

Is It Necessary to Collect Data on Daily Mobility and Long-Distance Travel in the Same Survey?

JEAN-LOUP MADRE
INRETS

JOËLLE MAFFRE
CREDOC

ABSTRACT

For nationwide household surveys, France and the United States traditionally give a different answer to this question. In France, we have dealt with both topics in the same big and infrequent surveys (1981–1982 and 1993–1994).

Because of the difference in the frequency of trips according to their length, we clearly need different instruments. For instance, in the last national survey conducted in France, we used

- An interview concerning trips made the previous day and during the previous weekend and a 7-day car diary for daily mobility; and
- An interview about the previous 3 months plus a self-administered questionnaire for journeys, where at least one destination was more than 80-km great circle distance from the place of residence. This standard threshold has to be discussed.

The main advantages are

- The general description of the household, of its members and of their vehicles has only once to be done; and
- The information collected can be cross-checked (for instance, the mileage is controlled with the odometer in the car diary, which allows the discussion of the perception of trip distance).

The main drawback is clearly that the survey is too long (1.5 h on average), which means that only one person can be interviewed for daily mobility and one person (the same one in only half of the surveyed households) for long-distance travel.

The analysis of overall mobility was first conducted by clustering trips according to their characteristics (mode, purpose, day of the week, and duration). Some of the classes are typical of local mobility (school trips by public transport) or of long distance (leisure journeys by air), but others are mixed (professional trips by train or car). A second clustering analysis is implemented on individuals according to the distribution of their trips in these different classes.

INTRODUCTION

In 1995, two different nationwide surveys have been conducted in the United States: the National Personal Transportation Survey (NPTS) for daily mobility and the American Travel Survey (ATS) for long-distance trips. In France, both of these fields have been considered in the same big survey, although not with the same survey instrument (called French NPTS in this paper). Indeed, the survey period has to be longer and the sample scheme has to be somewhat different for long-distance mobility because it is less frequent and less evenly distributed in the population.

In section 2, we will present the rather complex design adopted for the two most recent national surveys conducted in France (in 1981–1982 and 1993–1994). In section 3, we will discuss the main drawbacks and advantages of observing both types of mobility in the same survey, from the points of view of the accuracy of estimates and of survey design.

Although we use to consider both main types of mobility in France, it is the first time that long distance travel and daily mobility behaviors have been analyzed for the same individuals (Maffre and Volatier, 1998). We will present in section four the main results of this analysis made with a clustering approach implemented first on trips then on individuals. It will allow to discuss the threshold adopted to define long distance mobility (80-km great circle distance from the place of residence in France) and the optimal combination of instruments (interviews on daily mobility and on long distance, questions on travel frequency or habits, etc.) to cover all types of mobility (local trips around either the usual or an unusual place of residence, international, and interregional trips but also regional mobility).

DESIGN OF THE FRENCH NPTS

Approximately once every decade (in 1959, 1966–1967, 1973–1974, 1981–1982 and 1993–1994), a large survey is conducted on transportation behavior of the households living in France. It contains various survey instruments in order to describe the means of transport owned by the household, commuting habits, daily mobility, long-distance trips, etc. Data collected in each of these instruments used to be analyzed separately, so one could wonder why such a large quantity of information was gathered in one single heavy questionnaire.

General Design of 1993-1994 Survey

The most recent French NPTS retains the definitions and the essential principles used previously to allow the description of the evolution of the travel behavior. The purpose of this survey is to describe the trips made by households, as well as their use of public and private transport means. Specifically, we have attempted to describe all trips made, whatever their purpose, mode of transport, length, period in the year, or time of the day. Trip distance is self-reported (except odometer readings in the car diary) but, since most of origins and destinations have been geocoded, great circle distance has been used to check this information. We are also interested in the level of access to public transport and in the private transport ownership of

each household. The telecommunication aspect is treated in terms of

- Equipment ownership (number of telephone lines, mobile phones, minitel, personal computers, etc.), the new equipment having developed very rapidly since 1994;
- Telephone use during the trips (Massot, 1997); and
- Contact frequencies either by phone or by trip making.

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General Questions

- Household composition: sociodemographic questions for each member;
- The place of residence (equipment and communication material), its environment, (proximity of shops, of bus stops, etc.);
- Driving license ownership and driving experience, traffic accidents;
- Travel habits for up to two persons who cannot be interviewed because they are absent for a long time (other place of residence, frequency of trips, and usual mean of transports);
- Special tickets and discounts for public transports; and
- Description of the household's vehicles (bicycles, motorcycles, private cars, light trucks) and of any changes since January 1990.

Daily Mobility

- Description of trips made the day before the interview and during the last weekend, for a person chosen at random (A person); the date of the visit is chosen by the interviewer within a 6-week period, trying to spread them as much as possible all over the week;
- Commuting trips (home-to-work, home-to-school, etc.) for all members of the household; and
- A "car diary" for all trips made with one of the vehicles during the week following the first interview.

