



**HAL**  
open science

# The methodology of before/after mobility surveys questioned: the case of 1989/1993 survey about Atlantic-TGV

Olivier Klein, Michel Houée

► **To cite this version:**

Olivier Klein, Michel Houée. The methodology of before/after mobility surveys questioned: the case of 1989/1993 survey about Atlantic-TGV. 8th World Conference on Transportation Research, Jul 1998, Antwerp, Belgium. halshs-00720487

**HAL Id: halshs-00720487**

**<https://shs.hal.science/halshs-00720487>**

Submitted on 24 Jul 2012

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Communication at the 8th World Conference on Transportation Research**

**Antwerp, Belgium, 1998**

E4 : Ex-Post Evaluation and/or Post-Factum Analysis

**The methodology of before/after mobility surveys questioned :  
the case of 1989/1993 survey about Atlantic-TGV**

Paper n° 645

Olivier KLEIN  
Lecturer - Researcher  
Ecole nationale des Travaux Publics de l'Etat  
Laboratoire d'Economie des Transports

Rue Maurice Audin  
69518 Vaulx-en-Velin cedex  
France  
Tel : (33) 04 72 04 77 18  
fax : (33) 04 72 04 70 92  
e-mail:olivier.klein@entpe.fr

Michel HOUEE  
chargé de mission  
Ministère de l'Équipement, du Logement,  
des Transports et du Tourisme  
Direction des Affaires Economiques Internationales  
Service des Etudes Economiques

Tour Pascal B  
92055 Paris-La Défense cédex 04  
France  
tel : (33) 01 40 81 13 57  
fax : (33) 01 40 81 17 71  
e-mail : houee@eises.equipement.gouv.fr

In September 1989, right before the first startup of the Atlantic-TGV (TGV-A), then in September 1993, three years after the startup of the second branch of the TGV-A, the Laboratoire d'Economie des Transports (LET) carried out a survey into the routes concerned with this new transport supply. Led to the instigation of the Observatoire Economique et Statistique des Transports (OEST), a service of the French Ministry of Transport, this survey aimed at observing the modifications in mobility behaviours and trip purposes intervened jointly to the supply transformation. This work thus fits in the process of a posteriori evaluation of the TGV-A investment . It also fits in a research stream attempting to better understand how the transformation of a transport supply can accompany or not the socio-economic transformations which affect population groups, activities or spaces.

The analysis of the data collected allowed the publication of a book, displaying the main results obtained [Klein, Claisse, 1997]. The objective of this paper is to highlight the methodological findings from this survey. From this point of view, two directions are pursued. The first relates to the contents of the questionnaire in comparison with the two-fold objective to identify the evolutions of trip behaviour and to reveal the underlying socio-economic transformations. The second relates to the survey protocol and leads to wonder about the means required to implement such surveys. Previously, one will have taken care to show the main characteristics of the survey such as processed in 1989 and 1993.

## 1 THE FOLLOW-UP SURVEY OF THE ATLANTIC-TGV

The follow-up survey of the TGV-A organized in 1989 and 1993 is a survey coordinated among the three modes. It was submitted simultaneously to the travellers by rail, air and motorway. It is also an exhaustive survey in the sense that it aimed at the whole of trips, whatever their purpose, business, private or commuting. Last, the geographical area covered is very wide since it included all the radial relations which in 1993, were served by the TGV-A, that is to say the relations between Ile-de-France and 24 departements of the Western and South-western french coast. Figure below shows the main quantified characteristics of this operation.

### TECHNICAL CHARACTERISTICS

<b>1 Dates of field work</b>							
<b>1989</b>			<b>1993</b>				
sunday 17 september from 14h to 24h,			sunday 19 september from 14h to 24h				
monday 18 september from 6h to 13h,			monday 20 september from 6h to 13h				
tuesday 19 september from 6h to 24h			tuesday 21 september from 6h to 24h				
<b>2 Average sampling rate per mode</b>							
train : travellers 1/4, trains 1/2							
plane : travellers 1/3, planes 1/1							
motorway : cars 1/5							
<b>3 Size and weighting</b>							
	<b>1989</b>			<b>1993</b>			
	<b>a</b>	<b>b</b>	<b>c</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>a</b> questionnaires numb.
<b>plane</b>	2277	11559	5,08	2864	11661	4,07	after cleaning
<b>motorway</b>	2137	64136	30,01	2546	69322	27,23	<b>b</b> traffic on O/D surveyed
<b>train</b>	4224	61962	14,67	4901	59185	12,08	<b>c</b> average weighting
<b>Total</b>	8638	137657	15,94	10311	140168	13,59	rate

Taking into account the important differences between the three modes considered, it is actually three surveys, specific as for their methods, which had to be organized and, as far

as possible, coordinated. Coordination in fact is limited to overlap, spatial coherence (same relations observed on the three modes in the Province-Paris direction in order to avoid double counting), the similarity of the questionnaires (which differed only on some questions describing the journey ) and the self-filled character of the survey. To appreciate the differences, the simplest way is to give a brief description of the survey methods implemented on each mode.

In the trains first of all, the questionnaire was given to the travellers, on board, generally immediately after the last stop before Paris. It was collected little before the arrival in Paris which left approximately an hour so that interviewees can supplement it. The sampling procedure recommended to the interviewers to retain a seat row (or a compartment) upon four, whatever its occupancy and all over the train. On the night trains, it was impossible to operate that way. The interviewers then could operate on the platforms of the origin station of the train before its departure and in the corridors at the beginning of its course. In this case, they were recommended to survey as many travellers as possible. It is finally advisable to specify that only a train upon two was surveyed, the choice being carried out while seeking to fit to the diversity of the routes and types of services.

Because of the opposition of Air Inter crews, it was not possible to survey the air travellers according to methods similar to those of the train which would have consisted in distributing the questionnaire in the boarding area and to recover it at landing. It is thus in departure lounge, during the waiting period that the questionnaire was proposed to all the travellers being there, filled in by them and collected at boarding time. All the airports within the survey area served by Air Inter were covered, except for Quimper, plus La Rochelle, served by TAT. The airports of third level were thus not surveyed.

It is obviously on the motorway that the conditions of survey are most specific. The survey was achieved at the toll barrier of Saint-Arnoult, with the outlet of the motorways A10 and A11, going towards Paris. The interviewers sampled a car upon five at peak hours in order not to disturb the traffic flow. Before the handing-over of the questionnaire, the vehicle driver was questioned on its origin/destination, the main purpose for the journey and the car occupancy, answers being reported on a form with a reference number identical to that of the questionnaire. A questionnaire per vehicle was circulated. The motorway survey is thus a vehicle-based survey whereas the train and plane surveys are trip-based surveys.

