to a household. The correspondence between the demographic data from the National Register and from our survey was generally high.

The introduction letter of the survey proved to be very important in motivating people to participate. The response rates for the pilot survey were good. Nevertheless, they could probably have been higher for the telephone survey if more attempts to reach the respondent would have been foreseen.

Contrary to our original fears, the fact that in the telephone survey the respondent had to read out all his answers in the memory jogger to the interviewer, did not prove to be a problem. On the contrary, it allowed the interview to proceed smoothly in most cases.

Results from the validation and non-response interviews showed that the reasons for non-response were mostly independent of the method or any other elements specific for our survey.

The fact that in the telephone survey parents were asked to answer for their children (if under 15 years old), did not prove to be a problem.

Potential improvements

Based on the results mentioned above a slight adaptation of the sampling procedure would be recommended for the national travel survey. An overrepresentation in the sample of inhabitants from sparsely populated provinces and of 1-person households is desirable. The latter would also compensate partially for the underrepresentation of Brussels in the results, since that region has more households consisting of only 1 person. This could entail that the response rates for the national survey would be different from those of the pilot survey, which was based on a representative sample of the Belgian population.

Keeping the non-response as low as possible is crucial. Therefore persons who are less mobile also have to be motivated to participate. This has to be emphasised in the introduction letter and during the telephone calls. The interviewers have to be capable to concisely explain the 'how and why' of the survey, to master different arguments that could persuade hesitant people to participate or counter reasons for non-participation.

The principle of the diary day has to be clear, especially the fact that this day was chosen randomly and that basically there are no good reasons (on holiday, ill, too busy,...) to postpone this day, which will always lead to biased results.

The supporting phone calls of the mail survey should focus more on helping people with filling in the questionnaire, and not only on motivation. Furthermore, since the quality of data in mail, self-completion questionnaires is often of lesser quality, validation interviews are necessary for mail surveys.

Also a survey for non-respondents and for people for whom no telephone number is found would be very important in a nation-wide travel survey.

For the telephone survey a higher number of attempts to contact people for their diary data has to be foreseen. For technical questions regarding the household's vehicles, it would be good if the respondents could receive these questions on beforehand, so they can prepare them for the telephone interview. Some of the technical terms were unknown to some respondents. The interviewers have to be able to explain them during the interview.

Some respondents asked for the results of the survey. The possibility to send them a summary of the results could be foreseen.

3.2.2. The questionnaires

A mostly qualitative analysis of the completed questionnaires led to the following conclusions :

Weaknesses

In general, certain ‘mistakes’ occurred regularly :

- The instruction ‘tick 1 response’ was ignored.
- The answer category ‘other’ was filled in but not ticked.
- A response was filled in under ‘other’ that appeared as one of the other answer categories for that question.
- Some questions took the form of a table. Sometimes the table was filled in correctly but the preceding filter question was ignored.

These errors occurred most frequently for the questions regarding the relationship of the respondent with the head of the household, their highest degree obtained, professional status, frequency of use of different modes of transport, driving license and physical handicaps.

Furthermore, the technical characteristics of the vehicle were sometimes not known. Questions relating to mode of transport for the home-to-work/school trip, frequent business trips and the activity diary were difficult or misunderstood in some cases.

A question about the available means of information and communication in the household was badly received by some : they questioned the relevance of this question and some respondents showed fear of burglaries or TV and radio license fees.

Strengths

Most respondents find the topic of travel behaviour interesting. It is an area that can be surveyed well by self-completion questionnaires, which allow the respondent to get acquainted with the questions on beforehand and to fill them in whenever it suits him best.

Despite the particular problems indicated above, most respondents seemed to understand the questions correctly. The length of the questionnaire did not prove to be a problem. Neither did the more personal nature of some questions.

In the diaries the respondents correctly reported whole trips correctly as only 1 trip, also when they consisted of several stages each with a different mode of transport. They spontaneously used the notion of a ‘final destination’ to determine a trip.

An open question for remarks or comments at the end of the survey elicited a lot of response. The respondents used this opportunity to list a whole range of transport related problems.

Potential improvements

The layout and presentation of the questions might possibly be improved to avoid the aforementioned general problems. Some other questions should be reformulated to make them more understandable

or able to capture the whole range of possible responses. For other questions the exact answer categories could be simplified based on the use of the different categories in the pilot survey.

4 Conclusions

The pilot travel survey proved to be a very valuable exercise, able to meet our objectives. It led to a fully pre-tested set of material and logistic framework necessary for a Belgian national travel survey. Furthermore we were able to test different survey methods and select the most suitable one, and to refine the sampling procedure and survey protocol.

Based on all our analyses, the method that we recommend for a Belgian national travel survey is the mail method with telephonic support and a trip-based diary. The response rate obtained with the mail method was equal to that of the telephone method, but the data gathered proved to be more varied and the postal method allows for a data-collection of all the members of the household. The biggest problem is the lesser quality of the data. This can be compensated by validation interviews.

Regarding the type of diary, a trip-based diary was better understood by the respondents than an activity-based diary, and did not lead to fewer trips reported, as hypothesised above.

Since the pilot survey showed that ‘regular’ respondents differed – both regarding socio-demographics and mobility – from both non-respondents and households without a telephone number, collecting data for the latter two groups of households is necessary also in the national travel survey.

To have a representative set of responses the sample for the national survey will have to be stratified for the geographic and social characteristics that were related to varying response rates in the pilot survey.

The computer programme steering the telephone calls should be slightly adapted to make it more flexible. As to the questionnaires, some questions will have to be simplified, certain instructions clarified, and some answer categories revised.

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