Long-Distance Contacts

- Description of long-distance journeys (i.e., the origin or destination of which being more than 80-km great circle distance from the place of residence) by interview on the last 3 months, and using a self-administered "trip diary" during the following 3 months (i.e., during 6 months in total), for another person chosen at random (B person, the same person could be both A and B), for the same B person, contact frequencies either by phone or by trip making, for a better understanding of the complex relationships existing between transports and telecommunications; this instrument, based on trip frequency, could provide a good

description of regional mobility, between local and long distance, each described by a special instrument.

Comparison Between 1981–1982 and 1993–1994 Designs

In 1981–1982 for long-distance journeys, all the members of the household were surveyed. It was a combination of a 1-month retrospective interview and of diaries for 2 months implying four visits of the interviewer. These shorter periods for each instrument avoid the memory effects that we had to correct in 1993–1994 for a 3-month retrospective period, and the low response rate (only 60 percent) that we have obtained for a self-administered questionnaire returned by mail, which made the weighting procedure quite complex in this non-ignorable case (Armoogum, 1997).

For daily mobility, the sample has been divided into two parts.

- Half of households were attributed a car diary, similar to the instrument used in 1993–1994, but for all their four-wheel vehicles; and
- In the other households, a person was randomly selected (without any age limitation) to fill a 7-day diary; we call it a “segment diary,” because the mobility was described in terms of segments (i.e., mode by mode).

It implies that the selected person has to be at home twice: the first time to receive the diary from the interviewer who explains how to fill it, and the second time 1 week later to give it back. Thus, only local mobility (within 80-km great circle distance from the place of residence) is comparable between the daily mobility instruments of 1981–1982 and 1993–1994 surveys, because the constraint of presence at home is higher for a diary than for an interview. For instance, the return trip from 1-month holidays cannot be described in a weekly diary distributed at home, but it can be recorded by interview if the interviewer visits the household just after the end of this holiday period. For 1981–1982, the conversion from segments (i.e., mode by mode) to trips (i.e., purpose by purpose) has also been made in order to be able to compare the results of the two surveys.

Thus, by interview on trips made the day before and during the last weekend, we obtain a wider observation of mobility. Can we consider it as exhaustive? The example of holidays clearly shows that in an interview on the day before and on the last weekend conducted at home, only return trips are recorded but almost no departures, which can be collected in a long-distance instrument. Short trips made during holidays (or during a professional journey) are out of the scope of a long-distance instrument and can be described by interview only if the person is back home the day after (for a weekday trip) or the week after (for a trip made during a weekend).

These conditions are quite restrictive and clearly show that short trips made from a nonusual residence can be correctly reported neither in a long-distance instrument (they are out of the scope), nor by an interview on daily mobility conducted at home. Special methodology has to be implemented in order to observe those trips (Potier, 1996). It appears that the volume of these trips is quite important, in particular for urban tourism.

All these survey instruments are not equivalent for analyzing distributions, which is more and more important for environmental issues. For instance, commuting habits show

that 4 percent of commuters with the longest home-to-work distance generate 40 percent of the total traffic for this purpose (Massot et al., 1995). It is clear that a weekly diary or a single day interview make more difficult this analysis of concentrations.

Sample Scheme

In 1993-1994, a sample of 20,003 dwellings has been drawn from the 1990 Census and from the list of new residences built since that date. Because of out-of-the-scope residences (13 percent of secondary homes or vacant residences) and of total nonresponse (18 percent), Table 1 shows that 14,213 questionnaires were filled (only 7,608 in 1981-1982). The sample was spread over eight waves from May 1993 to April 1994 in order to neutralize the seasonal effects, which are important for private trips.

The survey objective is to collect as much information as possible about the trips. Thus, we have overrepresented the mobile households, having several cars (except in Paris, where we did not change the drawing probabilities, because the Parisians travel a lot, but have few cars due to high residential density). Although there has been a question about car ownership in every census since 1968, this is the first time that this information is used to stratify a transportation survey sample. In fact, this over-sampling is particularly useful for long distance mobility, which is very unevenly distributed and, at least in Europe, strongly correlated to the number of cars in the household. Daily mobility (measured by the number of trips per day) does not vary so much according to car ownership, but the distance traveled is much more correlated to it. Thus, the interest of oversampling depends on what we intend to measure.

The persons A and B were selected from the eligible individuals (over 5 years old, who are at home when the interviewer visits the household and able to respond). The probability to be chosen is equal for everyone in the household for person A; it is two-thirds for the individual who does the most long-distance travel for person B. This most mobile individual is determined by a general question on the frequency of long-distance trips asked of every member of the household at the first interview. On the other hand, in households with more than one car, the main vehicle had only one-third "chance" to receive the car diary in order to over sample responses for secondary cars, which are useful for the analysis of potential electric car demand.

Taking into account these procedures of oversampling, it is only in approximately half of the households that A person is also the B person (it is always the case for single persons and the probability decreases as the households has more members). That is why we have reweighted the subsample of persons who are both A and B, in order to obtain a good picture of overall mobility. This new AB weight is obviously less evenly distributed than those of A person or even of B person, which make the results more fragile on this subsample. For 1981-82, we just retain the description of long-distance journeys made by the individual, who has been selected to fill the segment diary and adopt his weight.