The given questionnaire contained a free of mail charge envelope. It was then required that a person of the vehicle fills in the questionnaire and mails it back. No information on the other passengers of the vehicle was collected which made it possible to preserve a questionnaire identical to the other modes (except the description of the O/D). The rate of return reached is very close to 30%.

The data were recorded and then underwent a logical cleaning primarily consisting in eliminating the too incomplete or incoherent questionnaires. Insofar as the methods of survey were extremely different between the modes, this operation was absolutely to be carried out before the grossing up of the data. This grossing up consisted in reconstructing, by assigning a weight to each questionnaire, the traffic of each mode on the corridors observed for the period of survey. It was carried out on the basis of figures provided by the operators, resulting from the countings carried out by the controllers in almost all the trains for SNCF, countings at boarding for Air Inter and TAT. The trains and the few planes non-surveyed were reconstituted starting from the questionnaires collected on the trains (or planes) which were the closest according to the schedule and the route. On the motorway, in addition to the traffic hour per hour raised by Cofiroute, the grossing up of the traffic by vehicle has also kept the structure per purpose according to the informations filled by

interviewers on the reference sheet. Motorway passenger traffic is then calculated by multiplying the weight of each road questionnaire by the number of vehicle's passengers reported on the sheet. Data cleaning eventually included a geographical cleaning consisting in the elimination of questionnaires without equivalent O/D on the other modes (such as A 71 Paris-Clermont).

From this rapid presentation of the survey, as well as from the analysis of the questionnaire presented in appendix, a certain number of difficulties will have appeared. Some are inherent to the type of survey carried out and subsequently hardly avoidable. Others are on the other hand the consequence of choices which could have been different. This is not the intention to try here to justify all the options selected, nor to describe the survey which one would have a priori conceived by taking into account what he knows a posteriori. The objective of the following pages is to highlight, concerning methodology, the findings, the conclusions or the generic questions, even if they are induced by the particular use that was made of them concerning TGV-A.

## 2 THE QUESTIONNAIRE QUESTIONED

The questionnaire is obviously an essential aspect of a survey of this type. One will tackle here briefly the problem of the non-responses which has some relation with the design of the form to be filled in. One will consider then the contents through some topics which appeared insufficiently treated through the questions raised, then by debating the adequacy of this type of method to the initial problematic.

### 2.1 Some questions made useless by too poor answer rates

According to the questions, one could identify two quite distinct configurations. In the first case, illustrated in the following table by two variables on a particular segment of the sample, the response rates obtained are always satisfactory, in 1989 as in 1993 and for the three modes. In this situation, no particular problem is noted.

Duration : response rates			Profession : response rates		
	1989	1993		1989	1993
PLANE	99%	100%	PLANE	96%	91%
ROAD	98%	97%	ROAD	99%	97%
TRAIN	99%	99%	TRAIN	97%	98%

**Tables 1 : business trips, "restricted" sample : response rates to the questions about "stay duration" and "profession" in 1989 and 1993, tuesday results calculated on grossed up figures**

The other configuration is met for questions which, since 1989, do not reach very satisfactory response rates. Since 1989 also, one notes variations from one mode to another which can be important. These variations, which indicate a higher response rate for road than for air and rail, can however be explained by the mode of selection of the people filling in the questionnaire and by the conditions under which they did it. On the basis of this unfavorable situation, the problem appears noticeably when one observes the major reduction in the response rate between 1989 and 1993. Indeed, together with this deterioration of the quantity of information collected, occurs a very strong irregularity of the phenomenon.

Function: response rates			Activity branch: response rates		
	1989	1993		1989	1993
PLANE	83%	79%	PLANE	76%	54%
ROAD	93%	85%	ROAD	83%	55%
TRAIN	81%	58%	TRAIN	72%	62%

**Tables 2 : business trips, "restricted" sample : response rates to the questions about "function within the company" and "activity branch of the company" in 1989 and 1993, tuesday results calculated on grossed up figures**

The examples presented above show thus that the railway mode never escapes this deterioration of the results, but that the road or the plane can just as easily undergo it in proportions equivalent to the railroad. These variables also highlight a strong irregularity of the phenomenon according to the profession of the interviewee. The management staff for example, answer, in 1993 only, very badly to a question about its function within the company whereas it answers rather better than the average to the one concerning the branch of industry of its company.

These bad results of the survey about certain questions do not claim for a global explanation. Neither the particular characteristics of the questionnaire, neither the methods of survey, nor the exogeneous elements such as the crisis of the booking system "Socrate", make it possible to entirely understand the phenomenon. It remains that we cannot get rid so easily of a fact: the design of the questionnaire makes it difficult to answer for certain topics. It is, *inter alia*, the case for the two variables presented above. In this respect, there is no quite new finding in there, except perhaps the constancy of the deterioration from 1989 to 1993. Is it directly related to the crisis of "Socrate"? But one can then wonder why the same phenomenon seems to happen also on the plane and the car, although with a lower width and regularity. Is it related to a major phenomenon of distrust with respect to the institutions or is it only the result of a random variability of the response rate to questions uneasy for the interviewee?

The weaknesses of the questionnaire are partly the result of a lack of time to be spent on the preparation of the survey in 1989. Between the end of June, when the LET received the oral insurance of the funding, and mid-September, time for everything being ready, it was not possible to test the questionnaire *in situ* (against transport users). They are also the result of the constraints applying to the design of the questionnaire, since this one had, as compared with the TGV Sud-Est one, to allow for a place where to specify trips with personal purpose. Taking into account the fact, as explained further, that a certain number of additional informations would have been interesting to collect, it is desirable, and it will be our recommendation on this topic, to design and circulate different questionnaires according to the trip purposes.

## **2.2 Certain topics could have been better treated**

Compared to the general problematic of the survey, several points which would deserve some further exam appeared when analysing the results. One will distinguish the topics which were not adressed on the one hand and the topics for which the information collected proved insufficient, on the other hand.

### **2.2.1 Four new topics to be adressed**

Compared to the general problematic of this survey, we were to observe the main variables describing the social, economic and spatial background of long-distance mobility and of related activities. Taking into consideration this objective, one notes the almost total absence from the questionnaire of some relevant topics. We will limit ourselves to mention them without proposing operational solutions which would make it possible to integrate them into a survey of this kind.

