Goods and Business Traffic in Germany

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1 DEFINITION OF GOODS AND BUSINESS TRAFFIC

1.1 Business Traffic in Germany

Like in other countries, much less research has to date gone into goods and business passenger traffic than into private passenger traffic, even though business traffic is gaining significance especially in the industrialized world. The intention of this paper is to present surveys which were conceived with the aim of compensating the lack of research in this sector in Germany.

Household surveys are the most valuable source when it comes to acquiring data on passenger traffic, as they supply the required information on all distances covered by people within a defined period of time, whatever means of transport they use for whatever purpose. Similar surveys made for goods traffic would, by analogy, have to consider the distances travelled, loading processes, and possibly also the processing of the goods handled from case to case, i.e. processes that are above all of relevance for logistics. Although it is a highly complex task to make sure that the complete goods handling chain is covered, it could in theory be solved at the consignor’s end, i.e. households or business units. A major problem in this context will be the question as to where to draw a dividing line between the population of all forwarding units, from which a representative sample can then be taken. But since in the course of handling processes, goods are also transported by people, who normally use vehicles, goods traffic surveys can, at least for part of the handling process, also be conducted by interviewing people, e.g. drivers in households, business units, etc., or of common carriers.

In Germany, highly efficient traffic statistics, which are recognized by law, have been compiled and are updated on a regular basis by different federal offices. One of these is the Federal Office for Motor Traffic with its central vehicle register showing the essential details for any vehicle registered in Germany. The traffic performance of large goods vehicles (lorries and semi-trailer motor vehicles) of a payload of more than 3.5 tons is, in addition, established on an annual basis in the form of a representative sample of 5 per mil (approx. 212,000 vehicles), covering a period of three days (so-called semi-weeks). These road haulage statistics are also based on law, which means that there is an obligation to supply the required data under the federal traffic statistics act.

The research project “A survey of required and available data on commercial traffic as a basis for pragmatic extensions of existing data” has, however, shown that traffic statistics, and, more precisely, the goods and business passenger traffic statistics, are incomplete as they do not adequately cover such smaller vehicles as motor cycles, passenger cars and lorries of a payload of up to 3.5 tons (Wermuth et al, 1998). Another research “Investigating the problem of ‘non-reported-trips’ in business passenger traffic in household surveys)” (Brög and Winter, 1990) has shown that only about one third to half of all trips forming part of business passenger traffic are reported in connection with written household surveys. This means that a major portion of business passenger traffic is not even considered in connection with passenger traffic statistics. Since especially for
trips using passenger cars and small lorries (delivery vans) it is often not possible to draw a clear line between goods and passenger traffic, business traffic, which is understood to include goods and business passenger traffic, should be at the centre of interest of specific surveys.

1.2 Business Traffic and its Structure

In the past, a number of attempts have been made to structure business traffic and to delimit its sub-categories. Frequently used definitions are listed in (Wermuth et al, 1998) and (Steinmeyer, 2003), however a generally accepted definition is as yet not available. This can be explained by the fact that, unlike private traffic, this sector has not been studied in depth. In addition, it is often necessary to arrive at a pragmatic definition of terms that relates to the purpose of the survey.

A general distinction that can be made in the traffic sector is the one between private and business traffic. Business traffic in its turn falls into the two main categories

- Goods traffic, i.e. trips primarily made with the aim of transporting goods, and
- Business passenger traffic, i.e. trips primarily made for a business or official purpose, including or not including goods transport. This category also covers trips made for purposes of passenger transport, e.g. a bus driver’s trips for a public transport company.

It is not always possible to clearly decide whether according to its primary purpose a trip forms part of goods or business passenger traffic. This applies, for instance, to trips made to maintain the operability of a vehicle (e.g. trips to the garage or the petrol station). This is why a third category may be included:

- “Other business traffic”, i.e. trips made for a combination of purposes or a different purpose.

Sub-categories of goods traffic are

- Commercial goods traffic, i.e. goods transported between places of production and consumption, and
- Works traffic, i.e. a company’s own goods transported on their own account including the required empty and return trips.

Business passenger traffic includes the sub-categories

- Service traffic, i.e. a combination of goods and passenger traffic, in which not only the person rendering a service, but also tools, spare parts or other goods are carried,
- Business and service traffic, i.e. trips made for a business purpose, and
- Passenger traffic, i.e. trips made for the purpose of transporting other people (e.g. trips made by bus drivers, taxi drivers, etc.) including the required empty and return trips.
Movement from one place to another using motor vehicles

Private traffic
*Trips made for private purposes*

Purpose of trip:
- To place of work
- To place of training/school
- Private shopping
- Collecting, transporting people
- Other private business
- Trip home

Business traffic
*Trips made for the purpose of gainful, non-profit making or other business activities*

Business passenger traffic with/without (small) goods transport

Business passenger traffic for purposes of passenger transport

Purpose of trip:
- Collecting, transporting people (on business)
- Trip back to company premises / parking space

Business passenger traffic in performing professional service

Purpose of trip:
- Performance of professional service, e.g.
  - Machinery installation
  - Repair
  - Consultation
  - Support service
  - etc.
- Trip back to company premises / parking space

Goods traffic
*Goods and material transport, incl. required empty trips*

Purpose of trip:
- Collecting, delivering, transporting goods, materials, machinery, equipment, etc.
- Trip back to company premises / parking space

Other business traffic with/without (small) goods transport

*Business traffic that cannot clearly be defined as business passenger traffic or goods traffic*

Purpose of trip:
- Other official / business matter
  (e.g. trips made to maintain the operability of a vehicle)
- Trip back to company premises / parking space

Fig. 1-1:  Functional structure of motor vehicle traffic
Trips made as part of business passenger traffic or what was called “other business traffic” above, may obviously also involve the transportation of goods, materials, machinery, equipment, and the like. Any empty and return trips, such as those back to the company premises / the parking space fall under the same category as that of the preceding trip.

Fig. 1-1 provides a general idea of the functional structure of motor vehicle traffic. The different traffic sectors are defined with a view to the (primary) purpose of a trip made. A detailed classification for private traffic using motor cars has for the purpose of this research been omitted.

1.3 Methods Used for Business Traffic Surveys

Typical problems of business traffic surveys are the heterogeneity of the actors and the recordable units (business units, vehicles, and persons), as well as the complex structure of movements and trips (shuttle trips for official and business purposes versus multi-destination trips, in particular as part of goods and service traffic). This, together with the different structures involved (sectors of industry, distribution of places of work, demographic and settlement structures, available infrastructure, and the like), forms the background against which business traffic surveys have to be developed with a view to specific information needs and the investigated regions.

As for the way in which a study is designed, a distinction has to be made between non-recurring and repeat surveys. Cross-sectional surveys consider a defined number of statistical units at one specific point in time, while longitudinal surveys are repeated at annual intervals, which in the case of the panel in addition relate to the same business units, in order to highlight developments or constants.

Before dealing in detail with the two principles of business traffic surveys, a general assessment will be made of the surveying methods used in this sector. These include:

- Household surveys, which expressly consider trips made for official / business purposes in their travel diaries;
- Interviews with the owners of vehicles registered for private and/or commercial use, the central vehicle register of the Federal Office for Motor Traffic serving as a basis;
- Interviews conducted in companies or business units with the aim of recording all business-related trips and movements of their employees;
- Analysis of transport documents;
- Analysis of travel expense reports;
- Roadside traffic counts; and
- Short interviews at points of access to business units, industrial estates, for specific cross sections, or in the form of cordon surveys.
Fig. 1-2 provides an overview of the advantages and disadvantages of the surveying methods listed above.

<table>
<thead>
<tr>
<th>Data collection using</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household interviews</strong></td>
<td>All persons moving for a professional purpose can be covered.</td>
<td>There are normally no links to places of work or any other commercial parameters</td>
</tr>
<tr>
<td></td>
<td>All purposes for which trips are made and all means of transport can be considered.</td>
<td>A relatively large number of persons contacted is of no relevance for the survey (cost factor!)</td>
</tr>
<tr>
<td></td>
<td>The population can be determined, and sampling can be made, with a relatively high degree of accuracy</td>
<td>Vehicle use, trips chain, etc. difficult to assess with the required detail</td>
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<tr>
<td></td>
<td></td>
<td>Trips made for official / business purposes are often not stated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Often limited to certain regions or local districts</td>
</tr>
<tr>
<td><strong>Interviews with car owners</strong></td>
<td>Population (car ownership) can be defined at a high degree of precision and relevance, using the central vehicle register of the Federal Office for Motor Traffic</td>
<td>Address of car owner is not necessarily identical with the location of a vehicle and the area in which it is used</td>
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<tr>
<td></td>
<td>Country-wide data acquisition</td>
<td>Restriction to motor-vehicle based business traffic</td>
</tr>
<tr>
<td></td>
<td>Clear regional distinction possible</td>
<td>When using the central vehicle register only national concept possible; national/non-national concept necessitates exchange with neighbouring countries</td>
</tr>
<tr>
<td></td>
<td>Car owners are contacted personally</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Questionnaires can be sent out for specific aspects and in the required numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activities, destinations, etc. for any business traffic purpose can be covered</td>
<td></td>
</tr>
<tr>
<td><strong>Interviews in companies or business units</strong></td>
<td>A two-stage process (1 – general business survey; 2 – vehicle travel diary survey) allows both general business data and travel-related data to be considered</td>
<td>Difficult to assess the population</td>
</tr>
<tr>
<td></td>
<td>Such a first step reduces the number of addresses and provides for sample stratification on the basis of the replies received</td>
<td>No data set known that would cover all companies, business units, or places of work, and that provides for a clear distinction</td>
</tr>
<tr>
<td></td>
<td>Activities, destinations, etc. for any business traffic purpose can be covered</td>
<td>Substantial input of organisational work and time to set up an address data bank and find out telephone numbers</td>
</tr>
<tr>
<td></td>
<td>All means of transport used for the trips can be covered</td>
<td>Business traffic with vehicles of private owners cannot be covered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited to certain regions or local districts</td>
</tr>
<tr>
<td><strong>Short roadside interviews</strong></td>
<td>All types of traffic, purposes and vehicle categories can be covered</td>
<td>Substantial organisational input, since local authorities have to be integrated</td>
</tr>
<tr>
<td></td>
<td>Microcensus linked with data available from counts or long-term census points supplies detailed insights into business traffic</td>
<td>Limited duration of interviews, i.e. only some essential key questions can be asked</td>
</tr>
<tr>
<td><strong>Traffic counts</strong></td>
<td>Count data can be used for comparison between road network data and extrapolated results</td>
<td>Data expansion may be difficult</td>
</tr>
<tr>
<td></td>
<td>Fairly efficient method providing rough characteristics</td>
<td>Data on personal behaviour as a road user and vehicle use cannot be recorded</td>
</tr>
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<td></td>
<td></td>
<td>Only supplies data for cross sections; no source-target relationships</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicles cannot be associated with business traffic or purposes of trips beyond any doubt</td>
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Fig. 1-2: Methods used for business traffic surveys and their advantages and disadvantages