Although proxy reporting has not been allowed, face-to-face interviewing has lead to rather low non-response rates (less than 20 percent except for the self-administered long-distance questionnaire that only 60 percent of households sent back).

CONFRONTING DIFFERENT INSTRUMENTS FROM THE SAME SURVEY

Measuring Their Accuracy and Comparing Their Scope

First, we will consider the distribution of trips by great circle distance between origin and destination for the different instruments described above (Table 2), then we will illustrate these findings by an analysis in terms of trip purpose, most of them being specific to a given range of trip distance. We have implemented a standard calculation of confidence interval: an exact calculation, taking into account the complexity of the sample scheme, gives for instance an accuracy of 5 percent instead of 4 percent for total long-distance mobility because of cluster effects (Armoogum et al., 1998*b*). The interview on daily mobility is more accurate than trip habits recorded as contact frequencies up to 50 km, and the retrospective interview on long-distance travel shows narrower confidence intervals for all long-distance trips (i.e., over 80 km). Because of the sample size (it is approximately twice larger in 1993–1994 than in 1981–1982), data on daily mobility are more accurate in the most recent survey for all classes of distance.

Moreover, these confidence intervals show significant differences between survey instruments for the estimation of the total distance traveled, except between 150 and 500 km. The main differences between long-distance trips seen through these long-period or short-period interviews are

- The definition of a trip is not exactly identical: a stop for hotel, restaurant, or shopping is not considered as a destination in the “long-distance” questionnaire; this is why the comparison has been made in terms of passenger-kilometers and not in terms of number of trips.
- Some purposes (mainly non-fixed work trips, but also shopping, education, and private business) are better reported in a short-period diary because of memory effects (Table 3).
- While longer trips (for holidays, second residence, visit, etc.) are better reported in a long-period diary, because people have to be at home to be interviewed (see the example of holidays above).

The questionnaire on contact frequencies gives a much higher estimate than daily mobility of distance traveled to a second residence and to visit friends or relatives (which correspond to clearly identified questions). But only 30 to 60 percent of passenger-kilometers for other private purposes and half of professional trips are frequent enough to be reported in this kind of instrument (Table 4). Thus, the proportion of global mobility collected by this method increases according to trip distance: contrary to what we have expected, it is only half for regional mobility (between 15 and 80 km) and around 100 percent on average over 80 km.

In terms of transportation means we find the same differences (Table 5).

- The interview on daily mobility shows a market share of car significantly higher than the survey instruments better adapted to collect very long trips, especially for visits and second residence.

- Modes often used for business trips (non-fixed work purpose) are better reported in a daily mobility interview (high-speed train, domestic flights, driver alone).
- While long-distance interview better covers international flights that are more used for holidays.

As we are aware that members of the household who cannot be interviewed because they are absent for a long period might travel a lot, there are a few questions about them in the general part of the questionnaire (other place of residence, frequency of trips and usual mean of transports for up to two absent persons). These persons are about 1 percent of the total population: 26 percent of them are soldiers and 26 percent are students. They have a high mobility, since the few items contained in the questionnaire (with a lot of missing data) allow them to estimate the distance traveled to about 5 percent of total long-distance traffic. In terms of passenger-kilometers, international flights represent the largest part of their mobility. However, the example of train military tickets shows that these questions on long absence do not exhaustively solve this problem: they correspond to 5.2 billions of passenger-kilometers of which 1.0 are reported in the long distance part and 0.7 can be estimated from the “long absence” part. In fact some soldiers living all the time in barracks are outside of the scope of “normal households” concerned by the French NPTS, but they are probably not numerous enough to explain the remaining gap.

This comparison of global mobility seen through different survey instruments show the specificity of each of them. We will now consider the same question for the use of different individual vehicles (car and motorcycle). In the conclusion we will get back to the discussion of accuracy and optimization of the minimum trip length for the definition of long distance travel.

Is the Description of Vehicles Use Given by Diaries Exhaustive?

In the French NPTS general car use is described in three instruments: the interview on daily mobility, the car diary, and a global estimate of annual mileage by purpose for each vehicle. Since the periods covered by each of these instruments rarely overlap, a systematic comparison is impossible trip by trip. Thus, it will be done globally. However, as this information is collected for the same households, their comparison is much more accurate than what could be done from independent data sources.

The constraint of presence at home to be interviewed limits particularly the observations on travel behavior. For car use, the odometer gives an objective measurement of trip distance, which is reported in the French NPTS car diaries. In SOFRES Parc-Auto panel (a yearly survey on the automobile behavior of French households), the yearly increase of the odometer can be compared for each car with the annual mileage declared by the household. The answer to this question is inaccurate (often rounded to 1000 or even 5000 km), but it is generally unbiased. The difference between those two estimates has been statistically significant only twice during the last decade (in 1991 because of the psychological effect of Gulf War) (Hivert, 1998). Thus total annual mileage declared for each car in the French NPTS can be considered as unbiased. Analyzing now this annual mileage by purpose, the information collected in the car-diaries proves consistent with the global estimate of annual mileage given for each

vehicle in the household (Table 6). This comparison allows to assess that in a weekly car diary or by interview on daily mobility for motorcycles, more than 80 percent of total annual mileage is described in detail: almost all home-to-work and nonholiday private trips, more than 50 percent of work related mileage, less than half of car use during holidays and 40 percent of the distance driven abroad.