#### *- Spatialization*

One can first of all mention the question of spatialization. In the questionnaire, the origin and the destination of the trip, the place of residence, and, only for business or commuting

purposes, the location of the company and of its headquarters were open questions. Each time, it was requested to specify the corresponding commune as well as département. The concern was, from the very stage of the design of the questionnaire, to have a redundancy of information on these essential questions in order to avoid a too heavy drop out rate. It actually appeared rapidly that the spatialization of the results by commune could not be considered. The sample size did not allow it, neither the way in which interviewees filled in the questionnaires, since only the indication of the département is reproduced on a significant part of the latter. For the destination within Ile-de-France, moreover, the indication "Paris" or "75" obviously corresponds to some generic indication referring indifferently to one or the other of the départements within the region. The problem of confusion between the origin of the trip and the entering point on the network can also be mentioned.

Under these conditions, the finest geographical frame on which the sample could be circulated distinguishes the 24 Province départements for the origin of the trips, but the only Ile-de-France area for the destination. In several cases, this smoothness of description proved to be insufficient. One can mention here the impossibility of disentangling, in the traffic for personal purpose of the Gironde or of the Loire-Atlantique, the part applicable to coastal zones and the one generated by the agglomerations of Bordeaux and Nantes, preventing the checking of possible specificities of urban tourism.

The same need for finer geographical approach was revealed in connection with comprehension for the phenomena of rail-road competition on the shortest relations. It is indeed obvious that the respective positions of the two modes are not the same ones according to whether one considers a relation between the center of Tours and the center of Paris or another between Loches (In the Indre-and-Loire, 40 km distant from Tours) and Etampes (in the Essonne, 50 km south from Paris) for example. However, both will be located in a perfectly identical way in the file of the survey. Last, one of the challenges of a more detailed geographical grid can also be to consider the question of the use of the most powerful means of transport as one of the components of a metropolisation process.

- *Pre and post-routing*

The questionnaire circulated to the users of the two means of public transport included no item concerning the initial routing to the station or to the airport of origin of the main trip. In the same way, access and egress were completely ignored of this survey. However, these two elements belong to the important determinants of mobility and modal split. It is all the more advisable to integrate them into the field of observation that one is interested in market segments where the private car gets a significant share. A request for information on the pre- and post-routing is also likely to help interviewees to make more clearly the departure between the origin of the trip on the one hand and the entering point into the network on the other hand.

- *pricing*

Although approached in the "train" and "plane" questionnaires (question 4), we will consider that this topic was not properly taken into account in the present survey. Indeed, the description of the type of ticket proposed to the train/plane users is fitting by no means with the real marketing of the transport documents. The distinction "full price/pass /other rebates" does not make it possible to disentangle situations which, in concrete terms, strongly differ. A "Modulo pass" subscription which allows the S.N.C.F. user or his company to buy less expensive transport documents cannot, for example, be compared to a contractual subscription allowing for a daily return on a specific O/D. Alike, what is for the user of a «plein ciel» Air Inter flight the cost of the full price ticket? Moreover, the too

small proportion of trains surveyed does not make it possible to gross up the number of travellers taking into account the pricing category of the various TGV (level 1, 2, 3 or 4). So, this information although essential is lost. As a whole, it proved impossible to incorporate the specific pricing of each trip among the analysis parameters.

This impossibility extremely detrimental for the results cannot be overcome through a solution very easy to implement. To propose the list of the various prices, in particular, would appear doubtless disastrous taking into account the extent of it. A solution is perhaps to use, in collaboration with the operators, the data registered on the ticket. But it is hardly possible to ask a person surveyed to show his ticket to an investigator, nor to perhaps copy the price of its ticket. It is thus advisable to keep investigating this topic.

- *Local economic consequences of the tourism activities*

The last point to be treated here specifically relates to private purpose trips. The information gathered on this subject relates to the detailed trip purpose as well as to the family and residential motivations at the destination point. Looking for the identification of the economic and social transformations which could affect the areas served in relation with the startup of a high-speed train service, a "before and after" mobility survey must initially make it possible to designate homogeneous segments of population whose trip behaviour evolved. It must then establish a link between the characteristics of these segments on the one hand and the attributes of the activities which justify trips on the other hand.

It appears that the three items approached in the questionnaire are not enough to meet these aims. Indeed, the proposed split of activities completely occults the level of mobilization of the local economic resources that their realization implies. It is undoubtedly advisable to look with specialists in the tourist economy for the possibility of implementing a simple indicator on this subject. Going in the same direction, the lodging category deserved to be surveyed in an exhaustive way. This exhaustiveness, not only did not prevent from measuring a possible residential motivation, but would have still made it possible to obtain information on possible impacts of TGV on the hotel activity.

**2.2.2 A perfectible questionnaire within the limits of a quantitative survey**

Certain questions or certain topics in the questionnaire, have sometimes generated important analysis difficulties. We review them here all the more readily as they nearly always conceal fundamental questions to this survey.

- *Fuzzy margins around commuting*

With the analysis, very strong ambiguities concerning the description of commuting trips appeared. They come from the multiplicity of the possible psychosocial representations of the double-location situation of provincial individual which remains during the week in Paris to practise its activity. The normative description suggested - starting place, place of arrival, place of residence, place of work, trip direction, duration of the stay - does not allow for a perfectly coherent answer at all the questions raised in the case of about half of those commuters. This is a matter for real questioning of our too mechanist schemes.

It appears moreover that the problem is more than just the difficulty for interviewees to define rigorously, in the case of weekly pendular and more or less regular migrations, their trip. Indeed, this survey completely gums the marginal mobility behaviours related to business activity. It comes back to the phenomenon of double-location which covers two not always exclusive situations: residential and professional double-location. The first case may correspond to young workers, generally bachelors, coming to Paris for working purposes and living in fact alone in Paris during the week, and with their parents or



partners in province at week-ends. We saw misunderstandings that result when one asks to specify the direction of the trip or the duration of the stay. The second case corresponds to individuals having an office in Paris and another in province. Are they doing, when they move from the one to the other, a business trip? But questions allowing for a detailed activity registration are in that case no longer adapted. A commuting trip? They cannot however be considered as usual commuters.

Such situations, of which people are not always self-conscious, are always difficult to describe. It should also be stressed that they relate to behaviours still marginal from a quantitative point of view. However, they reflect in the behaviours a certain shortening of the distances. They also reveal new types of residential or business mobility. In that respect, it looks as if they were revealing social evolutions already important from a qualitative point of view, and which may become important as well from a quantitative point of view.