The business-traffic-specific details traffic counts supply relate mainly to trucking traffic, which means goods traffic, since it is difficult to differentiate between different vehicle size groups merely from visual appraisal. Hence this method does not show by what percentage passenger cars are used for business traffic purposes. Neither do such counts supply any information on the purpose of a trip (goods transport, service rendered, empty trip, etc.), destinations, utilization factors, and the like.
This method is an appropriate instrument primarily when used for verifying computed network use or to furnish information of a more general nature on the relationship among different types of vehicles.

Short roadside interviews do indicate the percentage by which certain traffic purposes are represented in business traffic, a distinction being made into types of vehicles for the road cross section or sections considered from case to case. It should be noted that such interviews imply time restrictions, which only allows a limited number of aspects or questions to be covered. They are also difficult to organise, they rely on the support of local authorities, and require police presence. This kind of interviewing can be used for comprehensive assessment of how traffic volumes are produced or of individual participation. If target groups are approached in a well-designed manner, this method allows different aspects to be covered.

Household interviews produce the problems mentioned, i.e. that a very wide sample has to be defined in order to get a meaningful response. A second problem is that business passenger traffic cannot be fully covered in this way. Interviews with car owners and employees in industry, however, supply clearly defined insights, and can be conducted in a number of ways.

**Fig. 1-3** lists the advantages and disadvantages of different data collection methods. The figure shows that each method has its specific advantages and disadvantages, so that the question as to what method should be used has to be determined with a view to the purpose for which surveys are conducted. Such aspects as the financial and human resources involved, as well as the time required have to be carefully weighed.

Irrespective of any specific advantages and disadvantages, combinations of a number of methods should always be considered. Survey designs used in the German cities of Hannover, Kassel or Munich may serve as examples in this respect.

Starting from insights gained with
- Interviews conducted with car owners in connection with the nation-wide traffic survey “Motor Vehicle Traffic in Germany 2002” (KiD 2002), and
- Interviews conducted in industry, using the example of “intermobil Region Dresden”,
the following chapters will discuss the most essential approaches available for the collection of business traffic characteristics.
### Data collection using

<table>
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<tr>
<th>Written (postal) interviewing</th>
<th>Advantage</th>
<th>Disadvantage</th>
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</table>
|                              | • Respondents have more time to think about the questions and their answers  
• Respondents are not influenced by personality and conduct of interviewer  
• Questionnaires can be taken along for on-trip recording of distances travelled  
• Less cost-intensive than personal or telephone interviews  
• Two-stage approach allows the number of documents sent out to be controlled  | • Questionnaire must be simple and self-explanatory  
• There is no way of telling whether the questionnaire was completed by the target person himself/herself  
• Hardly any room for explanations and motivation, e.g. in case of communication problems  
• More organisational requirements if sample recovery is difficult to control  
• Low recovery rate, if no additional measures are taken  
• High postage rates  
• Pre-interview phone call useful, to find out about person to be contacted, number of vehicles, etc.  |  
| Personal interviewing | • Direct contact with interview partners  
• Possibility to respond to questions, possibly a higher recovery rate  
• Travel diaries can be handed out in the required numbers  
• Postage to be paid only for the travel diaries returned  | • High costs involved for interviewers  
• Considerable organisational requirements for the interview  
• Pre-interview phone calls necessary to make appointments and be sure that the respondent will be available for an interview  
• Respondents may be influenced by personality and conduct of interviewer  
• Interviewers require adequate interviewer training  |  
| Telephone interviewing | • Low material costs, since no detailed documents have to be prepared  
• A data entry form in the PC allows answers to be entered during the interview  
• Plausibility checks in parallel with data acquisition  
• Interviewers can be monitored  
• Travel diaries may be sent out in the required numbers  | • Non-availability of useful selection criteria (more people decide not to have their private telephone numbers listed, subscribers to mobile phone service normally not shown in directory); time and cost-consuming inquiries  
• Interviewers require adequate training  
• Conversation has to be limited in time and thus in the number of aspects covered  
• Respondents may be influenced by personality and conduct of interviewer  
• It may be necessary to send out survey material, as certain questions cannot be answered “off the cuff”  |  
| Internet interviewing | • Easier to handle than classical interviewing methods (automatic filtering, irrelevant questions, omitted, etc.)  
• Costs involved are low  
• Results available without much delay  | • Unlike telephone, email and Internet are not generally available (representative sample selection!)  
• Certain technical skills required to complete Internet questionnaires  
• Interviewing costs have to be borne by respondents  |  
| Traffic count using mobile phones | • Easy access to respondents  
• Exact data available on place and time (automatic transmission and plausibility check)  
• Easy handling for respondents  
• Independent of equipment  
• Interactive questionnaire possible  
• Long-term surveys without any loss in quality (low level of input requirements)  
• Immediate availability of traffic data (immediate processing in EDP systems)  | • High recruiting requirements  
• Time consuming development of voice files for voice-operated questionnaires (interactive voice response system)  
• Network providers must be prepared to make locating data available  |  

**Fig. 1-3:** Types of surveying methods and their advantages and disadvantages for business traffic surveys
2 NATIONWIDE SURVEY “MOTOR VEHICLE TRAFFIC IN GERMANY 2002” (KiD 2002)

2.1 Objective and Survey Design

2.1.1 OBJECTIVE OF THE NATIONWIDE SURVEY

Capital expenditure programmes on a federal and regional level and the development of traffic management concepts are two examples for which the Federal Ministry of Transport, Building, and Housing (BMVBW) has to rely on a sound motor traffic data base. To compensate information gaps, the ministry commissioned a project group with the preparation and implementation of a nationwide motor traffic survey which is to focus on business traffic and motor vehicles up to a payload of 3.5 t. Partners to the project are the Institute of Transportation and Urban Engineering IVS, Technical University Braunschweig, (Univ.-Prof. Dr. M. Wermuth, project management); the Federal Office for Motor Traffic KBA; the Institute of Applied Transport and Tourism Research IVT e.V.; WVI Prof. Dr. Wermuth Verkehrsforschung und Infrastrukturplanung GmbH, dealing with transport research and infrastructure planning; and Project Research Management Consultants Transport and Traffic P.U.T.V.

Since vehicles of both commercial and private owners are used for goods and business passenger traffic, the survey had to consider all types of vehicles. The methodological approach and the general concept to be used in the survey were prepared under research project 70.632/2000 “Kontinuierliche Befragung des Wirtschaftsverkehrs in unterschiedlichen Siedlungsräumen. – Phase 1, Methodenstudie/Vorbereitung der Befragung” (continuous business traffic surveys in different settlement areas – phase 1: preparation) which was commissioned by the BMVBW ministry /Wermuth et al. 2001/. The main survey was conducted under research project 70.0682/2001 “Kontinuierliche Befragung des Wirtschaftsverkehrs in unterschiedlichen Siedlungsräumen. – Phase 2, Hauptstudie” („Kraftfahrzeugverkehr in Deutschland 2002“ (KiD 2002)) (continuous business traffic survey in different settlement areas – phase 2: main survey “motor vehicle traffic in Germany 2002”), also commissioned by the same ministry.

The aim of the research was to develop a concept for, and conduct, a nationwide business traffic survey based on motor vehicle business traffic; to produce on that basis empirical parameters, in particular on traffic volume and traffic performance; and to develop recommendations for future surveys with a particular view to business traffic. One of the primary objectives of the research was to create a sound data base of current relevance for business traffic, which, like the KONTIV concept, may serve as a valuable empirical basis for more detailed research and planning work, and which will also be available for future projects of infrastructure planning and management, be it at the federal, state or regional level. At the end of the survey, in the autumn of the year 2003, the facts and figures produced by the survey were made available to the BMVBW ministry, so that all
interested parties, including political advisers, transport planners, and transport economists will for the first time have access to up-to-date and well-founded data in this transport sector.

2.1.2 Survey Design

The underlying concept of this survey is to consider the vehicle day both as an item under investigation as well as a survey item, and to use the central vehicle register of the Federal Office for Motor Traffic as a sampling source. This nationwide traffic survey is thus based on the resident concept.

