1 Introduction

Information on traffic volume and its development is an important basis for many aspects of highway planning, transport planning, traffic safety and environment. The data demand depends on the task that has to be solved. So we need

- road section-related data
- vehicle-related data
- person-related data

To get such data, different methods have to be applied. The Federal Highway Research Institute (BASt) as a research institute in the responsibilities of the Federal Ministry for Transport, Building and Housing publishes different data of the volume of road traffic in Germany:

a) Yearly information on traffic volume (average daily traffic) and vehicle mileage on federal trunk roads in Germany (motorways and highways outside built-up areas). To get this information we have established a system of different traffic counts:

- automatic counting stations: about 600 on motorways and about 700 on highways.
- the manual road traffic count (Straßenverkehrszählung – SVZ): manual road traffic count on motorways and highways on about 10,000 counting stations every 5 years (last 2005)
- traffic count of foreign motor vehicles: manual road traffic count on motorways and European highways on about 400 counting stations every 5 years (last 2003)

b) In irregular intervals the BASt realizes the so-called vehicle mileage survey (last 2002). In this survey information is gathered on vehicle mileage on all German roads and of vehicles registered in Germany. Main part of the study are reports of about 125,000 vehicle owners. These data are basis for yearly estimations of vehicle kilometres (see model of DIW) etc.

The aim of the presentation is to illustrate the different data collection methods.
2. Data collection

2.1 Road traffic counts

Results of road traffic counts will be needed for many questions concerning of road constructions etc. In this context the BASt is responsible for traffic counts on federal trunk roads: motorways and federal roads. We use two different kinds of data collection methods:

- Permanent Counts
- Short-time Counts

To get extensive information on the traffic volume of federal trunk roads, the BASt has implemented a system of traffic counts:

- Automatic Counting Stations
- The Manual Road Traffic Count (manuelle Straßenverkehrszählung)
- Traffic Count of Foreign Motor Vehicles (Ausländerverkehrszählung)

2.1.1 Automatic Counting Stations

Since 1975 a net of automatic counting stations has been implemented on federal trunk roads. In 2004 the net of automatic counting stations contained about 1.300 counting stations (figure 1). This means that we have traffic volume information for a sample of the total road net.
Figure 1 shows that we have all in all a good distribution of automatic counting stations German-wide. In relation to the length of the roads, a counting station is implemented on motorways every 20km on average and about every 50km on federal roads.

Motor vehicles will be counted by using induction loops. This allows a classification of detection up to 9 types of motor vehicles: 8 motor vehicle types and 1 category of non-classifiable motor vehicles (table 1).

Table 1: Classification of vehicle detection

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>5+1</th>
<th>8+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>motor vehicle</td>
<td>similar to passenger car</td>
<td>non-classifiable motor vehicles</td>
<td>non-classifiable motor vehicles</td>
</tr>
<tr>
<td>passenger car</td>
<td>passenger car</td>
<td>motorbike</td>
<td>passenger car</td>
</tr>
<tr>
<td>passenger car with trailer</td>
<td>passenger car with trailer</td>
<td>small truck / van</td>
<td>small truck / van</td>
</tr>
<tr>
<td>similar to truck</td>
<td>truck &gt; 3.5 t without trailer</td>
<td>towed truck / tractor-trailer</td>
<td>tractor-trailer</td>
</tr>
<tr>
<td>bus</td>
<td>bus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data collection is permanent so that we have hourly information on the road traffic volume for every motor vehicle type and every lane. In the end we have extensive information on every counting station (see table 2).

Table 2: Results of automatic counting stations (example North Rhine-Westphalia)

![Table 2](image)

Furthermore the BASt estimates on the basis of these data the average daily traffic and motor vehicle mileages on motorways national/federal roads (figure 2).
2.1.2 The Manual Road Traffic Count (manuelle Straßenverkehrszählung (SVZ))

Due to the fact that automatic counting stations can only be a sample of the total federal trunk road net, a manual traffic count is realized every five years. The Manual Road Traffic Count started in 1952/53, the last manual traffic count has been realized this year.