This normative character of the statistical surveys has often been underlined. A first possible solution would be to design a specific questionnaire for commuting in a broad sense. More detailed and better adapted questions would then make it possible to determine these complex situations more precisely. Whatsoever, the analysis of the evolution of the long-distance mobility behaviour cannot probably avoid more qualitative investigations to supplement the statistical approaches.

- *The metropolisation : a possible way to deal with business activities*

The problem raised here is due to the lack of contents of the lists of items retained for pre-coded questions. Indeed, within the framework of a problematic which look for revealing the internal links between territories, neither the detailed purposes suggested, neither the professions, nor the functions in the company make it possible to treat easily the sample on a hierarchical basis. However, certain splits of the working population were recently tested which could be of some help [Damette, 1994]. Such an approach seems all the more promising in the analysis of long-distance mobility that high-speed transport is well-known as being particularly sensitive to these flows that structure the territory.

- *The civil service unappropriately taken into account*

As a whole, the civil servants encountered no doubt specific difficulties to fill in the questionnaire. Difficulty to indicate their profession, or the size of the organization to which they were belonging (referring to which level of the administrative structure). We remind here the problems of delimitation of the civil service in a questionnaire (certain surveyed people can perfectly include there the employees of all public entities, the territorial civil servants or the civil servants of the Administration having a specific status, whereas others will exclude these categories).

From an analysis viewpoint, the various options suggested by the questionnaire did not always make it possible to distinguish the various activities of civil servants. Those indeed are to be found quite massively, concerning the detailed trip purpose, in categories «meeting of an agent of your administration" (question 8 of the "train" and "plane" questionnaires) and "information exchange" (question 9). Perhaps would it be advisable to pay more attention to the specificities of this category of employees insofar as the phenomena of hierarchisation of the territories also evolve through the Administration activity.

- *private purpose: items unclear*

The questionnaire proved, concerning trips with personal purpose, relatively poor. One can note a lack of logic in the definition of the various detailed purposes. Can one consider the

question while trying for example to reveal a degree of constraint of the trip through the various purposes suggested? It is a solution which implies to give first a precise definition of this concept of constraint.

On a more general level, the family proves to be the determining factor for leisure mobility. Within this framework, confusion in the items between the "remote family" and the "friends" is a real pity. Alike, the choice of answers proposed to the question about socio-familial motivations at destination (question 12 of the "train" and "plane" questionnaires) deserved to be largely expanded. The question about residential motivation (question 13) would have also gained to be expanded. She could in particular have been expanded without difficulty to the real lodging conditions and would have deserved to be exhaustive to this respect.

- *«Other» private purpose : a topic neglected by the analysts of interurban mobility*

In volume, private trips during weekdays prove to be almost as important as business trips. A part of them corresponds without ambiguity to leisure trips (long weekends, holidays...). But another significant part belongs indeed to the category "other private" without it being possible to know some more. There is a market segment the analysis of which is in total waste, including in the analysis carried out on the case of the TGV-A, without nothing, except some a priori on the useless mobility of people who do not work at weekdays, being able to justify this disinterest. It is again advisable to think of better detailing these trips.

### **2.3 To better integrate the short-term effects**

We would like to finish this examination of the contents of the questionnaire by a more fundamental question about the capacity of such a survey procedure specific and embarked to answer the initial problems. The question of the link between the transformation of a transport supply and the socio-economic evolutions of the territories it serves cannot indeed be put in a intemporal way. The state of the short-term situation - economic initially - is obviously largely determining these evolutions. It contributes meanwhile to build the link we are looking for between the transport supply and the territory.

To introduce a temporal dimension into the analysis is thus absolutely unavoidable. The experience of this survey confirms it largely considering the impact of the 1993 recession (for which it is advisable to add, the same year, the effect of the railway crisis: "Socrate", etc.) on the whole of the results of the analysis. Nevertheless, it is obvious that the social request for this type of research initially aims at results likely to be sufficiently abstracted from this particular context not to remain specific to it, at lessons bringing light to future choices. It is a fact that, from this point of view, the comparison of the characteristics of travellers' flows between 1989 and 1993 appear delicate and especially largely subjective. Quite clever who will know, on this basis, how to measure the crisis effect in connection with the evolutions of the business traffic between the Indre-and-Loire and Ile-de-France.

However, we are condemned to observe the TGV performance in an always particular context. It is the obviousness against which we run up here. But at the same time, it should well be recognised that the situations of crisis, or on the contrary, of economic improvement, are the chronic stakes of our social evolution. Specificities which mark each one of them do not imply only that it is necessary to seek, or build, a median situation to evaluate the large investments in transport. The reaction, in periods of crisis, of demand to high-speed rail supply is also instructive for the future.. It is not thus a question of eliminating the factors of the economic situation, but of finding the means to better integrate them into the analysis.

Multiplication of the waves of survey, cross-sectional household surveys or panel surveys over several years, the statistical solutions can be profitable. They are however heavy to set up and, of course, very expensive. Without deciding there upon, it seems that, here again, qualitative approaches, although by nature less reliable, can prove useful to supplement a specific quantitative survey. It is advisable, by all means, to better integrate the concern of the effects of the short-term evolutions situation in the design of the survey instruments.

### **3 QUESTION OF MEANS**

One will look within this section upon the proper size of the survey not only to obtain a better reliability as for the quantitative results, but also to refine and enrich in an important proportion the conclusions obtained. One will first of all tackle the question of the number of questionnaires available which was recurring throughout the analysis process. Then, one will examine representativeness biases more related to the differentiated ways in which could be observed the multiple traffic components.

#### **3.1 Insufficient size**

More than 15.000 questionnaires were collected at the time of the 1989 survey . In 1993, this figure rises with more than 18.000. The logical cleaning (elimination of the too incomplete or incoherent questionnaires) and the geographical one (elimination of the questionnaires corresponding to a non covered relation) decreased this size in an important way. The net sample thus contains 8638 questionnaires in 1989 and 10311 in 1993. These figures could a priori appear comfortable to carry out a statistical analysis. It is by no means the case and, on many occasions, they proved insufficient to continue the analysis.