The daily routine of vehicle usage cannot be surveyed for either all vehicles nor for individual vehicles on all days. This is why the sampling procedure is employed, which means that vehicle usage is surveyed only for a random sample of vehicle days, i.e. for a random choice of vehicles and an equally random choice of day (data of survey or day under report). The parent population of this survey is thus the total number of all vehicle days from which a selected sample is taken as a random sample.

The central vehicle register of the Federal Office for Motor Traffic as a basis for selection provides almost ideal conditions for selection of a representative sample. Since the register of all motor vehicles registered in Germany is updated on a daily basis, the selected basis is in full agreement with the parent population basis, and is thus fully known in terms of both volume and structure. This basis at the same time offers advantages in terms of the theory of sampling, as it renders sample plan phasing superfluous, which would adversely affect the accuracy of the results, and which is, for instance, necessary for household surveys. This is because each element of the parent population is included in the sampling basis and is clearly identifiable. The central vehicle register, in addition, supplies a number of vehicle and owner features that have an effect on vehicle usage and that can be utilised for effective parent population stratification, and thus contribute to the accuracy of the results.

The survey is conceived as a written postal survey for a defined reference date. The questionnaire has the form of a diary that does not only contain the set of questions, but also supplies the respondent with the necessary information on the procedure and data protection, as well as assistance for how to complete the questionnaire.

Vehicles of commercial owners account for a major portion of business traffic, but those of private owners are also used for official/commercial purposes. From this follows that a complete and extensive analysis of business traffic should consider all types of vehicles and all groups of owners. For reasons of research efficiency it was decided that the survey should concentrate on vehicle groups frequently used for business traffic purposes and for which little information is available as to their contribution to this transport sector, rather than on vehicle groups that are already
represented in other surveys. Against this background, the nationwide KiD 2002 survey was given a structure that falls into one main and three additional surveys (Fig. 2-1).

![Diagram of vehicle types](image)

**Fig. 2-1:** System of the nationwide KiD 2002 traffic survey

The main survey, which is at the centre of KiD 2002, the following types of vehicles were subjected to closer analysis:

- Motor cycles of commercial owners,
- Passenger cars of commercial owners,
- Lorries of commercial owners (up to, and including, a payload of 3.5 tons), and
- Lorries of private owners (up to, and including, a payload of 3.5 tons).

Additional survey I is to link up to the official road haulage statistics, and it covers the types of vehicles included in these statistics:

- Lorries of a payload of 3.5 t plus, and
- Semi-trailer motor vehicles.

A link with the traffic survey „Mobilität in Deutschland“ (MiD 2002), which used the known KONTIV design and was conducted simultaneously as a household survey, was produced by additional survey II. This second element covers business traffic with the vehicle groups

- Motor cycles of private owners, and
- Passenger cars of private owners.
**Additional survey III** covers all other vehicles and supplies information on business traffic using these types of vehicles, which include

- Motorbuses used outside regular service,
- Other tractors,
- Emergency and protection vehicles,
- Motorhomes, and
- All other officially registered vehicles

These four sub-surveys together produce a complete picture of road-based business traffic. On the basis of this structural system chosen for KiD 2002, a vehicle-based, an owner-based, a spatial as well as a temporal stratification is made for representative sampling.

### 2.1.3 Regional Supplementation of the Main Survey

Regional and local traffic planners normally require a higher density of business traffic data. This induced the Federal Ministry of Traffic, Building, and Housing (BMVBW) to offer the federal states and local governments the option of supplementing the federal sample for their particular planning region in order to account for their specific needs. In all nine federal states, regions and cities seized this opportunity, and expanded the federal sample for selected vehicle groups of the main survey. These nine regional surveys increased the volume of the selected sample in the main survey by more than 55,000 vehicle owners additionally contacted.

### 2.2 Survey Preparation

#### 2.2.1 Pilot Test for Method Verification

The feasibility of the surveying method, the aspects to be covered by the survey, and the preparation, implementation and evaluation procedures for such a nationwide traffic survey were verified as part of a KiD 2002 methods analysis (FE-No. 70.632/2000), using a pilot test with a total of 1,980 vehicles. For the pilot test, three versions of a questionnaire were developed, which differed in layout and survey handling. The groups included in this pilot test were passenger cars of commercial owners, lorries of up to, and including, 3.5 t payload of commercial owners, and lorries of up to, and including, 3.5 t payload of private owners.

The recovery rate and the quality of the answers exceeded the expectations by far and thus confirmed the methodological concept and that the volume of questions asked is appropriate. The results of the pilot test, i.e. the willingness of the people surveyed to respond and the quality of their answers, shows that a column-based questionnaire with an extensive set of questions were preferred. For this type of questionnaire, the recovery rate of questionnaires that are fit for use (net
sample) was 50.8% based on the gross sample. It is worth noting in this context that the questionnaire with the shortest programme, which consequently required the least input on behalf of the respondents, showed the lowest answer rate.

The pilot test was designed to include a primary run and two reminders, with which the complete survey documents were sent out a second (and third) time. For the primary run, the response sample accounted for 32.1% of the gross sample, while for the first reminder this figure was 21.8% and for the second reminder 5.4%. In view of the poor benefit-to-input ratio, it was recommended that the second reminder should be dispensed for the main survey.

As a general conclusion of the favourable results produced in the pilot study it was recommended that the concept should be implemented in terms of both its contents and organisational structure, due consideration being given to the experience gathered in the pilot test and the improvements proposed for concept optimisation.

### 2.2.2 Survey Documents

The survey documents sent out to the owners of the selected vehicles included the following:

- Covering letter
- Questionnaire with questions on vehicle and owner
- Travel diary (for trips on reference day),
- Data protection declaration
- Notes on how to complete the questionnaire and on participation in the survey
- Accompanying letter of the trade associations, and
- Prepaid reply envelope.

The covering letter, the questionnaire for vehicle and owner, the travel diary, the data protection declaration, as well as the notes together form a 12-page brochure, in which the covering letter, the data protection declaration and the notes are used like an envelope for the coloured A4-pages containing the questions. As mentioned above, the questionnaire uses the successful column design of previous household surveys that asked for personal data. It falls into two main sets of questions.

A first general set of questions asks for vehicle- and owner-specific data, which are not available from the central vehicle register, or, if so, not with the required detail. This concerns questions on

- Location of the vehicle
- Use as a leased or rented vehicle
- Sector of industry of the owner or the main user
- Company size, showing number of staff, or persons of the household
- Vehicle fleet of owner, and
- Vehicles taken off the road.
The travel diary, in which the vehicle movements were to be recorded for a defined reference date, accounted for the largest portion of the questionnaire. For the travel diary, the users had to enter the following criteria for the first eleven trips (or parts of a trip):

- Address and kind of source
- Time when started
- Purpose of trip
- Type of load carried
- Gross weight of load
- Type of goods
- Number of people in the vehicle
- Use of a trailer/semi-trailer
- Address and kind of destination
- End of trip, and
- Distance travelled.

To reduce the input of time for the respondents in case of intensively used vehicles, while at the same time also covering the type of structure of additional trips or parts of trips, a reduced set of questions was asked for trip numbers 12 to 18. For any additional trips on the travel day, only the number of trips beyond the recorded 18 trips as well as their total distance had to be entered.

**Fig. 2-2** gives a general impression of the layout of the questionnaire.

---

**Fig. 2-2:** Travel diary for the first eleven trips on the travel day
Attached to the survey material was a letter of the umbrella organisations of the German industry, in which they underline the significance and benefits of this all-German traffic survey and ask the car owners receiving the material to participate in the survey.

2.3 Stratification Concept for the Main Survey

To be sure that reliable vehicle usage data are obtained for all groups of vehicles, all parts of the country and all periods of the year, sample stratification was used. The parent population was stratified with a view to functional (vehicle and owner characteristics), geographical (district of registration, vehicle base), and temporal characteristics (weekday, season), which are known to have an influence on the way vehicles are used, but which are not available for the parent population from the central vehicle register.

The functional stratification characteristics actually used were the type of vehicle, owner group, type of drive system, sector of industry of the owner, vehicle age and the piston displacement (in the order shown).

The sector of industry of the vehicle owner is a major stratification characteristic. The German classification of industries issued by the Federal Bureau of Statistics (“Klassifikation der Wirtschaftszweige”, Ausgabe 1993 (WZ 93)) comprises 17 chapters. Since 1 July 2001, the Federal Office for Motor Traffic has been using this systematic classification for its central vehicle register as a means of coding data on the profession or trade of self-employed vehicle owners. Since this classification, which has also been adopted for KiD 2002, is compatible with the classification the European Union uses for sectors in industry (“Nomenclature générale des activités économiques dans les Communautés européennes” (NACE Rev. 1)), and also with the classification the United Nations Organisation has developed for that purpose (“International Standard Industrial Classification (ISIC Rev. 3)), the classification standards can be compared on an international level.

The geographic stratification was made on the basis of the systematic approach of the Federal Office for Building and Regional Planning (BBR), in which administrative districts and towns not belonging to a federal state are classified as separate categories depending on settlement homogeneity (Federal Office for Building and Regional Planning - BBR, 2000). For the KiD 2002 survey, the nine types of administrative districts were used to form four suitable geographic units.

On the basis of these stratification criteria and their distinctive features, the strata were determined according to the homogeneity of the annual vehicle mileage obtained from the earlier 1990/1993 mileage survey. For this purpose, the total vehicle population for the KiD 2002 survey was subdivided into 145 strata, so that the main survey comprised 99 strata (Fig. 2-3), additional survey I 12 strata, additional survey II 29 strata, and additional survey III 5 strata.
The selected sample of each vehicle group was distributed proportionally over the different strata such that it reflected the parent population distribution (vehicle population in the central vehicle register). To ensure that stratum-based evaluation results are statistically verified, a minimum number of interviews is required for each stratum. If the required minimum of 240 vehicles per stratum in the main survey (or 260 vehicles per stratum in the additional surveys) was not available, vehicles were added to produce the required total of 240 and 260 vehicles, respectively, per stratum.