Therefore people count traffic volume on all sections of the federal trunk roads and on nearly all sections of the remaining classified roads. So we have about 10,000 manual counting stations on federal trunk roads and more than 40,000 counting stations in total.

With regard to this extensive number of counting stations the Manual Road Traffic Count can only be realised on a few days and a few hours of the year (table 2).

Following the automatic counting stations the SVZ distinguishes between 6 motor vehicle types:

- passenger car
- motorcycle
- small truck < 3.5t / van
- truck > 3.5t without trailer
- towed truck / tractor-trailer
- bus

To get information for a whole year the automatic counting stations were used for estimating. An automatic counting station with a similar traffic characteristic therefore belongs to every manual counting station.

In the end we have detailed information on every section of federal trunk roads (figure 3):
the average daily traffic for different days
average hourly traffic volume for day and night
the relevant traffic volume for designing roads

Table 3: Results of the manual traffic road count (example)

<table>
<thead>
<tr>
<th>Freie Strecken der Bundesfernstraßen</th>
<th>Niedersachsen</th>
<th>Gültigkeitsbereich (bzw. Lage) der Zählstelle</th>
<th>ZAL [km]</th>
<th>FS Bauamt</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK - Zt</td>
<td>Strasse (E-Strasse)</td>
<td>Zählstelle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AS Norhausen - AS Südhausen</td>
<td>99,9</td>
<td>2</td>
<td>99</td>
</tr>
<tr>
<td>2509 3346</td>
<td>K 1234</td>
<td>AS Norhausen - AS Südhausen</td>
<td>99,9</td>
<td>2</td>
<td>99</td>
</tr>
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<td>K 1234</td>
<td>AK Oberwiesental-Süd - AS Oberwiesental-Nord</td>
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<td>2</td>
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Furthermore the Manual Road Traffic Count leads to road-netwide information on traffic volume (figure 3)

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</table>

Furthermore the Manual Road Traffic Count leads to road-netwide information on traffic volume (figure 3)
Figure 3: Average daily traffic (ADT) on motorways in Germany 2000
2.1.3 Manual Road Traffic Count of Foreign Motor Vehicles

Due to the lack of information on cross-boarder traffic in 1998 a road traffic count of foreign motor vehicles was realised.

Therefore a manual road traffic count of foreign motor vehicles on motorways and European highways was realized. A differentiation was made according to nationality and 5 categories of vehicles:

- passenger car
- small truck / van
- truck > 3.5t without trailer
- towed trucks / tractor trailer
- buses

Counting took place at 411 census points in all. There is a differentiation of two types of census points:

- 37 long-term census points (data collection on 15 days a year)
- 374 short-term census points (data collection on 8 days a year)

Furthermore data of automatic counting stations were used for estimation of the average daily traffic (ADT).

The ADT on motorways in 2003 was about 4,000 vehicles (see table 4).

Table 4: Motor vehicle traffic from foreign countries (all nations)