##### **3.1.1 Sunday-Monday on the one hand, Tuesday on the other : two distinct samples**

The first element to consider to understand the situation is due to the impossibility of merging Tuesday and Sunday-Monday sub-samples. To carry out this operation it is indeed necessary to be able to answer a simple question: "how much a Tuesday trip represents in terms of Sunday-Monday trips? " or in more rigorous terms: " what is the relative weight of a Tuesday trip compared to a Sunday-Monday trip? ".

This question has absolutely to be answered by mode, for obvious reasons, and by purpose because the proportion of the various purposes according to the days of the week strongly varies. One will stop there by accepting the assumption according to which, for a given mode and a purpose, trips of any day of the week are structurally equivalent to trips of any other day. One sees how much this assumption is restrictive and not easily acceptable in practice.

Within this framework, to calculate the relative weight of trips of various days of the week, it is necessary on the one hand to know about volumes of traffic of each mode for each day of the week considered. That does not appear out of reach. But it is necessary moreover to lay out, for each mode and each day, the structure of the traffic according to the purpose, i.e. to survey every day or to relate completely certain days to others. One can for example consider, alike S.N.C.F. through the concept of basic week-day", that Tuesday, Wednesday and Thursday are, concerning laong distance journeys, identical days. According to this logic, one can possibly accept that a Monday afternoon replaces a Tuesday (or Wednesday or Thursday) afternoon. Alike for Friday morning which would remain an ordinary morning of week-day. On the other hand, from Friday afternoon up to Monday morning, no period is comparable.

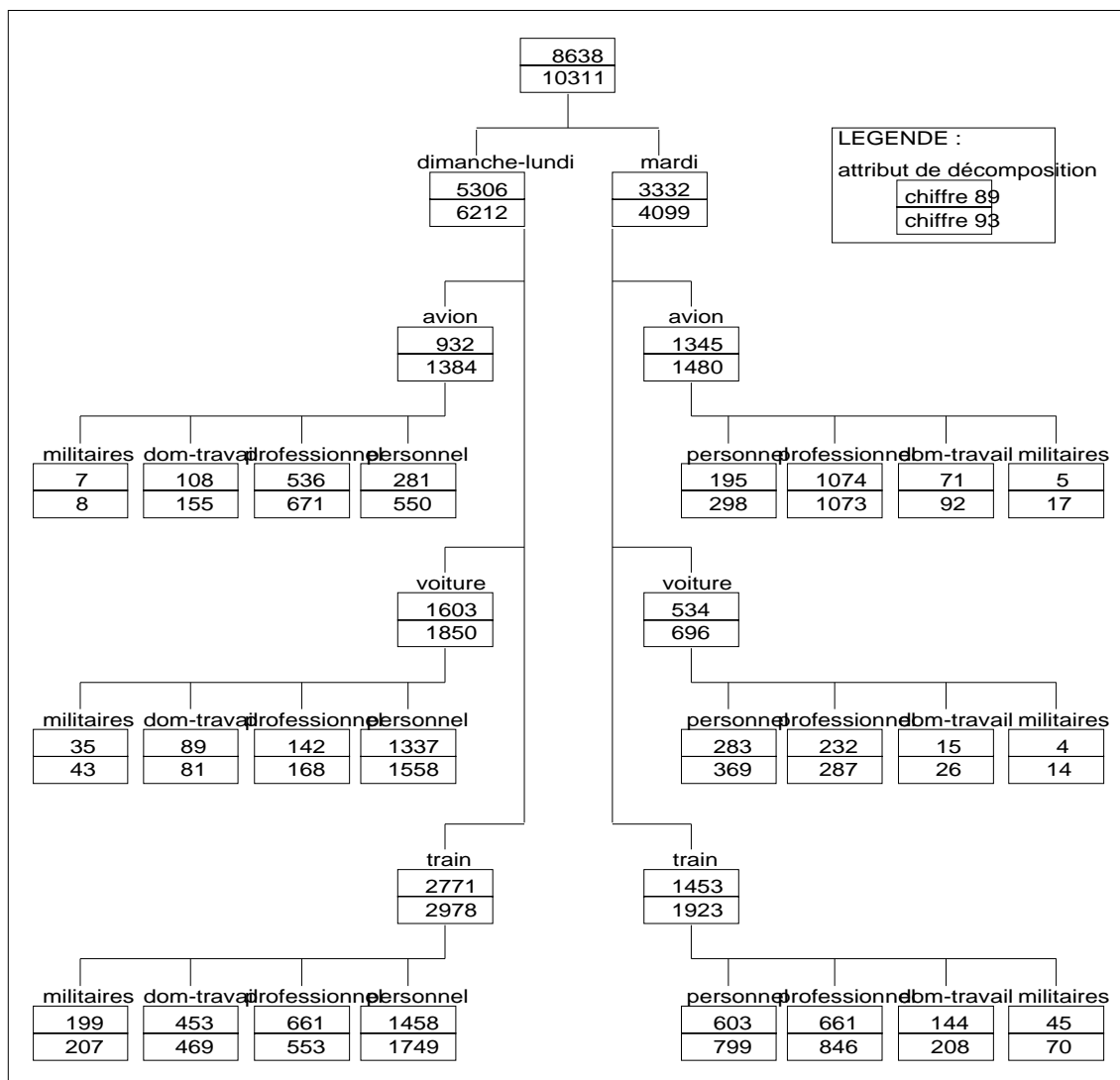
A survey representative of the whole week should thus at least cover the whole of the weekend thus defined plus an ordinary week-day. In the absence of this extension, it remains impossible to compare the samples collected at various periods. The present

survey, limited for budgetary purposes to one period of weekend return (Sunday afternoon and Monday morning) on the one hand and an ordinary week-day (Tuesday) on the other hand, thus led to the constitution of two independent samples. More samples, but of lower size, which accentuates brittleness in the statistical sense.

### **3.1.2. 3 modes, 3 main purposes, ten O-D pairs and tiny samples**

The core of the survey is to locate in a relatively fine way the precise motivations for travelling. The analysis thus implied the constitution of sub-samples presenting a minimal homogeneity, of which a detailed description was to be made. The following graph shows how a simple decomposition by mode and main purpose leads to sizes which are no longer impressive. One so visualizes that commuting cannot, for sample size reasons, allow for any geographical analysis, by socio-demographic categories or precise branch of industry.