The surveys were conducted for a period of one year between November 2001 and October 2002. During this period, a total of four samples were taken. The main survey covered a total of eight surveying phases and the additional surveys four surveying phases. Each phase lasted exactly one week for the primary run and one week for the reminders, with seven reference days each. The 16 survey weeks or 112 survey days thus covered about one third of the year, and since the survey
weeks were almost uniformly distributed over the entire year, seasonal factors and also school holidays, which may have an effect on the kind of vehicle usage, are adequately accounted for. The selected sample was also uniformly distributed over the groups of weekdays Monday, Tuesday to Thursday, Friday, Saturday and Sunday, and vehicles of the weekday group Tuesday to Thursday were in their turn uniformly distributed over the individual weekdays.

2.4 Implementation

2.4.1 Implementation Procedure

With each of the total of four sampling procedures, the selected samples were drawn from the central vehicle register of the Federal Office for Motor Traffic for two successive phases of the main survey and for always one phase of the three additional surveys. This was done in compliance with the stratification and sample plan specifications. Random sampling was used for vehicle drawing. To avoid repeat sampling, vehicles already selected were marked. However, vehicle owners under whose names more than one vehicle was registered could be contacted repeatedly for the survey, but always for another vehicle.

Each sample drawing resulted in an address file for preparation of the envelope sheet for the survey documents. Once these documents had been complied, they were sent out to the owners of the vehicles selected, together with an accompanying letter of German trade associations and a prepaid envelope addressed to the Federal Office for Motor Traffic. Survey material mailing was timed such that each vehicle owner received the papers about one week in advance of the reference date assigned to him. He was asked to complete the general set of questions in the questionnaire during this week and to make sure that the survey documents were passed on to the driver using the vehicle by the reference date. This one-week margin is indispensable especially for cases in which the vehicle base and the address of the owner are not the same, so that transmission of the material to the driver might require some extra time.

Should the questionnaire not have been returned to the Federal Office for Motor Traffic within a period of two weeks after the defined reference date, and should the Office not have received any reply indicating refusal to cooperate, the reminders were sent out. This meant that for each non-response of the primary run the survey documents were compiled and sent out a second time with a new reference date. The completion margin for this reminder was the same as that for the primary run.

Questionnaires returned to the Federal Office for Motor Traffic were subjected to a visual review and provided with a “returned” symbol or code reflecting the perceptible quality of answers. Questionnaires classified as having been completed were then passed on for data entry, and all other questionnaires were destroyed as required under the data protection regulations. Fig. 2-4 shows the survey design described above.
2.4.2 **PROJECT ACCOMPANYING MEASURES**

To improve respondent acceptance and to make sure that the expected recovery rates were achieved, a number of measures were taken to accompany the project. The main target groups for these measures were the vehicle owners who had received the questionnaire, and also the drivers of the selected vehicles, who were offered additional information on the survey and, more importantly, assistance in completing the questionnaire. In addition, anybody else seeking information could make use of this source of information. Apart from the covering letter of the trade associations mentioned above, the following measures were offered during the survey period:

- A hot-line and information service was set up.
- An Internet homepage was created under KiD 2002 ([http://www.verkehrsbefragung.de](http://www.verkehrsbefragung.de)).
- Owners of a large vehicle fleet could rely on personal assistance.
- An article service was set up.
- The survey was presented in the trade press, on seminars, in statistics workshops, and for vehicle owners with very large transport fleets.

To demonstrate to outsiders the close relationship with the KiD 2002 traffic survey and between the individual measures, any information given in writing and all graphical information always carried the project logo.
2.4.3 Survey Organisation

For quantification of the recovery rate, the following characteristics of the individual sample sizes are of relevance. The size of the selected sample typically decreases from one stage to the next until the net sample remains.

- **Selected sample**
The selected sample refers to the vehicle volume selected from the central vehicle register. Under the federal survey, a total of 87,098 vehicles were selected for participation in the main survey, 3,517 vehicles for additional survey I; 8,298 vehicles for additional survey II; and 1,816 vehicles for additional survey III.

- **Gross sample**
The gross sample was produced after the selected sample had been corrected to consider the so-called “false losses” (e.g. “error in the central vehicle register”, “mail undeliverable”, etc.), most of which are due to constant changes in the register data when vehicles are entered in, or deleted from, the register, or when they are reregistered. These losses do not affect the quality of the data, because the vehicles concerned were no longer registered, or the owner addresses did not exist anymore on the relevant reference date, so that they did not form part of the sample any more. For the main survey, the gross sample included 79,079 vehicles; for additional survey I 3,260 vehicles; for additional survey II 7,644 vehicles; and for additional survey III 1,662 vehicles.

- **Response sample**
The response sample was produced after the gross sample had been corrected to account for “real losses”, i.e. those refusing to participate and non-respondents. The response sample thus relates to the number of questionnaires returned, without considering the quality of entries in the questionnaires. For the main survey, the response sample covered 44,841 vehicles; for additional survey I 2,575 vehicles; for additional survey II 4,355 vehicles; and for additional survey III 1,182 vehicles.

- **Net sample**
The response sample includes a certain number of questionnaires that are not fit for use. When reducing the response sample by these “unfit” questionnaires, one finally arrives at the net sample, i.e. the total number of cases that can be used. For the main survey, the net sample volume covered 43,861 vehicles; for additional survey I 2,537 vehicles; for additional survey II 4,249 vehicles; and for additional survey III 1,131 vehicles. The utilisable recovery is finally obtained as the quotient between the net sample and the gross sample volumes.

The recovery rates achieved with the different sub-surveys of KiD 2002 were by about 10 % above the results expected from the methods analysis. All survey phases thus showed the following recovery rates:
• Main survey 55.5 % (motor cycles and passenger cars of commercial owners, lorries up to, and including, 3.5 t payload),
• Additional survey I 77.8 % (lorries of 3.5 t payload plus and semi-trailer motor vehicles),
• Additional survey II 55.6 % (motor cycles and passenger cars of private owners),
• Additional survey III 68.1 % (other vehicles with official registration number), and thus
• Federal survey 56.5 % (all vehicles).
The volumes of the different samples, as well as the recovery rates achieved for the federal survey are listed in Fig. 2-5.

<table>
<thead>
<tr>
<th>Selected sample</th>
<th>100,729</th>
</tr>
</thead>
<tbody>
<tr>
<td>False losses</td>
<td>9,084</td>
</tr>
<tr>
<td>Gross sample</td>
<td>91,645</td>
</tr>
<tr>
<td>True losses</td>
<td>38,692</td>
</tr>
<tr>
<td>Response sample</td>
<td>52,953</td>
</tr>
<tr>
<td>Unfit for use</td>
<td>1,175</td>
</tr>
<tr>
<td>Net sample</td>
<td>51,778</td>
</tr>
</tbody>
</table>

Fig. 2-5: Sample correction and recovery rates of federal survey

From the above follows that the total number of cases that could be used for the federal survey is higher by 4,914 (approx. 10 %) than was expected from the methods analysis. Added to the total of 51,778 net cases in the federal survey could be another 25,019 net cases of the regional surveys mentioned. Here again, the number of net samples exceeds the total of 22,480 net cases expected and ordered by 2,507. As agreed, the net samples of the regional surveys will be submitted to the Federal Ministry of Transport, Building, and Housing (BMVBW) for expansion of the federal sample so that a total of 76,797 cases can be utilised for evaluation. Of this total, 68,880 net cases represent the vehicle groups of the main survey.

2.5 Evaluation

2.5.1 Data Acquisition and Preparation

Data acquisition started with the visual inspection of the returned questionnaires, i.e. before the first data were entered. As required under the data protection regulations, only the data of completed
questionnaires were used. To make sure that these data were of a high quality, great significance was attached not only to correct transmission of the data supplied with the questionnaires, but also to the plausibility of these data.

The plausibility check comprised two stages, with the first stage implemented in the entry program such that only admissible characteristics and attributes were accepted. Alert and error messages immediately warned of any implausible answers and combinations of answers.

The second stage of the plausibility check followed after data entry had been completed, which means that the complete daily report for a vehicle was analysed in respect of contents and logical relationship between the details furnished. Any data records found to be implausible were classified as cases that cannot be utilised and were rejected.

Another major element of the second stage of the plausibility check was a comparison between post codes and addresses reported in the questionnaires. For this purpose, addresses shown as vehicle base, as well as addresses of owner, point of origin and destination, were translated as accurately as possible into geo-coordinates, due regard always being given to the relevant data protection regulations. A Geographic Information System (GIS) was then used to project these coordinates to a digital map and check them for correct correspondence of post code area and coded address. This geocoding not only increases the quality of the data, but also allows the data collected on vehicle use to be shown in a geographic correlation and at almost any optional geographic aggregation level. The quality achieved with geographic address coding is illustrated in Fig. 2-6.

Fig. 2-6: Quality of address geocoding for the national survey
2.5.2 Non-response Analysis, Weighting and Extrapolation

The real non-response losses may distort results if there is a relationship between the willingness of the owners to respond and whether or not their vehicle is used.

The readiness of respondents to answer questions asked depends on certain structural characteristics of the vehicle owner and the vehicle. For private owners it is found to be 48 % and thus slightly lower than the rate established for commercial owners. In the latter group, the response rate varies for different sectors of industry. The type of vehicle and the settlement structure (town/country), too, correlate with the response rate. The differences in the response rate produce minor distortions with regard to the structural characteristics mentioned, but these can be corrected by certain “structural adjustments” (stratification after sampling) when the data are extrapolated, for which purpose again the data supplied by the central vehicle register are used.