A car that is away from home for a long period is less likely to be covered by a car diary. Indeed, the main driver of the car has to be at home twice: when the interviewer hands out the car diary, and 1 week later when he collects it. A diary returned by post can describe up to 91 percent of the total mileage (Rennes, 1997).

How to Estimate Under-Reporting Due to Memory Effects?

In the last French NPTS a person in the household had to describe the trips he (or she) made during the day before the interview and during the last weekend. As last Saturday can be 1 week before, we suspect memory effects. The car diary gives a more homogeneous picture of the whole week, since it begins to be filled on any day of the week.

- Table 7 compares the results of these two survey instruments. For weekdays they give the same picture of car trips. It can only be noted that car diaries are less likely to be filled out by persons away from home for long periods; thus, more long distance trips are described by interview. For measuring changes between 1981-1982 and 1993-1994, our recommendation is to limit the scope to trips within 80-km great circle distance from the place of residence of the household. Within this radius, total traffic (in vehicle-km) is almost the same.

- There are 2 percent less trips collected in the car diary.
- But there average length is a little higher (9.9 km in the car diary, 9.7 km for car drivers in daily trips, this difference being significant—with a threshold of 5 percent—due to the big size of samples). This is probably due to a slightly different understanding of the definition of a trip, when the driver fills his diary alone without the assistance of the interviewer (probably short stops omitted).

The last weekend is too far away to avoid memory effects. Underestimation is important (about 30 percent) for very short trips (under 2 km). When they are longer, Sunday trips are a little less under-reported than Saturday trips, probably because they are more recent and perhaps because they correspond to specific purposes that are better memorized. Thus, since private cars are used for a wide range of trip distances, we have used the figures in the two right columns of Table 7 as correction coefficients for all motorized weekend trips.

Short Distances Are Underestimated

This comparison of two survey instruments also allows us to discuss the perception of distance by drivers. Controlled by the odometer, trip distance is well estimated by car diaries. If we compare trips by class of great circle distance between origin and

destination, we notice a substantial underestimation of trip distance for trips whose origin and destination are located inside same municipality (roughly less than 5 km); this underestimation is also observed for travel time, but it is less important (Table 8). For longer trips (between different municipalities within 15 km) the underestimation has dropped from 10 percent in the weekly segment diary of 1981–1982 to 5 percent in the 1993–1994 interview. This improvement is probably due to the local maps that were given to interviewers. The underestimation of trip distance for car driver trips can hardly be generalized to all modes: if we use the same coefficient of correction, many walking and cycling trips become too fast. On the other hand, long-distance trips length seems a little overestimated.

ANALYZING OVERALL MOBILITY OBSERVED BY DIFFERENT INSTRUMENTS

Trips Clustering

Although local mobility (commuting, shopping, etc.) and long-distance mobility (holidays, professional journeys, etc.) are quite different by nature, they can be described by using the same concepts:

- Journey from home to home;
- Trip for a given purpose; and
- Segment using one single mode.

From the data collected in the French NPTS conducted in 1981-1982 and in 1993-1994, we have clustered trips according to their main characteristics: purpose, main mode, duration, and day of the week. In order to balance the importance of local and of long-distance mobility, the clustering procedure has been implemented on the distance traveled, not on the trip itself.

In 1994 like in 1982, some classes are typical of local mobility: for instance, those of commuting or of short trips by car (Table 9). The other classes are characterized by transport modes or by trip purpose, but trip distance is non-discriminate. Indeed, a wide range of trip distance is represented in each of those classes.

The evolution of clusters shows the profound structural changes in mobility, which has occurred between the early 1980s and the mid-1990s:

- In 1994, a new class emerges which is specific of long distance: it contains air trips (their number has tripled between 1982 and 1994, and the corresponding distance traveled has been multiplied by 7) and it concerns mainly private purposes while professional trips develop mainly by road or rail;
 - The huge increase of local trips by car (half of total passenger-kms in 1994) has lead to split this class into two new ones: short private trips (5 km in average) on a weekday (for instance, shopping in a super-market) and medium distance (32 km in average) weekend trips (visits to parents or relatives, outings, etc.); and
 - The use of two-wheels decreases (their class is merged with the class of trips by coach).