One realizes that, even for the two "great" purposes - business and private - the situation, taking into account the geographical diversity of the survey area, is not at all comfortable. Let us not forget indeed that the need for respecting the main spatial characteristics of the zone covered by the survey rises rather directly from the initial problematic of this survey. It was thus advisable not to operate regroupings without integrating these characteristics. In fact, the 24 départements which constitute the origin area of the relations observed can hardly be divided into less than ten zones about homogeneous. On the basis of a maximum sample size of a thousand individuals, even if, according to the purpose, all territories do not generate the same flows nor offer the same potential for analysis, one checks that a situation where degrees of uncertainty on the results are very high is rapidly reached. However, at this stage of the decomposition, we are just at the beginning of the analysis since neither the economic variables, neither those related to the detailed trip purpose, nor still those accounting for the social and demographic position of the individual have been considered. Compared to the displayed problematic, it becomes obvious then that the relevancy of the analysis of the results of this survey was considerably limited by its size.



**Graph 1 : Evolution of the number of available questionnaires and building of homogeneous sub-samples**

It is not a question here to deplore a completed operation. The objective is to expose as precisely as possible the limits of such a method of survey. Another way of raising the problem is to try to determine afterwards the dimension that should have been carried out. Let us take the example of one of the main agglomerations of the study area, Nantes, for business purpose. The numbers of questionnaires available for Tuesday are exhibited in the table below.

	Plane	Car	Train	Total
1989	104	22	87	213
1993	33	37	186	256

**Tableau 3 : number of questionnaires available on tuesday, for Loire-Atlantique and business purpose, according to the mode**

It can be seen from this example, selected among the less problematic part of the sample, that approximately 200 to 250 questionnaires per year are obtained for all modes. In order to determine the required size of our sample, one needs to disrelate three variables among most important. Let us choose for example the variable distinguishing Parisians from provincials (2 modalities), the detailed purpose of trip (5 modalities) and an aggregate variable of professional status, say 3 modalities. One obtains a theoretical split in

$2 \times 5 \times 3 = 30$  groups. It is estimated then that the average size of these groups must be of 30 questionnaires in order to achieve the minimal goal of statistical reliability which we are looking for. These conditions then imply to collect 900 questionnaires during each of the two years, on Tuesday, for Loire-Atlantique and business purpose.

The small calculation above thus results to a multiplication by 4 of the sample size. If one now introduces a differentiation according to the modes, the table above shows a very heterogeneous situation. Let us specify that the number of questionnaires collected on each mode depends obviously on the traffic on this mode, but also of the rate of survey specific to each mode. Thus, on the example used, the respective rail and road market shares are, unexpectedly, equivalent (they are equal in 1989). The sampling rate inevitably limited for the road, where it is determined by the number of questionnaires which it is possible to circulate to the toll barrier without disturbing the traffic and by the mailing-back rate, still reinforces the conditions of minimal reliability exposed in the preceding paragraph. If one remembers that the Nantes example is one of the most favorable, one measures that to impose, for this type of survey, a sample per O/D, per day and per main purpose of about a thousand questionnaires is by no means exaggerated. This is nothing but the classical guarantee of an acceptable statistical reliability.

### **3.2 A problematic representativeness**

To the problems of number of questionnaires which have been just mentioned, one should add the problems of representativeness of the sample. They are due to some extent to the survey methodologies and to the sampling options. We review, in the following lines, the main aspects of these questions, starting with those which are related to the surveying process.

#### **3.2.1 Procedure and representativeness : constraints to a large extent unavoidable**

In this respect, the first point to be underlined is the disparity of the procedures implemented to survey each of the three modes. This disparity is irreducible if surveys are implemented during the travel. It does not certainly appear impossible to improve marginally the situation, by carrying out a survey inside the aircraft as in the trains (<sup>1</sup>). But the essential difference has anyhow its origin elsewhere since it differentiates private car and public transport.

This differentiation occurs twice. On the one hand, the questionnaire, circulated to the car users at the toll barrier and mailed-back, is filled in by car users in conditions completely different from those in which are placed the train or plane users. The influence of this context on the answers is impossible to measure, but it is probably effective, in particular for the questions requiring to think about or to remember (for example: "How many journeys have you carried out during the last 12 months on this O/D?"). In addition the individual survey (a questionnaire circulated to an individual) carried out in the public modes of transport becomes a vehicle survey in the case of car travel (a questionnaire circulated by vehicle). To obtain results comparable from one mode to the other, it is then absolutely necessary to collect the main characteristics of all the occupants of a vehicle (<sup>2</sup>). But that implies that the structure of the «road» questionnaire be deeply modified as compared with the «air» and «rail» questionnaires.

Another difficulty coming from the procedure adopted for the road traffic relates to the affordable sampling rate. Indeed, it is first of all necessary to take into account the response rate which amounts in 1989 as well as in 1993 to approximately 30%. But it is

---

<sup>1</sup>) this way of doing faced the opposition of Air Inter crew

<sup>2</sup>) unless one use a random procedure keeping the designation of the respondent under control.

also necessary to take into account the impossibility of stopping all the vehicles at all the toll ways under penalty of slowing down the traffic. The experiment shows that on the most favorable segments from this point of view (personal purpose in the middle of Sunday

afternoon), one reaches a maximum sampling rate of 10% (against 3-4% on average). It is then advisable to try to increase this rate, in particular at early morning or late evening periods for which the response rate is, as one can easily imagine, very low.

To keep on going with this catalogue of the representativeness biases rising from the procedure, one can concerning the train, wonder about the best way to avoid that, if the questionnaire is circulated to two or three people travelling together, the response of one of them prevents the other members of the group to fill in the questionnaire. This phenomenon is, according to the observations of the interviewers, particularly frequent with old couples.

The main difficulty encountered on the train is actually of a totally different nature since it relates to the night trains. To have the questionnaires filled in on the platform before the departure of the train, has the advantage of being able, with only one team of interviewers, to cover several departures of night trains. This way of doing introduced on the other hand a geographical distortion of the results insofar as, unless you increase considerably the number of interviewers, only a few stations can be covered by the survey. Another distortion of the results comes from the fact that people arriving at the last moment are ignored. To circulate and collect the questionnaires in the train corridors, during the travel, in addition to the painfulness of the interviewers' task, has the disadvantage of making it possible to approach only the awoken travellers, thus operating another significant selection within the target population (prevalence of young people travelling together).

Whatsoever, the main point is that neither one nor the other of these two methods are satisfactory concerning the response rate. The observation of long-distance relations, for which a significant proportion of journeys is carried out at night, thus appeared problematic. The solution may be, in this particular case, to circulate mailed-back questionnaires to be mailed on arrival in Paris. Of course, since the introduction of TGV, this traffic has strongly decreased. But it was a very large one in 1989 on Toulouse-Paris, Hendaye-Paris or Brittany-Paris.