To find out whether the willingness to respond may, in addition, also be determined by characteristics of vehicle use, so that undesired “primary” non-response effects have to be expected to occur, a subsequent telephone survey was conducted for non-response cases randomly selected from the main survey (so-called non-response sample).

From the 3,188 selected KiD 2002 non-respondents, a total of 1,969 owners (62 %) could be contacted by telephone using the owner addresses filed in the central vehicle register. Of these, 1,135 vehicle owners (58 %) were prepared to take part in the telephone interview. There is no indication that the response losses of the non-response sample resulting from inaccessibility and refusal to respond correlate with characteristics of vehicle use. From this follows that the respondents of the non-response sample can be regarded to be representative of all non-respondents of the main survey.

A comparison of the characteristics of vehicle use between respondents and non-respondents in the main survey showed that the refusal to respond – in terms of “unit non-response” – evidently also had to do with vehicle use and not only with structural characteristics of the owner and the vehicle, for which a subsequent structural adjustment as part of the extrapolation is adequate.

This primary non-response effect of KiD 2002 concerns the characteristic of traffic participation (“Vehicle used on reference day yes/no”): The non-response analysis revealed that vehicle owners whose vehicle was not used on the reference day showed a higher willingness to participate in KiD 2002 than owners of a vehicle used on that day. The KiD 2002 distortion which results from the unit non-response and favours the immobile vehicles can be corrected in the extrapolation by introducing a weighting factor.

Item non-response analyses had a pragmatic orientation and meant that follow-up measures were taken if structural characteristics of vehicle and owner were missing or remained vague.
For evaluation, an extrapolation factor, a weighting factor unit non-response, and the number of extrapolation days are added to the vehicle data record.

### 2.5.3 KiD 2002 Basic Evaluation

Also part of the research was a basic evaluation. This evaluation remained limited to the characteristics that permit an explanatory description to be given for business traffic and thus serve as a basis for more detailed in-depth analysis.

The characteristics used are the following average figures that relate to one day:

- Number of vehicles forming part of the parent population
- Number of mobile vehicles
- Number of people transported
- Number of tonnes transported
- Number of trips
- Number of chains of trips
- Trip frequency per vehicle
- Trip chain frequency per vehicle
- Road performance per vehicle
- Passenger transport performance per vehicle
- Goods transport performance per vehicle
- Duration of traffic involvement per vehicle

In the basic tables these characteristics fall into sub-groups characterised by the following features:

- Type of vehicle
- Type of owner
- Type of district of owner address
- Type of weekday, and
- Sector of industry according to details furnished in the questionnaire, where possible with a suitable summary

In particular, classification according to sectors of industry or groups of industry, which is based on the 17 chapters of the “Klassifikation der Wirtschaftszweige, Ausgabe 1993 (WZ 93) allows business traffic to be described with a high degree of differentiation. Like publications with road haulage statistics, the results in the basic tables are characterised by a quality standard, which is defined by the quality criteria “number of vehicles in the net sample”, and “simple relative standard error”. Also shown are such results as percentage of business traffic, distances travelled, purpose of trips, type of load carried, and the like.
The results obtained from the basic evaluation confirm the significant role of business traffic as one element of road traffic. Of all motor vehicles officially registered in Germany, and this also includes motor cycles and passenger cars of private owners, 64.6 % (Mon.-Fri.) and 56.7 % (Mon.-Sun.) are mobile per day. Every fourth (24.1 %) (Mon.-Fri.) and every fifth (20.7 %) (Mon.-Sun.) of these mobile vehicles is used at least once per day for official/business purposes. From the vehicle groups considered in the KiD 2002 main survey, 70.7 % (Mon.-Fri.) and 64.7 % (Mon.-Sun.) of the mobile motor cycles and passenger cars of commercial owners, and 89.7 % (Mon.-Fri.) and 88.0 % (Mon.-Sun.) of the mobile lorries of a payload of up to, and including, 3.5 t are used at least once per day for official/business purposes.

The number of trips made by all motor vehicles registered in Germany totals 37,957.6 million per year, 6,330.8 million of which are made by the vehicle groups of the main survey alone, i.e. by the small vehicles of business traffic. All these trips taken together add up to 715.912 billion vehicle kilometres per year – 557.847 billion vehicle kilometres (77.9 %) on workdays Monday to Friday, and 158.065 billion vehicle kilometres (22.1 %) on Saturdays, Sundays, and public holidays.

When considering the total vehicle traffic produced by all motor vehicles registered in Germany, business traffic accounts for a percentage of

- 26.5 % (Mon.-Fri.) and 23.1 % (Mon.-Sun.), based on number of trips, and
- 33.7 % (Mon.-Fri.) and 28.4 % (Mon.-Sun.), based on annual road performance.

When considering the types of vehicles included in the main survey – as the major element of the KiD 2002 survey – business traffic contributes to the annual road performance of the different types of vehicles with the following percentage figures:

- 69.6 % (Mon.-Fri.) and 63.8 % (Mon.-Sun.) for passenger cars and motor cycles of commercial owners, and
- 87.9 % (Mon.-Fri.) and 85.8 % (Mon.-Sun.) for lorries up to, and including, 3.5 t payload.

But also the passenger cars and motor cycles of private owners (as an absolute figure and as a sum total of all vehicles of this group) account for a substantial portion of the road performance that can be classified as business traffic. At about 63.8 billion vehicle kilometres, this performance is almost identical with that of passenger cars and motor cycles of commercial owners (about 64.6 billion vehicle kilometres).

The normal distinction for business traffic is the one made into goods traffic and business passenger traffic. For purposes of the KiD 2002 survey, the trips reported by the respondents were classified according to their purpose. However, there was also another type of trip, which did have an official/business purpose, but its (primary) cause was not to transport goods or passengers, or to render a professional service. These other official/business trips were normally made to maintain the operability of vehicles, and were classified as “other business traffic”. All remaining traffic was referred to as “private traffic”.
When differentiating the annual road performance (Mon.-Sun.) with respect to the different traffic sectors it is found that for all motor vehicles registered in Germany, goods traffic accounts for 10.0 %, business passenger traffic for 14.2 %, other business traffic for 4.2 %, and private traffic for 71.6 % of the total annual road performance. The classification of the annual road performance of the different vehicle groups according to types of traffic is shown in Fig. 2-7.

Apart from illustrating “global“ characteristics of motor vehicle traffic, and, in particular, of business traffic, the data recorded can also be used to determine additional characteristics of how motor vehicles registered in Germany are used. Vehicle-related and trip-related characteristics that were considered to be essential for such considerations are listed in Fig. 2-8 for weekdays Monday to Friday.
### Vehicle-related characteristics – traffic volume

<table>
<thead>
<tr>
<th></th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage mobile vehicles [%]</td>
<td>65.5</td>
<td>69.7</td>
<td>69.8</td>
<td>74.7</td>
<td>17.8</td>
</tr>
<tr>
<td>Veh. trips per mobile veh. [trip/veh*d]</td>
<td>3.4</td>
<td>4.3</td>
<td>5.6</td>
<td>5.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Veh. trips per mobile veh., BT [trip/veh*d]</td>
<td>0.4</td>
<td>2.8</td>
<td>5.0</td>
<td>5.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Percentage load trips, BT [%]</td>
<td>22.5</td>
<td>21.9</td>
<td>72.7</td>
<td>78.4</td>
<td>36.0</td>
</tr>
<tr>
<td>Traffic involvement per mobile veh [min/veh*d]</td>
<td>74.7</td>
<td>118.9</td>
<td>115.8</td>
<td>374.1</td>
<td>104.5</td>
</tr>
</tbody>
</table>

### Vehicle-rated characteristics – road performance

<table>
<thead>
<tr>
<th></th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veh. road performance per mobile veh [veh km/veh*d]</td>
<td>57.2</td>
<td>108.0</td>
<td>87.5</td>
<td>321.4</td>
<td>59.9</td>
</tr>
<tr>
<td>Veh. road performance per mobile veh, BT [veh km/veh*d]</td>
<td>8.5</td>
<td>75.2</td>
<td>77.0</td>
<td>320.0</td>
<td>43.5</td>
</tr>
<tr>
<td>Goods transport performance per mobile veh, BT [tkm/veh*d]</td>
<td>4.3</td>
<td>3.4</td>
<td>43.9</td>
<td>3,108.3</td>
<td>196.5</td>
</tr>
</tbody>
</table>

### Trip-related characteristics

<table>
<thead>
<tr>
<th></th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
<th>Mon-Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean distance per trip, BT [km]</td>
<td>18.4</td>
<td>25.9</td>
<td>14.7</td>
<td>55.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Mean distance per trip, PT [km]</td>
<td>16.1</td>
<td>22.3</td>
<td>19.1</td>
<td>/</td>
<td>21.0</td>
</tr>
<tr>
<td>Mean duration per trip, BT [min]</td>
<td>31.0</td>
<td>33.1</td>
<td>28.1</td>
<td>83.8</td>
<td>26.4</td>
</tr>
<tr>
<td>Mean duration per trip, PT [min]</td>
<td>21.4</td>
<td>26.0</td>
<td>25.8</td>
<td>/</td>
<td>27.9</td>
</tr>
<tr>
<td>Mean volume goods transported per load trip [kg]</td>
<td>97.3</td>
<td>114.1</td>
<td>483.8</td>
<td>8,978.4</td>
<td>3,486.9</td>
</tr>
</tbody>
</table>

**Fig. 2-8:** Selected characteristics for weekdays Monday to Friday

### 2.5.4 DATA PRESENTATION

The data collected and prepared under the KiD 2002 project (including the net cases obtained with the regional surveys) were submitted to the Ministry of Transport, Building, and Housing (BMVBW) in the form of three files

- Vehicle file
- (Individual) trip file, and
- Chain-of-trips file

The data records contained in the three files can be linked by means of an identification marker (vehicle ID), which was assigned to each completed questionnaire when entering the data into the system (cf. **Fig. 2-9**). For easy processing on any optional software tools, the three files are presented in the form of text files (ANSI character set).
2.6 Recommendations

The final report (Wermuth et al, 2003) drawn up on the basis of the experience gained with the project surveys makes a number of recommendations for the design and implementation of future motor traffic surveys, special attention being directed at the aspects

- Surveying method and procedure,
- Survey design,
- Selection method,
- Data collection,
- Survey documents and programme,
- Non-response analysis, weighting and extrapolation,
- Address geocoding,
- Accompanying measures,
- Updating and periodic review, and
- Integration of survey updates into traffic statistics

One of the central recommendations is that the general design of this survey as well as the concrete structure of its different elements should be adopted for vehicle traffic surveys and, in particular, for surveys conducted with a view to business traffic using motor vehicles. A key role is for these
surveys assigned to the central vehicle register of the Federal Office for Motor Traffic as a source for the selection of representative samples.