The “leisure weekend trips by car” clearly show the continuity between local and long-distance mobility: trip duration is between 0.5 and 1 h for a third of those trips, while it is between 1 and 3 h for another third of them. The importance of this class (32 percent of total passenger-km) shows that beyond the area of daily mobility, car use has permitted the emergence of a wider private mobility area at the regional scale. Urban sprawl has boosted this kind of mobility, because low population density leads to higher motorization and to longer trips. Regional shopping centers and amusement parks develop new purposes for longer trips mainly during weekends. It is a response to the need of a wider variety of activities and relationships. Another structural change concerns long distance mobility: leisure market (for instance, holidays abroad by charter) has a growing importance for air transport, while professional trips are developing by road (with the improvement of the motor-way network) and by rail (with high-speed trains).

Persons Clustering

Separately for 1982 and 1994, we have implemented a second clustering procedure on persons according to the distribution of the trips they have made among the seven classes defined above. These “mobility classes” are much more stable than the “trip classes:” Table 10 shows that just one class disappears (students by two-wheels) and one emerges (active travelers, mobile during weekends).

This later group has been split from “car users in outer suburbs or rural areas.” Half of its members belong to a multimotorized household, and it contains a high proportion of men (64 percent). Their mobility is not much higher, except for long-distance (professional) trips. Urban sprawl and the diffusion of car ownership explain the growing importance of these groups of car users living in low-density areas. On the other hand, the big group of youngsters and elderly with a very low mobility, but a quite high proportion of long-distance trips, decrease.

CONCLUSIONS

Even though the definition of a trip is only slightly different, its understanding by interviewers and interviewees is not quite the same in the surveys on daily mobility or on long distance travel. For instance, results are easier to compare in terms of distance traveled than number of trips, and this makes it complicated to detect the overlapping part when merging both data sources for a global analysis (Maffre and Volatier, 1998). The cluster analysis does not show a clear border between long distance and short distance: only three out of seven classes characterize local mobility and only one is typical of long distance (air travel for leisure), while the others are mixed. If we are looking for a simple indicator based on travel behavior, it is only over 350 km that the share of car use decreases.

It is more from statistical considerations than from descriptive analysis that the specificity and the scope of a long-distance survey instrument has to be discussed. By combining a daily mobility and a long-distance questionnaire, we obtain quite a uniform level of accuracy (around 5 percent) for all trip distance classes.

The least accurate estimate of distance traveled is for regional mobility (50- to 80-km

great circle distance), which questions the 80-km threshold generally chosen to define the scope of long distance trips. Lowering it would mean much more trips reported (about 80 percent more for a threshold of 50 km), which would imply collecting data over a shorter period (for instance 2 months instead of 3). Thus, the respondent burden would increase by only 20 percent. This shorter survey period would reduce substantially the problems caused by memory effects (Armoogum et al., 1997a), but it would also reduce accuracy on data for longer trips (by about 15 percent), because fewer would be collected.

When we decided a general design of the survey relying on instruments for daily mobility and for long-distance travel, we were aware that the segment of regional mobility would be less accurately covered. At that time, we thought that the questionnaire on contact frequencies would not only describe relationships between telecommunication and travel habits, but would also fill this gap. In fact, it is only for visits to friends and relatives and to secondary residences that this description in terms of frequency of contacts gives a good picture of mobility. Moreover, it covers long distance better than medium-distance mobility. Thus, the best solution for a more accurate description of regional mobility seems to be a lower distance threshold for the long-distance instrument described above.

Although the description of trips made during a given period is generally the best way to obtain a correct picture of mobility, it is important to collect some information through general questions on travel habits for persons who are absent long enough to make a direct interview impossible. Indeed, these people represent a notable share of long-distance mobility.

We have shown by cross-checking data from our different survey instruments that the interview on trips made the day before and during the last weekend give a good picture of overall mobility, except for very long trips (over 500 km) for specific purposes (holidays, secondary residence, etc.) and modes (international flights) which imply too long an absence from home. Generally, the departure trip cannot be described, but the information on the return trip is collected, which is rarely the case in a weekly trip diary. However, new methods have to be found to describe short trips made from a nonusual place of residence. Improving the understanding of the scope described by each survey instrument is the main advantage resulting from merging all of them in the same survey. It has made possible the evaluation of underreporting of short weekend trips, which has been corrected by reweighting. It has also made possible the comparison between 1981–1982 and 1993–1994 data, since the car diary is the same for both surveys, while the daily mobility instrument has changed from a weekly segment diary to an interview on trips made the day before and during the previous weekend. Because of the constraint of presence at home, which is lighter for the 1993–1994 interview than for the 1981–1982 diary, we have recommended measuring the changes only within an 80-km great circle distance from the place of residence (i.e., for local mobility not covered by the long-distance instruments). In addition to this cross-checking facility, the other advantages provided by daily mobility and long distance travel instruments in the same survey (mainly economies due to a common description of the household, of the individuals and of the vehicles) can be considered as minor ones.

We recommend a joint daily-mobility and long-distance survey, mainly because of the benefits derived from cross checking the data collected. However, if the option of

considering only one type of mobility is adopted, as many cross checks as possible should be built in. In a long-distance survey only, one could include the following (ranked by decreasing order of importance):

- Long absences of household members (weekly or monthly commuters, military service, students, etc.);
- For frequent travelers (air miles, etc.);
- Questions about the contact set (second homes, friends or relatives visited away from home, business contacts);
- Where? How often? Using what mode?; and
- Use of vehicles in the household (mileage of the last 12 months, total mileage of the car and year of production, etc.).