Concerning air traffic, the impossibility to survey on board, even to circulate the questionnaires at boarding and to collect them at landing, was already mentioned. This situation is potentially leading to important biases, in particular to collect information on people travelling together, to approach the travellers most stressed by the atmosphere in the departure lounge (which are probably less accustomed to air travel), and to catch late people.

It is clear that no magic solution exist which would solve all the problems of representativeness involved in the procedure. Some improvements are possible in the perspective of a new survey, but they remain marginal in most cases.

### **3.2.2. Possible progresses about sampling are related to available resources**

The main challenge deals with the choice of the samples. It is from this point of view that the results have to be improved considerably, in the direction of an increased statistical reliability. But, everytime, this improvement implies more means that those which have been gathered for the present operation. We will first raise the question distinctly for each mode, then in a transverse way.

- *To survey national roads?*

Concerning the road traffic, the choice was made to observe only motorway flows. It seems clear, indeed, that the main part of the long-distance traffic uses the motorway network. It is on the other hand less obvious than, in particular on the shortest relations (Le Mans-Paris or Tours-Paris), the traffic using the national roads is neglectible at weekend returns period, especially if the destination in Ile-de-France corresponds to this route. Was it necessary to survey traffic on N10 and N23? It is advisable before answering to take into account the complexity and the low efficiency of the required procedure (using police staff).

- *To survey a large proportion of trains is a must*

The rail traffic is the one with the lower survey rate. Indeed, the choice was made, taking into account the allocated budget, to survey only one train out of two on average. Within this framework, the selection of the trains actually observed thus aimed at alternating on each destination, the types of train and route while endeavouring as well as possible to cover the various periods of the day. In practice, it was also necessary to integrate in the process of choice the constraints implied by the organisation of the movements of the interviewers surveying in the trains.

In fact, this average proportion of a train upon two is not sufficient in comparison with the frequencies of the various services. The problem appears clearly at the step of weighting. Indeed, to obtain volumes of coherent traffics on each of the three modes, and thus comparable or summable figures, it is necessary, within the weighting procedure, to take into account all the trains having circulated during the survey period on the relations covered by the survey. The weight (the number of travellers) of the non surveyed trains must thus be split among the questionnaires collected in the trains actually surveyed.

When a relation is served by a relatively low number of trains (it is the case for Brest -5 daily services to Paris-, but also for Quimper -4-, Hendaye/Tarbes -3- or La Rochelle -2-), the schedules of the surveyed and non surveyed trains are distant by several hours. Everything apart being equal, this different temporal positioning is very likely to induce differences in the structure of customers in each train, in the type of trips made and in the purposes which generate these trips. In addition to temporal variations, various levels of pricing and types of services can make a difference between trains in terms of travel time or intermediate stations served. These elements still strengthen the differences in customers structure which cannot be taken into account.

However, it is not possible to take into account the specificities of the trains which were not surveyed. It goes as if the population of their travellers were perfectly identical to that of the train which precedes them or which follows them by a few hours. This situation is all the more detrimental in the present case that having to disposal two distinct 24 hours samples does not make it possible to compensate for one day by another.

Grossing up data in such a situation proves extremely hazardous. The small proportion of trains surveyed is thus an additional, but important element weakening the results. It presents moreover the serious disadvantage not to allow any control of the biases introduced at the weighting and even more at the trains selection steps. For this type of survey, it appears essential to survey nearly all the trains, representing a train through questionnaires collected in another becoming a matter of exception.

- *To survey all large airports... and the small ones too?*

The observation of the air traffic raises, to a much lower extent, the same type of problem. Indeed, always for budgetary reasons, it was decided in 1989 not to survey the Quimper



airport, the results of which were likely to prove very close to those of Brest. In order to guarantee the comparability of the results between the various modes, it nevertheless was necessary to take into account the Quimper-Paris traffic. The grossing up, as for the train, consisted in fictitiously filling the planes taking off from Quimper with individuals having answered the survey in Brest. Biases are of the same type, although geographical instead of temporal. It results in particular from this operation that it became impossible to disentangle north and south Brittany, and therefore, the «Breton isthmus», including Finistère, Cotes d'Armor and Morbihan, never could be broken up on a finer level in spite of its geographical extent <sup>(3)</sup>. It seems essential, in such a study, to survey all airports with a significant traffic to Paris.

The cities served by «third level» companies, or in any case, through a «small» airport, raise difficulties of another kind insofar as the corresponding traffic is in any event marginal. From a qualitative point of view, it can nevertheless be unsatisfactory to systematically eliminate from the observation the "richer" traffic of small size cities. Perhaps taking into account poor yield of an interviewer used to «cover» the airport of Agen (or of Saint-Brieuc, Angoulême - in 1989 only -, Foix, Pau, Tarbes, etc), it is advisable to think of another method of survey in this specific case (circulation of the questionnaires at landing in Paris or in the opposite direction, etc).

As a whole, considering sampling choices mode by mode reveals many difficulties. Certain constraints bring disadvantages having a lot of consequences. It is in particular the case of the small proportion of trains surveyed. Others are mentioned here more with the concern of forgetting nothing. The important may be is that all the elements mentioned are cumulative. Each in a different way, they contribute to weaken the representativeness of the sample collected. But especially, biases which they induce become important because they are reinforced by a general characteristic of the survey which also contributes to weaken the representativeness of the sample: the too small number of days surveyed.

- *To survey at least a full week*

If one refers to the two segments on which attention has been focused when analysing the results, Parisian weekend trips on the one hand and business trips on the other hand, one measures that the results are based in both cases on a single 24 hours period, from Sunday afternoon to Monday morning in the first case, Tuesday in the second. The question of the survey size was mentioned above. As an example, results about business trips concerning the Loire-Atlantique département are relying on approximately 200 or 250 Tuesday questionnaires, all modes together. This highlights the weakness of the sample. Any random event generating registered trips will in such conditions have a strong effect on the whole of the results.

The operators know well that between two days a priori perfectly similar, the traffic on a relation can vary in proportions sometimes important. Being interested more in the structure of the traffic that in its volume makes it even more critical, since, by nature, these random variations are not identical for all the categories of travellers. With one-day samples, we become completely dependent on these random variations. Even worse, it makes it difficult to identify them and disentangle from the structural trends we are looking for.