<table>
<thead>
<tr>
<th></th>
<th>mileage [mill.veh-km]</th>
<th>ADT [veh./24h]</th>
<th>percentage on all veh.</th>
<th>percentage on all veh.</th>
</tr>
</thead>
<tbody>
<tr>
<td>passenger car</td>
<td>8560</td>
<td>1952</td>
<td>48,3%</td>
<td></td>
</tr>
<tr>
<td>bus</td>
<td>219</td>
<td>50</td>
<td>1,2%</td>
<td></td>
</tr>
<tr>
<td>small truck / van</td>
<td>1009</td>
<td>230</td>
<td>5,7%</td>
<td></td>
</tr>
<tr>
<td>truck &gt; 3.5t without trailer</td>
<td>943</td>
<td>215</td>
<td>5,3%</td>
<td></td>
</tr>
<tr>
<td>towed truck / tractor trailer</td>
<td>6999</td>
<td>1596</td>
<td>39,5%</td>
<td></td>
</tr>
<tr>
<td>passenger transport</td>
<td>8780</td>
<td>2002</td>
<td>49,5%</td>
<td>5,0%</td>
</tr>
<tr>
<td>freight transport</td>
<td>8951</td>
<td>2041</td>
<td>50,5%</td>
<td>22,1%</td>
</tr>
<tr>
<td>all vehicles</td>
<td>17730</td>
<td>4043</td>
<td>100,0%</td>
<td>8,3%</td>
</tr>
</tbody>
</table>
2.2 Motor Vehicle Mileage Survey

The above illustrated traffic counts give results for classified roads outside urban area only. But for many aspects (traffic safety for instance) we need information on mileages of motor vehicles on all roads. Due to the fact that the German traffic counts only allow statements with regard to classified roads outside urban areas, the BASt realizes in irregular intervals the so-called “motor-vehicle survey”. These data are also the basis for the DIW to estimate yearly motor vehicle mileages.

In total this survey was realized three times: 1990, 1993 and last in 2002. The aim is to get two basic kinds of information:

(1) mileages of motor vehicles registered in Germany
(2) mileages of motor vehicles in Germany

ad (1)

Mileages of motor vehicles registered in Germany contain mileages in and outside Germany. In order to get this information, a survey of motor vehicle owners was realized. For this purpose, owners of motor vehicles were asked over the year in six waves about the readings of their speedometers for two times (time distance 10 weeks). The survey in 2002 covered approximately 127,000 vehicle owners from the master file at the Federal Motor Transport Authority (Kraftfahrt-Bundesamt) using a method based on random sample theory. The overall response quota was approximately 70%.

The analyses show that the kilometres driven by motor vehicles amounted to approximately 703,000 million vehicle-km with a vehicle population of 53.5 million (in 2002). Cars accounted for 85% of the total kilometres in 2002, while vehicles of freight transport made up 11%.

Concerning cars, the average number of kilometres in 2002 was 13,400 km per car. Compared with 1993 this is a decrease of 5.6%. With regard to vehicles of freight transport, the average number of kilometres was about 22,900 km. Towed trucks and tractor-trailer do about 73,000km per year.

ad (2)

The aim of this part is to get information on mileages of motor vehicles in Germany. This includes all motor vehicles being used in Germany.

In order to get this information, the kilometres of motor vehicles registered in Germany must be reduced by mileages in foreign countries and must be completed by information of mileages of foreign motor vehicles on German roads.

Therefore German drivers have to be asked about the kilometres they drove outside Germany, and foreign drivers have to be asked about the kilometres they drove within Germany. In the past the drivers were asked during passport controls at the borders. With regard to the process of the
European Unification in 2002 it was only possible to use this method on the borders to Poland, Czech Republic and Switzerland. To get information for all other countries, an additional survey on service areas on motorways was realized. At about 27 service areas drivers in cross-boarder traffic were interviewed.

In 2002 the results showed that the kilometres of vehicles registered in Germany were nearly the same as the kilometres by all vehicles in Germany at approximately 703,000 million vehicle-km. However, if the data are differentiated according to passenger transport and freight transport, it can be seen that vehicle kilometres are “exported” in passenger traffic. This “export balance” amounts to approximately 4,200 million vehicle-km. In contrast, there is an “import” with regard to kilometres in freight transport. This balance amounting to 4,500 million vehicle-km.

3 Summary

As described above the BASt has implemented a net of different data collection methods to get detailed information on traffic volume in Germany.

With regard to the process of the European Unification it gets more and more difficult to get information on the traffic volume in cross-boarder traffic. Therefore methods of data collection have to be adapted and the data exchange between the European countries should be intensified.