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TABLE 1 Sample Sizes

	Sample Size		Gain in comparison with a uniform scheme
	1981–1982	1993–1994	1993–1994 ¹
Households	7.608	14.213	—
Persons	21.358	38.455	—
Daily trips	76.445	95.924	2.8%
Long distance :			
- Journeys			
* self-administered	—	13.829	23.0%
* retrospective	17.550	23.062	23.0%
- Trips (retro)	38.839	41.774	23.0%
Vehicles	8.012	19.258	21.1%
Car diary (trips)	61.235	197.003	6.8%

Sources: INSEE-INRETS 1981–1982 and 1993–1994 French NPTS.

¹ For optimization of the sample scheme, the probability of drawing multi-car households has been doubled. Moreover, the most mobile person in the household had a two-thirds chance to be interviewed on long distance travel, and the car diary had only a one-third chance to be attributed to the main car in multicar households (because of the interest for the potential market of electric vehicles).

TABLE 2 Accuracy of Data by Great Circle Distance for Different Survey Instruments

Great circle	Sample size ¹					Estimate of trip distance (in km per week per person)				
	Daily Mobility 1981-82	Daily Mobility 1993-94	Contact frequencies 1993-94	Long Distance 1993-94	Daily Mobility 1981-82	Daily Mobility 1993-94	Contact frequencies 1993-94	Long Distance 1993-94	Contact frequencies /Daily Mobility	Long Distance/ Daily Mobility
Distance	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9=7/6)	(10=8/6)
<5 km	30 217	48 721	261	150	10±7%	11±3%	—	—	0%	0%
5–14 km	7 527	18 709	5331	247	29±6%	37±3%	4±8%	—	10%	0%
15–49 km	3 393	10 238	17 452	881	31±8%	46±4%	23±5%	—	49%	0%
50–79 km	366	1 361	5 298	2 859	8±18%	12±9%	8±8%	1±11%	63%	11%
80–149 km	226	1 021	605	13 814	7±20%	15±11%	10±8%	10±6%	66%	68%
150–349 km	157	633	8 534	11 307	11±26%	18±13%	15±6%	17±5%	84%	91%
350–499 km	19	148	4 586	3 941	2±70%	9±24%	9±9%	10±6%	99%	115%
> = 500 km	17	97	6643	3 101	3±69%	8±28%	20±12%	12±6%	254%	153%
Total	41,922	80,928	54,160	36,300	161±5%	247±5%	88±4%	102±4%	36%	41%

Sources: INSEE-INRETS 1981–1982 and 1993–1994 French NPTS.

¹ Total figures differ from those on table 1 because walking trips (not recorded during weekends in 1993-94) have been excluded as well as those with an unknown trip distance.

TABLE 3 Long-Distance Traffic¹ by Purpose
(Unit: Billions of Passenger-Kilometers per Year and Percent)

	Daily Trips 1	Long Distance 2	Ratio 3 = 2/1
Fixed workplace	9.3	8.7	93 %
Non-fixed workplace	29.9	20.8	69 %
Other work-related trips	14.3	18.4	129 %
Education	2.6	1.3	48 %
Private business	4.7	2.2	47 %
Shopping	1.9	0.9	49 %
Visits	60.0	76.3	127 %
Escorting	11.9	5.4	45 %
Holidays	63.3	108.5	171 %
Second residence	6.8	10.7	159 %
Hotel, restaurant, ...	2.1	0.5	25 %
Other leisure	36.1	31.6	88 %
Total	243.0	285.2	117 %

Source : INSEE-INRETS 1993–1994 French NPTS.

¹ Trips over 100 km, whose origin or destination are more than 80 km great circle away from the residence

N.B.- Face-to-face survey on trips made:

- During the day before the interview and the last weekend for “Daily Trips:” sample of 1,978 trips.
- During 3 months before the interview for “Long Distance” (only 1 month for the most mobile persons): sample of 41,774 trips.

TABLE 4 Mobility Habits by Purpose
(Units: Billions of Passenger Kilometers per Year and Percent)

	Daily Trips 1	Contact Frequencies 2	Ratio 3 = 2/1
Private business	4.1	1.2	29 %
Sports	9.7	2.9	29 %
Medical care	5.5	2.6	46 %
Work related	81.7	42.1	51 %
Shopping	13.9	7.4	53 %
Education	7.4	4.7	64 %
Visits	76.3	139.1	182 %
Second residence	7.9	19.7	248 %
Others	90.3	10.2	11 %
Total	296.8	229.8	77 %

Source: INSEE-INRETS 1993–1994 French NPTS. N.B. Only contact frequencies with locations more than 15 km away from home (or outside the conurbation of residence) have been described. Thus, trips with both origin and destination within 15-km great circle distance from the place of residence have been excluded for this comparison. Data come from a face-to-face interview on trips made during the day before the interview and the last weekend for daily mobility (sample of 14,390 trips), and visits for contact frequencies (sample of 48,568 contacts by trip making).