In addition to the more general recommendations made for the organisation of surveys and the specific recommendations on the aspects to be covered by the survey programme, the attention is drawn to non-response analyses which are regarded to be indispensable, as they allow possible distortions to be avoided, i.e. deviations between the (evaluation) results and the real distribution of characteristics in the parent population. Any distortions noted may then be corrected by weighting factors used for the individual data records and/or by structural adjustments in the extrapolation (stratification after sampling).

Address data are recommended to be geocoded, due regard being given to data protection regulations. In this way, Geographic Information Systems (GIS) can be used for evaluation. Data users can then define the correlation between the data collected and geographical data in whatever way they choose. Geocoding can, in addition, be used to subject address data to extensive plausibility checks, both with respect to individual data and within the context of the programme reported for one specific day.

Also stressed as part of the conclusions drawn is the need of data updates. It is recommended that KiD surveys be conducted on a continuous basis using small-sized samples to be sure that federal traffic planning can rely on a current and sound data base. Should periodic updates be preferred, it is recommended that these be made at five-year intervals.

2.7 Outlook

The KiD 2002 transport survey conducted on a federal level greatly improves the information base available for German traffic statistics. This applies, in particular, to business traffic using small vehicles. The large number of characteristics collected with the questionnaires, as well as the data attached to the data records from the central vehicle register of the Federal Office for Motor Traffic, can be used for the computation of a wide range of specific features. When combined, the vehicle details available from the central vehicle register and the details of vehicle usage obtained from the surveys can be analysed in many different ways to reflect the use of motor vehicles in general and for purposes of business traffic in particular.

The insights gained and the data material collected with the KiD 2002 survey will for the first time make it possible for vehicle-based business traffic to be accounted for in future traffic concepts and planning programmes in a way that adequately reflects its significance for society and industry, both in terms of volume and structure. Transport policy as well as transport planners and economists will thus have an instrument at their disposal that allows them to better adapt their objectives and activities to requirements.
The data collection methods employed under the KiD 2002 survey have proved to be a successful and efficient instrument for both nationwide and regional surveys conducted to collect data on motor vehicle traffic, and, more specifically on its role as part of business traffic. Unlike household surveys and business surveys, the KiD method is, in the opinion of the authors, the only method available to date that allows motor vehicle based business traffic to be covered in all its aspects, which means including business traffic with vehicles of private owners. On principle, it is possible to translate the method to other vehicle-based surveys using other geographic and/or temporal criteria or relating to other aspects (types of vehicles, sectors of industry, survey programme, etc.).

Once the data are available for scientific purposes, they may trigger a process in the business traffic sector which compares to traffic research developments experienced after the KONTIV samples for passenger transport had been established. In particular the sector of transport modelling will benefit from the data base now available with in-depth traffic research activities. One central aspect of such activities will be the development of existing or new business traffic models.
3 BUSINESS SURVEYS AND VEHICLE TRAVEL DIARY SURVEYS - EXPERIENCES FROM HAMBURG AND DRESDEN

Goods traffic and the traffic for commercial services are an increasing part of today’s traffic volume. The reason for this development is the structural change from an industrial era to a services industry (/Gornig, 1991/). The effects of this change in structure are an expansion in traffic volume and in vehicle miles of travel (VMT), an ever growing demand in road traffic and new segments of business passenger traffic (/Reinkemeyer, 1994/). Up to now, research in Germany has not taken into account this grown significance of business passenger traffic. Especially the empirical foundation and the travel survey methods were neglected for a long time.

Business surveys are a well-known methodology in the field of economical research and policy analysis (/Ertel et al., 1990/). Just few publications in transportation research are about commercial or business passenger traffic or travel survey methods (for example /Brög and Winter, 1990/; /Schütte, 1997/). The technical literature in Germany just names the possibility of business surveys, they do not give any practical hints for the procedure. The official recommendations for surveys include some general hints about goods traffic and suggest traffic counts at census points, questioning in the vehicle and in businesses (/FGSV, 1991/). Advices for travel behaviour surveys (mainly about private passenger traffic) only concern the different kinds of surveys (personal or telephone interviews, mail-out). The main problem are missing standard designs for collecting and processing data. The results of different examinations cannot be compared with each other because of this lacking formal comparability and they remain restricted to their origin situation.

In 2000, a first survey about the handling of business traffic in German cities took place. Only 36 percent of the cities conduct business traffic surveys, or have such surveys conducted (/Steinmeyer, 2002/, p. 2). Therefore, the conclusion had to be drawn that – besides a lack of explanation with the methodology to collect data – the demand for this kind of surveys was very low. The missing awareness for the problem of business passenger traffic has to change in connection with a necessary evaluation of measures, which needs complex travel demand models. The increasing significance of business passenger traffic, in combination with an ever growing number of commercial vehicles and employees in the services industry, the complex structure in utilization of commercial and private vehicles per type and size, requires more than traffic counts. Business surveys and vehicle travel diary surveys are one possibility.

The following chapter shows the experiences in methodology and the survey findings of two regional surveys in Hamburg and Dresden. Each of them contained a business survey and a vehicle travel diary survey. The comparison of our own methodological experiences with international experiences allows recommendations for business surveys (especially) in Germany to be made.
3.1 Survey Methodology

The general aim of the two surveys was to estimate the meaning of personal business traffic. The idea was to show that, from the number of employees per enterprise and the number of regular mobile employees, the number of used vehicles (commercial and private vehicles) per business can be estimated. For this purpose, the characteristics of the businesses, for example the number of commercial vehicles according to type and size and furthermore the characteristics of the employees and their travel characteristics (type and number of trips, destinations, purposes) had to be collected.

At first the relevant sectors of industry and their parameters were identified by the following criteria (based on the official statistics in Germany):
- the number of licensed commercial cars, small freight cars or vans and trucks up to a total weight of 3.5 tons per sector
- the number of employees according to occupational groups per sector and
- the number of businesses per sector.

The sectors of industry selected for the surveys were
- the building industry
- credit institutions and insurance trade
- commercial services, predominantly for enterprises, e.g. engineering offices
- other services, e.g. lawyers and notaries

These four sectors hold nearly 60 percent of all commercial cars and trucks up to a total weight of 3.5 tons (/Kraftfahrt-Bundesamt, 2000/) and they account for 50 percent of the vehicles miles of travel in Germany (/BaSt, 1993/).

Both commercial vehicle surveys were designed as two-stage surveys: The first stage – the business survey – covered a questionnaire for general topics to survey the characteristics of the business, their vehicles and employees. The data were used to classify the businesses and to determine the system characteristics. The second stage was a vehicle travel diary survey. Vehicle trip records were used to survey the travel characteristics of the employees in commercial vehicles. What number and what kind of trips do they make? What are the purposes and destinations? etc. The difference was in the procedure of the business survey:
- mail-out and face-to-face interviews in Hamburg and
- only face-to-face interviews in Dresden.

In both surveys the businesses were informed by a written advance notice and contacted by telephone to identify a contact person within the business. Then the business survey and afterwards the vehicle travel diary survey were conducted in spring 2001.
The possible responses in the questionnaires were oriented to the official statistics and to the limited experiences from surveys which took place in previous years. Most of the questions had lists of possible responses including an “other” category for most questions which, in the opinion of the respondent, were not covered by the listed responses. They had to recover the description of the “other” category. The questionnaire design was tested in pilot test procedures in the form of telephone interviews and was optimized afterwards.

The potential businesses were selected from an address file which was a combination of different data sets. The data provided in the business file included the

- name of the business/establishment
- full street address
- telephone number
- in a few cases the name of the business manager and
- type of business.

The business files do not include the number of commercial vehicles, the number of employees or other helpful data.

To provide a good quality, the following quality control efforts were part of the surveys:

- a surveyor/recruiter manual
- a surveyor training
- supervision by the project management
- an editor/coder manual and
- using a computer program specifically written to check data coding and editing.