As compared with the situation which prevailed for the present survey, it thus appears essential, for an study of this kind, to considerably enlarge the number of days surveyed.

---

<sup>(3)</sup> In fact, this impossibility to divide Breton isthmus is also a consequence of the survey procedure adopted for night trains

This recommendation is of very particular importance for the weekdays traffic. Such a solution would make it possible moreover to get rid of the distortion concerning the durations of stay due to the fact of surveying only a Tuesday <sup>(4)</sup>. The optimum would be no doubt to survey two weekends and a whole week. An acceptable solution would be to cover one whole week, including the week-end, increasing as a consequence very substantially the number of questionnaires available.

- *A survey five times more important*

Thus is completed the review of the main problems involved in the procedure, the sampling and the dimensioning of this survey. It is a fact that the main part of the recommendations mean using more resources than available for this survey. One can roughly estimate the expansion factor from a two days survey sampling only half of the trains to a one week survey covering the whole of the relations, to 5. The hugeness of the means to implement, on the basis of statistical requirement which are by no means luxurious, leads to strongly wonder about the reproducibility of such a methodology at that scale. Perhaps a third of France, all the modes and all the purposes implies a sum of means out of reach. This suggests studying the alternative way of a follow-up panel of residents of the zones served by the TGV, which, in addition to its intrinsic advantages in terms of behavioural analysis and of observation of the progressive growth, can by its naturally multimodal, intertemporal and multidirectional character, have a better cost/efficiency ratio.

The solution to restrict the geographical field of observation can only answer very partially the problem. Indeed, a significant part of the costs of survey can be regarded as fixed costs, independent of the origin-destination pairs which one wishes to observe. It is so for the costs of collecting questionnaires on the motorway for which no geographical selection can be operated before computing and grossing up the data. The same applies, but in a partial way, for the expenditure related to the railway survey, except choosing to cover only one of the two branches.

Whatsoever, any restriction of the geographical area considered would implies a considerable impoverishment of the problematic insofar as it is commonly admitted that the characteristics and the local economic situation seem at the very least as determining as the evolutions of transport supply to explain the qualitative transformations of flows between the province and Ile-de-France. To this first argument, can be added a second related to interstitial areas. Indeed, the way in which the inhabitants of the large metropolitan areas can attribute value to the TGV in their business or leisure activities is well-known. The present survey largely confirms, from this point of view, the lesson already withdrawn from past experiments, Paris-Lyon in particular. Concerning less polarized areas and smaller cities, on the one hand views are not so fixed and the local characteristics have an even greater weight on the other hand,. If one considers in addition, that nowadays debates about routes or location of stations are mainly focused on these intermediate spaces, it is clear why the analysis of the consequences of TGV services is at present a real challenge.

## **CONCLUSION**

These few pages may appear quite critical concerning a survey the analysis of which has been spread over such a long time and remains nevertheless incomplete. In fact, the intention is multifold : it is first a question of preventing from the everlasting temptation to

---

<sup>(4)</sup> On tuesday, because parisiens are surveyed when they come back to Paris, the stay duration of business travellers among them seldom exceeds two days

interpret data beyond what they mean; it is then a way to let everybody aware of the numerous difficulties related to the implementation of such a survey and an attempt to capitalize this experiment. Beyond the errors, the insufficiencies, anyway unavoidable, it is a matter of learning the lessons of a rigorous attempts - at least in its intention - to observe long-distance mobility and its socio-economic implications.

The lesson to be drawn from the whole of the points, rather concrete and technical, which were approached here are multiple. One will particularly retain the questions related to sampling because they do not appear in an obvious way during the preparation of such a survey. Indeed, the importance of the total volumes of questionnaires which one is about to collect and to treat then appears to be the determining element. It all the better dissimulate the weakness of sample sizes available at the level of homogeneous sub-groups than uncertainty about the survey rates strongly disturbs the possible quantitative forecasts. Dimensions related to the design of the questionnaire are not completely specific to this type of survey. They lead nevertheless to think about the best way to adress the problematic.

It is probably impossible to determine "the" good method to tackle the question of the link between the transport supply and the economic and social changes through travel behaviour patterns. The methodology of a before and after survey has its own difficulties, even its disadvantages, strongly underlined here. It is however of some interest, considering not only these results about TGV-A, but also former results such as, for instance, those based on the survey carry out by the LET in 80-85 on the South-east area concerning business trips and which initiated the understanding of high-speed mobility [Bonnafous, 1987]. It is in addition undoubtedly perfectible, and confrontation with other approaches, like the longitudinal follow-up survey implemented concerning the TGV Nord and which is the subject of another communication within this session, can prove worth doing.

As a whole, this survey confirms the insufficiency of the quantitative methods to collect the whole of information required to understand the observed phenomena. As a further step to the South-east survey, the LET had already carried out a qualitative survey, through discussions in the companies, to try to specify the socio-economic transformations that the survey of mobility seemed to reveal [Buisson *and Al*, 1987]. This step appeared quite useful in order to give a significance to the located transformations.

The qualitative approach is thus not to exclude from the set of observations of mobility itself, quite to the contrary. As our knowledge in this field enrich, many behaviours which are marginal in terms of number of travellers appear to have an importance larger than their weight in the traffic. It is so for instance for half-day returns the importance of which clearly is, beyond the adoption of such behaviours which remains limited, related to the potentiality they represent in terms of flexibility and fluidity. Another illustration is to be found in the phenomena of double-location which reveals a revolving perception of space, although to a type of practice and a model of representation corresponds only a limited number of individuals. Last, mobility surveys make hardly possible to insert mobility within the general sociability of individuals, nor within the relational networks inside their organization. All these elements go strongly in the direction to advise that quantitative mobility observation sets be complemented by a steady qualitative approach.

## **BIBLIOGRAPHY**

- BONNAFOUS, A., (1987), The régional impact of the TGV, *Transportation*, vol 14, n°2, pp. 127-137.  
BUISSON, M.-A., et *alii*,(1986), Effets indirects du TGV et transformation du tertiaire supérieur en Rhône-Alpes, Rapport de recherche pour le compte du Ministère des Transports, Laboratoire d'Economie des Transports, Lyon, décembre 1986, 87p.

- DAMETTE, F., (1994), La France en ville, La documentation française/DATAR, coll. Informations et analyses, 271 p.
- KLEIN, O., CLAISSE, G., (1997), Le TGV-Atlantique : entre récession et concurrence, Laboratoire d'Economie des Transports, coll. Etudes & Recherches, Lyon, 163p.