TABLE 5 Long-Distance Traffic¹ by Main Mean of Transportation²
(Unit: Billions of Passenger Kilometers per Year)

	Daily Mobility	Long Without	Distance With	Absent for a Long Period⁵	Traffic Counting
Motorcycle	0.8	0.6	0.7	—	
Private car ³	149.0	134.8	151.3	1.1	
Driver alone	33.3	21.4	23.4	0.9	
Driver w/passenger(s)	50.3	45.5	51.2	0.1	
Passenger	58.7	59.4	67.1	0.1	
Driver or passenger	6.1	8.4	9.5	—	
Bus	9.4	10.5	11.8	—	
Train	32.4	29.9	33.6	1.4	41.5
TGV ⁴ 1st class	(6,6)	2.9	3.2	—	4.3
TGV ⁴ 2nd class	13.2	9.9	11.2	0.2	15.2
Train 1st class	1.9	2.6	2.9	—	2.5
Train 2nd class	9.5	14.1	15.8	1.1	19.5
Unknown	1.2	0.5	0.5	0.1	
Air	46.6	68.5	76.4	8.8	
Domestic flights	10.3	7.9	8.8	0.1	11.9
International flights	36.3	60.5	67.6	8.7	
Ferries	2.5	2.0	2.4	—	
Unknown	2.3	8.4	8.8	3.4	
Total	243.0	255.0	285.2	14.7	

Source : INSEE-INRETS 1993–1994 French NPTS.
 OEST (National Accounts) and SNCF (National Railways).

¹ Trips over 100 km, whose origin or destination are more than 80 km great circle away from the residence of the household.

² For multi-modal trips the “main mean of transport” is defined as follows:

- For daily trips, according to a hierarchy favoring the heaviest modes,
- In the long-distance part, it is the mode with which the longest distance is covered.

These two definitions give the same results, except for rare cases when urban public transport and automobile are used in combination.

³ From both parts of the NPTS, long-distance traffic on motorways is estimated to 37 billion vehicle-km. This figure is consistent with 57 billion of vehicle-km evaluated by traffic counting of cars and light trucks registered in France, of which 64 percent are counted in the region where they are registered (local traffic).

⁴ High-speed train

⁵ Estimated from the few questions in the general part of the questionnaire (cf. section 2.1 1).

N.B.- Face-to-face survey on trips made:

- During the day before the interview and the last weekend for “Daily Mobility:” sample of 1,978 trips.
- During the last 3 months for “Long Distance” (only the past month for the most mobile persons): sample of 41,774 trips.

TABLE 6 Car and Motorcycle Mileage by Purpose: Comparison Between General Questions on Annual Mileage and Trip Diaries Data [Unit: Annual Mileage per Vehicle (km)]

	Commuting	Work-Related	Holidays	Leisure Weekends	Others	Total	Of Which: Abroad
AUTOMOBILES							
1993–1994							
1) Annual mileage	3,900	1,850	1,600	2,500	4,050	13,900	320
2) Car diary ¹	3,800	900	400	2,600	3,900	11,600	130
3)=2)/1) percent in the car diary	100	50	25	100	100	83	40
1981–1982							
4) Annual mileage	3,200	1,600	1,700	2,500	3,200	12,200	
5) Car diary ¹	3,200	1,100	—	—	—	10,200	
6)=5)/4) percent in the car diary	100	70	²	—	—	84	
MOTORCYCLE							
1993–1994							
7) Annual mileage	1,300	100	400	1,100	800	3,700	
8) Daily mobility ³	1,400	100	200	500	800	3,000	
9)=8)/7) percent in daily mobility	100	100	50	50	100	80	

Source : INSEE-INRETS 1993–1994 French NPTS

¹ Weekly mileage has been extrapolated to yearly mileage on the basis of 52 weeks.

The purpose distribution has been computed by attributing a main purpose to each trip-chain (from home to home).

In order to define the “main purpose,” the hierarchy is given by the order of columns (those of the left-hand side are dominant compared to those of the right-hand side).

As purpose code is more detailed in the diaries, purpose groups are defined as follows:

- Commuting = fixed place of work or study;
- Work related = other professional purposes;
- Holidays = Holidays (including weekends in the car diary because they have unfortunately been attributed the same code);
- Leisure weekends = secondary residence, spectacles, entertainment, outing, visiting friends;
- Others = shopping, medical care, accompanying, visiting relatives.

² Assuming that as in 1993–1994 private trips are exhaustively reported except for holidays, only 10 percent of mileage for holidays is described in the car diary; this ratio has increased between 1981–1982 and 1993–1994, due to the growing number of shorter holiday periods, which makes easier to report them in weekly diaries.

³ Here, annual mileage is compared with the interview on trips made the day before and during the last weekend. The purpose “non fixed work” has been shifted from the column “work related” to the column “commuting.”