**Business survey response in Hamburg**

- 1,497 businesses were anticipated to be contacted for mail-out
- 541 recruited businesses (four questionnaires could not be used)
- 537 recorded questionnaires
- mail-out response: 36 percent
- 554 businesses were anticipated to be contacted for face-to-face interviews
- 220 recruited businesses and recorded questionnaires
- interviewer response: 40 percent

**Business survey response in Dresden**

- 2,038 businesses were anticipated to be contacted
- 861 recruited businesses (four questionnaires could not be used)
- 856 recorded questionnaires
- interviewer response: 42 percent

The response in the vehicle travel diary survey is within a range of 30 percent.
The “editor/coder manual” helped the surveyors to edit the recorded data. A self-written computer program controlled the main values. The different data had been checked in the following ways:

- intra-record checks on business data (business survey)
- inter-record checks comparing business and vehicle roster data for consistency (business survey)
- intra-record checks on vehicle data (travel diary survey)
- inter-record checks comparing vehicle trip data with business and vehicle roster data for consistency (travel diary survey)

Different approaches, information and data were verified for the validation and calibration of the survey. Most of the required data were not available or did not exist in the needed way. The results from this process and the recommended factors will be described in chapter 3.3.

The following detailed results are part of a doctoral thesis at the Technical University of Hamburg-Harburg (/Steinmeyer, 2003/). The dissertation combines the described two business surveys including a vehicle travel diary survey about personal business traffic. Alongside with recommendations for survey methodology, the dissertation provides statistically reliable behavioural indicators for the generation of personal business travel in the four selected economic sectors.

### 3.2 Survey findings

The mentioned surveys provide characteristics of businesses and indicators for travel behaviour in personal business traffic. Some of the findings will be described.

**Characteristics of the business**

Both business surveys found that most recruited businesses (nearly 80 percent) are of the smallest scale (1 to 5 employees per business) followed by small businesses (17 percent, 10 to 49 employees), medium-sized (3 percent, 49 to 249 employees) and large-scale businesses (1 percent, more than 250 employees). Official statistics let us expect a bigger part of large-scale businesses. But often they are not able or willing to answer. This has to be taken into consideration for prospective surveys; a personal kind of (first) contact and different, variable questionnaires for the different subjects and topics (employee-oriented, vehicle-orientied etc.) can be a possibility.

Each enterprise has a specific number of employees who have to cover distances for occupational reasons. The survey shows that 76 percent of the businesses in Dresden have a maximum of 5 employees who regularly make business trips. In Hamburg the corresponding percentage amounts to 67%. 4 percent of the recruited businesses in Dresden do not generate business passenger traffic. The inquiry in Hamburg generated for the same a value of 8 percent.
The analysis of the data establishes significant values for the average number of commercial vehicles and, in addition, significant values between the average number of regularly mobile employees to the number of employees per business and sector. With these relationships it is possible to calculate the average number of employees, mobile employees, and vehicles per business and sector direct from the official statistics.

The value “mobile employees” allows calculations to be made for the number of persons, who are – in the region – mobile for a commercial purpose. The following example shows the idea: the businesses in Dresden employ 16,466 persons in the sector of building and construction, 60 percent are regularly mobile for commercial purposes. With 16 percent immobile persons per travel day, there are 8,299 mobile employees a weekday. Allowing for the 95% confidence interval, there is a range of a minimum 7,602 up to a maximum 10,751 mobile employees a weekday – just for the sector “building and constructing”. This calculation is not absolutely exact, but it shows in a direct way the magnitude and significance of business passenger traffic.

**Characteristics of the employees / commercial vehicles**

Due to vehicle trip records it was possible to generate some detailed information about the occupational journeys made by 598 employees using commercial vehicles (341 businesses).

**Fig. 3-1** shows the allocation of the recorded journeys in relation to their purposes.

![Fig. 3-1](image)

**Fig. 3-1:** Purposes of the trips (only business traffic), Dresden

Source: Steinmeyer, 2003
The figure shows differences between the sectors. Employees in building and construction make 42 percent of all trips with occupational purposes for “conferences and meetings” and 32 percent for “costumer services” (including maintenance). 65 percent of all trips in the credit and insurance trade and commercial services are for “conferences and meetings”. Other services present a non-uniform picture. The reason is a mixture of businesses within the other services: from lawyers and journalists/reporters to nursing staff. The more types of businesses in a sector, the larger the number of purposes. The figure does not contain the trips back to the business or back to the own household. And it has to be considered that no enterprises were interviewed whose business segments solely comprise the logistics and goods transport sector.

Regarding the destinations of the trips the differences between the sectors become clearer – although most of the trips end at the address of another business. The largest proportion are businesses of the service sector. Nearly 5 percent of the trips (all sectors) take place in order to reach a different office of the own company (if they are affiliated enterprises). In building and construction, the most of the trips end at construction sites. In credit institutions and credit trade, private households represent 33 percent of all trip destinations.

For the selected sectors of industry (building industry, credit institutions and insurance trade, commercial services and other services) characteristics of the business and travel characteristics were found.
<table>
<thead>
<tr>
<th>sector</th>
<th>average [trips / day]</th>
<th>[n]</th>
<th>standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>building industry</td>
<td>4.1</td>
<td>146</td>
<td>2.67</td>
</tr>
<tr>
<td>credit institutions and insurance trade</td>
<td>5.1</td>
<td>48</td>
<td>2.49</td>
</tr>
<tr>
<td>commercial services, predominantly for enterprises</td>
<td>4.0</td>
<td>174</td>
<td>2.63</td>
</tr>
<tr>
<td>other services, e.g. lawyers and notaries</td>
<td>4.6</td>
<td>21</td>
<td>3.36</td>
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</tbody>
</table>

**Fig. 3-3:** Average number of trips per mobile employee and day by sector, Dresden  
Source: Steinmeyer, 2003

An employee in the credit institution and insurance trade makes 5.1 trips per day, while commercial services’ employees (4.0 trips/day) and building industry (4.1 trips /day) have the lowest number of trips a day. The following figure shows the average number of tours per day by sector.

<table>
<thead>
<tr>
<th>sector</th>
<th>average [tours / day]</th>
<th>[n]</th>
<th>standard deviation</th>
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<td>building industry</td>
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<tr>
<td>credit institutions and insurance trade</td>
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<td>0.73</td>
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<td>174</td>
<td>0.65</td>
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<tr>
<td>other services, e.g. lawyers and notaries</td>
<td>1.2</td>
<td>21</td>
<td>0.51</td>
</tr>
</tbody>
</table>

**Fig. 3-4:** Average number of tours per mobile employee and day by sector, Dresden  
Source: Steinmeyer, 2003

Travel characteristics of business passenger traffic are the number of trips, the kind of tour, as well as the purposes and destinations. The number of realized trips and tours per day and the purposes are significantly influenced by the sector of industry. In addition, disparaties in the number of professional trips and tours a day per occupational group could be shown.

The evaluations have shown that these average tours per day for Dresden hardly differ from the values known from the literature in other German cities. These identified values seem to be regionally transferable. The sector of industry supposed to be the characterizing factor and the area can be neglected.

The legitimate conclusion is that the volume of traffic for occupational purposes consits of a floating and a constant part: the coherences between the employees, the mobile persons and the number of commercial vehicles are variable for the respective town. The number of trips and tours per mobile employee and sector are rather static.
3.3 Methodological Conclusions

Business surveys are one possibility to record characteristics of businesses, their vehicles and employees. Business survey mean the methodical recording of questions by mail-out, telephone or personal interviews with one or several contact persons in a business. In comparison with an enterprise survey, with which all units of the enterprise, i.e. also the units in other parts of the country, are part of the sample, only the local business units are considered in a business survey.

Matched with travel diary surveys, mobility patterns and travel characteristics can be collected. In America (/DRCOG, 2001/) or Australia (/Transport Data Centre, 2002/; /Taylor et al, 1997a/b, 1998/), the methodological questions of business surveys and commercial vehicle surveys are discussed. Up to now, research in Germany has not taken into account the increased significance of business traffic. Especially the empirical foundation and the travel survey methods have been neglected for a long time. Nevertheless, the problems of data collection, validation and calibration are transferable. The following procedure has proven successful.

The first step consists of an official advance notice by mail addressed to the management of the business. Integration of the municipal authority, the chamber of industry or the board of trade will support the acceptance and later response. Additional public relations measures have to be taken in connection with the local media.

The second step includes the business survey by telephone. For this purpose, the address file has to contain the phone numbers for all businesses, if not, the data set has to be completed. The aim of the first telephone contact is to check the existence of the business and to ask for a contact person. If the business does not exist any more, the address file can be cleared (due to the quality of the available address lists this has a direct influence on the response quotas). After the 5th unsuccessful call, the telephone contact can be finished, the business is “not available”. At this state, the general participation readiness for the obtainable businesses has to be asked and a contact person (staff manager, fleet manager or someone else) has to be identified. He/she is the addressee for the vehicle travel diaries. The surveyors should furthermore insist on receiving some central statements concerning the business. The characteristics of businesses which do not take part in the survey can be used in a separate database for non-response considerations. For those participating, the complete business characteristics have to be asked. The main data (number of employees, number and type of the commercial vehicles) are needed for the sample design in the travel diary survey.

The third step is the mail-out of the travel diaries including information on how to the fill in the diaries and the explanations about how the data will be used. The number of commercial vehicles (or mobile employees) determines the later procedure (collection of the documents by a surveyor or return by a stamped and addressed envelope). In addition, a telephone hotline and continuous response and quality control has to be guaranteed.