**TABLE 7 Total Number of Car Driver Trips:
Comparison Car Diary/Daily Trips**

Trip Distance	Weekday	Saturday	Sunday
<2 km	1,01	1,29	1,32
2–11 km	0,97	1,21	1,16
12–44 km	0,98	1,19	1,12
>44 km	0,91	1,06	1,00

Source : INSEE-INRETS 1993–1994 French NPTS.

TABLE 8 Car Driver Local Trips¹ Seen Through Different Survey Instruments

Origin and Destination:												
	In the Same Municipality			In Municipalities Distant:						Total		
				<=15 km			>15 km					
	DT	CD	DT/CD	DT	CD	DT/CD	DT	CD	DT/CD	DT	CD	DT/CD
Travel Diary (DT) and Car Diary (CD) in 1981–1982²												
Number of trips (millions)	179	172	1.04	164	155	1.06	29	29	1.00	372	356	1.04
Trip length (km)	2.8	3.7	0.76	8.3	9.1	0.90	37.6	39.1	0.96	7.9	8.9	0.88
Great circle distance (km)	0.0	0.0		5.9	6.0	0.99	28.5	28.2	1.01	4.8	4.9	0.99
Trip duration (min)	9.7	10.1	0.96	17.0	17.0	1.00	42.8	44.1	0.97	15.5	15.8	0.98
Mean speed (km/h)	17.2	22.0	0.78	29.1	32.2	0.90	52.7	53.2	0.99	30.5	33.8	0.90
Daily Trips (DT) and Car Diary (CD) in 1993–1994³												
Number of trips (millions)	193	199	0.97	230	216	1.06	56	55	1.02	479	470	1.02
Trip length (km)	2.6	3.4	0.77	8.8	9.3	0.95	37.4	36.2	1.03	9.7	9.9	0.97
Great circle distance (km)	0.0	0.0		6.3	6.4	1.00	28.5	28.8	0.99	6.4	6.3	1.01
Trip duration (min)	8.8	9.6	0.92	16.4	16.7	0.98	41.4	40.2	1.03	16.2	16.4	0.99
Mean speed (km/h)	17.8	21.2	0.84	32.4	33.6	0.96	54.3	54.0	1.01	35.7	36.3	0.98

Source : INSEE-INRETS 1981–1982 and 1993–1994 French NPTS.

¹ As more long-distance trips are collected by interview than in a diary, we consider only local trips, with origin and destination within 80 km from residence, driving a car of the household.

² DT = Daily Trips collected in a weekly segment diary, CD = Weekly Car Diary.

³ DT = Daily Trips collected by interview on the previous day and on the last weekend (only single mode trips: for multi-mode trips distance made by car and precise O–D are unknown) CD = the same kind of weekly Car Diary: excluding trip purpose “to the station” (for comparison with single mode trips).

TABLE 9 Trips Clusters in 1982 and 1994

1982				1994			
	Distance of Trip (Mean)	Percent of Trips <100 km	Percent of Total Distance Traveled		Distance of Trip (Mean)	Percent of Trips <100 km	Percent of Total Distance Traveled
Two-wheels	3 km	100	3	Trips by two-wheels or by coach	22 km	96	6
Trips by coach	40 km	95	3				
Private short trips by car	10 km	99	42	Short trips by car	5 km	100	17
				Leisure weekend trips by car	35 km	94	32
Home-to-work trips by train or car	12 km	100	18	Home-to-work trips by car or by train	13 km	100	9
Commuting trips by local public transports	7 km	100	7	School trips by public transports	8 km	100	6
Professional and air trips	31 km	98	10	Professional trips by train or car	35 km	93	15
Leisure trips by train or car, often >5 h long:	76 km	86	17	Leisure trips by air	1195 km	1	15
TOTAL	12 km	99	100		16 km	98	100

Sources: CREDOC calculations on 1982 and 1994 French NPTS.

TABLE 10 Mobility Clusters in 1982 and 1994

1982				1994			
	Percent of Total Population	Number of Trips/Week	Percent of Trips >100 km		Percent of Total Population	Number of Trips/Week	Percent of Trips >100 km
Youngsters and elderly with low mobility	42%	2.9	3.5%	Youngsters and elderly with low mobility	34	3.8	5.8%
School children by public transports	10%	15.8	1.1%	School children by public transport	13%	14.3	1.3%
Actives by car in rural areas	22%	22.9	1.3%	Car users in outer suburbs or rural areas	27%	22.4	1.4%
Mobile actives in urban areas	14%	23.5	0.9%	Mobile actives in inner suburbs	10%	20.2	1.5%
				Active travelers, mobile during week-ends	11%	24.5	2.9%
Students by two-wheels	9%	24.8	0.3%				
Young households by car in outer suburbs	3%	54.4	0.3%	Households by car in outer suburbs	5%	48.4	0.7%
Total	100%	14.8	1.2%	Total	100%	16.4	1.9%

Sources: CREDOC calculations on 1982 and 1994 French NPTS.