Fig. 3-5 shows the procedure.
### Written advance notice

- Official letter with assistance of the government, the board of trade or other relevant/helpful organisations

### Business Survey (CATI)

- possibility to check the quality of the address file and the existence of the business
- identification of a main contact person within the business and
- recruitment of businesses

<table>
<thead>
<tr>
<th>the business cannot be recruited:</th>
<th>the business is recruited:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• survey the main characteristics of the business</td>
<td>• identification of a contact person (staff manager, fleet manager etc.)</td>
</tr>
<tr>
<td>• include the data into a data bank for a former non-response-analysis</td>
<td>• survey the number and type of vehicles per business, the characteristics of their employees (mobile, non-mobile) and</td>
</tr>
<tr>
<td>• include the data into the data bank for second stage of the survey (vehicle travel diary survey)</td>
<td></td>
</tr>
</tbody>
</table>

### Vehicle (or employee) travel diary survey

- sending the complete set of travel diary records acc. to the number of vehicles per business (or mobile employees)
- including explanations about the procedure, hints for completion
- use travel diary records for the travel day
- enclose a directed and stamped envelope for sending back the documents

### Response control

- checking the response on the basis of the business factor (five employee size groups)

### Reminder

- send a postal reminder or call to remind the business to fill in the questionnaires
- there is no need for more than one reminder

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**Fig. 3-5:** Procedure for a two-stage business and vehicle travel diary survey

Source: Steinmeyer, 2003, p. 145

The advantages of this procedure are:

- the telephone calls help to identify wrong addresses and not existing businesses in the address file. With this step the sample can be cleared (less deficient delivery) and the bias in the response can be estimated.

- big businesses are often not able or willing to answer. The personal contact improves the readiness to participate and identifies the contact person. This ensures that the survey records find a competent addressee and are not mistaken as normal mail in the business, i.e. without an addressee this could lead to a non-response.
• in case of a refusal to participate, identification details of the business can be asked briefly. This offers the possibility to estimate the distortions (bias) which arise from a non-response.
• with the graded procedure of telephone contact and consignment of the documents in several waves the interview staff can be used for the support of the questions at the same time.
• the telephonic business survey with mail out of the travel diaries involves less staff than interviews directly in the businesses.
• the survey documents can be arranged and sent out such that they reflect the special characteristics of the business (large or small business, number of employees or vehicles).
• in comparison to an exclusive interviewer survey directly in the businesses this approach involves moderate costs.

The disadvantages of this standarized, postal procedure are the following points:
• differences in understanding between surveyor and respondent cannot be discussed; questionnaires answered differently can lead to falsification of the results.
• the results of a survey are as good as the preparation and especially the concept of the survey documents are; issues or questions which were processed insufficiently or even forgotten cannot be derived from the later answers of the standardized questionnaires,
• the recorded information has to be coded and edited. This takes time, and mistakes are possible (wrong codes, and the like) while editing data.

This procedure has proven to be the most pragmatic and most manageable solution.

The sample design (address file, sample planning) plays an all-important role. The problem consists in the fact that no address register including all places of work, businesses and enterprises is known (/Bonny, 1992/, p. 162). The three sources for addresses in Germany are:
• lists of the rating authority,
• merchant address CD ROMs or address books and
• membership lists of the board of trade and the chamber of industry.
Each of these three lists has different advantages and disadvantages. The summary is that most data sets include the category ”business” or “business location”; however, none of the address sources is ideal. Irrespective of the address source chosen, it is always necessary to check the address material with address books, industry-specific phone books and if necessary site surveys. When combining these different data sets, it is necessary to check the data set for doubles. This can be simplified by means of electronic data processing systems. However, in most cases the decision – are two items the same businesses? – can be carried out only on the basis of human decisions. For this, the required regulations have to be defined. Completing the address files (telephone numbers) can take much time.

The integrated and checked address file represents the basis for the sample. To date, no information is available on the parameters of the parent population and their significance for business traffic. The address records do not contain any details which can be used for the sample. For this reason,
the specified two-stage procedure can be recommended. The first step (business survey) has to be focused on businesses, and it records the number of employees and vehicles for type and size. This ensures that the vehicle travel diary survey is comparable with the official statistics and the parameters found out in the first step.

A general problem are falsifications that result from systematic faults. Every participation denial of an interview group distorts the results. The appraisal of the bias and the extension of the sample helps to get a sufficiently large sample, but it still does not make it representative. Normally a meaningfully stratified sample supplies better results, i.e. results which as exactly as possible represent the parent population, than a simple random selection. Furthermore stratification of the sample allows the required sample sizes to be decreased. Statements for concerning subgroups of a parent population should be based on a sample which must be appointed to the subset that is at the centre of interest. For various reasons, stratification of the sample should be related to the economic sectors and oriented at the number and type of vehicles per business.

The following times can be provided for the contacts, consignments and reminder:
- beginning of the surveys with consignment of the advance notice (addressee: general manager)
- telephone call 5 working days according to the first sending,
- consignment of the survey documents one day after the telephone call; between consignment and deadline take 5 working days into account provided that the central contact person is identified in the business
- continuous response control and
- after 3 weeks sending the reminder.

The response in business surveys turns out to be lower than in household interviews in connection with private passenger transport. This has to be taken into account by sample planning. For businesses, the survey can be completed after one reminder for reasons of effectiveness (/Wermuth et al, 2001/; /Prognos, 2001/, p. 47).

Data coding and editing as well as control of the edited data represents an important aspect after the real survey. Standarized postal surveys have the disadvantage that the recorded information has to be edited in a database. This can be supported by computer programs that are already provided in the editors data mask (for example: arrival time of a trip has to be after the start time). Nevertheless there will be faulty inputs. Spot checking of the edited values in relation to the recorded information on paper is necessary. Incompletely recorded or faulty diaries for which no additions or corrections can be completed, have to be selected and declared to be unfit for use.

Sufficient time is needed for data checking (for completeness and plausibility) as well as for comparison between pre-classification of the business in the address data file and the industry-specific assignment through the businesses. Control questions can be used to check the quality of the recorded information and to derive missing details and to carry out corrections. The data have to be checked as a minimum in the following four ways
• intra-record checks on business data (business survey)
• inter-record checks comparing business and vehicle roster data for consistency (business survey)
• intra-record checks on vehicle data (travel diary survey)
• inter-record checks comparing vehicle trip data with business and vehicle roster data for consistency (travel diary survey)

Computer programs are able to optimize this step, but they have to be self written. After data checking and cleaning the information has to be calibrated and expanded.

Calibration has to be oriented to the different stages of the survey. Calibration data for the business survey can be
• a business expansion factor and
• a vehicles adjustment factor.

The data from the vehicle travel diary survey have to be expanded with a third factor
• to weight the vehicles that completed the travel diary survey in proportion to the number of vehicles reported in the business survey respectively for the universe of all commercial vehicles.

The business expansion factor is needed to weight the number of businesses completing the business survey in proportion to the survey universe of businesses. The number of employees per business is a quantity that can be used to weight the data (use five employee size groups: 1-9, 10-24, 25-49, 50-249 and 250+ employees per business). The problem – in Germany – can be that the required data for this first step are not available. The vehicle adjustment factor has to be applied in combination with the first factor. To represent the number of vehicles at the survey universe of businesses, the inventory vehicles have to be expanded. In Germany these data are available from the central vehicle register of the Federal Office for Motor Traffic.

Using a stratified random survey to generate a sample for the second stage of the survey, the recorded data have to be expanded. The distribution of completed vehicle travel diaries is not identical with the universe of the survey. So the third factor has to calibrate the surveyed vehicle travel characteristics to the universe of commercial vehicles. Data which were surveyed, calibrated and expanded in such a manner are able to answer the questions about business traffic.

**Conclusion**

The two described surveys and international experiences show that business surveys and vehicle (or employee) diary surveys are able to produce valid data on business traffic and its characteristics. This could be shown in a comparison of these results (for example the values of purposes) with data from interviews at counting points, for which non-reporting analysis can be done very exactly (/Rümenapp, 2003/). Some methodological questions (sample design, calibration etc.) need detailed research – but in general it is a proven method to answer priority questions about business traffic in our regions.
4 Résumé

According to current knowledge of traffic science only the methods described in chapter 2 and chapter 3
- Written (postal) interviews with car owners and
- Written (postal) or personal (face-to-face) interviews in companies or business units are suitable to survey business traffic (goods traffic and business passenger traffic).

Both methods have special advantages and disadvantages (quod vide Fig. 1-2). The principal advantages of written (postal) interviews with car owners are:
- using the central vehicle register of the Federal Office for Motor Traffic as a sampling source the population of all motor vehicles in Germany is fully known in terms of both volume and structure,
- a representative and very effective stratified sample can be selected (nationwide, regional and local) and
- all types of vehicles and all groups of owners can be considered.

Consequently only this method can survey the motor vehicle based business traffic in all its aspects, which means including business traffic with vehicles of private owners. The principal disadvantage is you can survey the traffic with motor vehicles only. The advantage of the written (postal) or personal (face-to-face) interviews in companies or business units is the possibility to survey business traffic with all transport modes (for example lorries, passenger cars, bicycles, pedestrians), but related to companies or business units. This method has some additional basic disadvantages:
- it is difficult to assess the population,
- the survey is limited to regions or local districts and
- business traffic with vehicles of private owners cannot be surveyed.

These disadvantages have their roots in the possible sampling sources of addresses:
- the membership lists of the Board of Trade and the Chamber of Industry,
- merchant address CD-ROMs or address books and
- the lists of the rating authority.

The described surveys were independent to each other, because of different research programs and different editors. Furthermore the regional commercial vehicle surveys in Hamburg and Dresden has been done in spring 2001, while the nationwide survey “Motor Vehicle Traffic in Germany 2002” took place in 2002.

The experiences of the three surveys can be generalized (quod vide chapter 1.3 and 3.3) because of preliminary investigations, a comparison between technical literature – even with international experiences – and own background (/Steinmeyer, 2003/).
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Sommer, 2002/

Steinmeyer, 2002/


