The Measurement of Road Traffics

Olga Kastlova
Prague, 21 – 23 September 2011

Demand

- Increasing need and demand for statistical information on vehicles on the roads in a country and on kilometres driven by these vehicles
- Traffic density, number of road vehicles especially use of passenger cars is increasing in most of the countries

Demand (cont.)

- Data needed for national as well as for international purposes
- Reliable statistics is essential for policy making, strategic decisions, infrastructure management and planning, road safety, environmental assessment
International context

- No legislation for this type of statistics within European Union yet
- There are some processes for starting this type of data collection regularly
- At present only international organization collecting road traffic data is United Nations Economic Commission for Europe

International context (cont.)

- Countries send traffic data to UNECE every 5 years which corresponds in most countries to road traffic censuses on their territory
- Countries were invited to carry out the censuses in accordance with the Resolution No. 259
- WP.6 – Working Party on Transport Statistics, Task Force to discuss scope and methodology

International context (cont.)

- No harmonized methodology
- WP.6 decided to set up a Task Force with the aim to draft a methodological handbook with best practices of the countries
- **Handbook on Statistics on Road Traffic**
  - contains basic principles on the methods used for data collection on road traffic
- Later Eurostat took as a basis the results and continued to work in this direction
**Methods**
- Road traffic census (data sent to UNECE are on this basis)
- Odometer reading (from technical inspections)
- Household survey

**Road Traffic Census**
- Most common way in the countries to get information on road traffic
- Most countries carry out road censuses regularly (usually not every year)
- Censuses are costly
- Censuses could be national or focusing on some local area or in the cities (urban censuses)

**Road Traffic Census**
Nation-wide traffic censuses should be conducted regularly, following the same method, on the same set dates and with procedures as harmonised as possible, the objective being to acquire information on road traffic intensity.
Road Traffic Census (cont.)

- In the majority of States such regular censuses are being conducted in compliance with the UNECE recommendation every five years. The range, organisation and evaluation of the censuses carried out in individual years should follow the same pattern in order to ensure that the results are comparable with those from the preceding census in terms of both the methodology of the census and the evaluation of the results.

Principals

- One of the basic inputs for calculating vehicle-kilometres
- In the majority of countries regular censuses conducted in compliance with the UNECE recommendation every 5 years
- Method includes
  - Range of the Census
  - Organization
  - Calculation methods

Range of the census

- Where on the road network
- When in time period counting should take place
- Terminology:
  - Section (counting section) – stretch of road between two consecutive intersections
  - Road traffic intensity - Annual Average Daily Traffic (AADT)
  - Is the average over a year of the number of vehicles passing a point in a given counting section each day.
**Types of road**

- Very difficult to reach agreement on the terminology

For the purpose of this presentation national network is considered:

- motorways
- E-roads
- class I roads
- class II roads
- other (regional roads)

Local roads, i.e. roads in an urban area are not included in this method.

---

**Traffic count should be conducted**

- on all motorways, E-roads, main roads
- selected sections of other (regional roads)

- great care must be taken with selection of counting sections
- coverage of counts on regional roads at least 10 – 20%

---

**Time range**

- the best to carry out censuses over the longest period possible
- taking into account economic and personnel requirements

**MANUAL COUNTS**

- counting days in the spring, summer and autumn (lower traffic expected in the winter)
- typical average working day should be selected (Tuesday, Thursday)
- morning or afternoon peak hours
- include peak hours on Friday and Sunday (or holiday afternoon)
Automatic counting equipment

- Monitoring traffic over the year, 24 hours a day
- Some only count vehicles
- Some classify vehicles – according to axle configuration
- Manual count results are usually more accurate

Manual counts

- In each period (i.e. spring, summer and autumn) counts should be carried out on at least one working day and on one Friday or Sunday, i.e. a total of 3 x 2 = 6 counting days, and for at least 3 hours on each day. This gives a traffic sample of 18 hours, i.e. 0.2% of a whole year's traffic.
- In this case, however, a statistical error could be quite significant.

Time of a day

- Count should last 3 – 5 hours
- Peak hours on working days are usually between 7.00 and 11.00 between 13.00 and 17.00
- Recreational traffic peak between 14.00 and 18.00
- Minimum: 6 counting days in a year for at least 3 hours
- Optimum: 10 days for 4 hours a day, which gives a sample 0.45% of a whole year’s traffic
In order to assess the volume of night traffic, it is recommended to carry out counts on a small sample of selected counting sections (approximately 1% of the total length of all the counting sections) for 16 to 24 hours.

Because manual counts are quite costly, counting hours could be reduced, e.g. by counting for 10 days on sections with high traffic intensity (5,000 vehicles per day) and for just 6 days on others. This depends on the situation and capacity in each country.

The four-hour interval should be applied in the same months, week days and hours as in the preceding count, thereby ensuring maximum comparability of results of counting with that of the preceding period.
For instance, the schedule for the count could look like this

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Year in the week</th>
<th>4 hours</th>
<th>16 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>April</td>
<td>Wednesday</td>
<td>7.00</td>
<td>19.00</td>
</tr>
<tr>
<td>2</td>
<td>May</td>
<td>Thursday</td>
<td>7.00</td>
<td>21.00</td>
</tr>
<tr>
<td>3</td>
<td>June</td>
<td>Friday</td>
<td>3.00</td>
<td>19.00</td>
</tr>
<tr>
<td>4</td>
<td>July</td>
<td>Monday</td>
<td>7.00</td>
<td>21.00</td>
</tr>
<tr>
<td>5</td>
<td>August</td>
<td>Tuesday</td>
<td>7.00</td>
<td>19.00</td>
</tr>
<tr>
<td>6</td>
<td>September</td>
<td>Monday</td>
<td>7.00</td>
<td>21.00</td>
</tr>
<tr>
<td>7</td>
<td>October</td>
<td>Tuesday</td>
<td>7.00</td>
<td>19.00</td>
</tr>
</tbody>
</table>

Organization

**Counting points**
- as a rule equipped with two counters (motorways, international links, roads where intensity exceeds 3,500 vehicles /24 hours)
- less loaded section could be equipped with only a single counter (e.g. Sunday counts)

**Counting points**
- To determine the coefficients for converting 4-hour to 16-hour figures, it is recommended to carry out the 16-hour count between 5.00 and 21.00 hours on selected key counting sections equivalent to approximately 3% of the total number of sections.
- On selected international road sections the count should also be carried out during the night (from 21.00 to 5.00 hours) in order to meet the requirements set by the UNECE method for counts on international (E) roads if these are not covered by automatic equipment.
**Vehicle type**

In compliance with the UNECE recommendation the following categories should be counted:

- **Category A**: Motor vehicles with not more than 3 wheels
- **Category B**: Passenger and light goods vehicles (not more than 3.5 t)
- **Category C**: Goods road vehicle (more than 3.5 t)
- **Category D**: Busses, coaches, trolleybuses

In order to obtain more complete information about the traffic flow structure, the following vehicle breakdown, from which also the values as required by international agreements for international road counts may be calculated, is used in the Czech Republic:

- 1. N1 – light goods vehicles (permissible maximum weight up to 3.5 t)
- 2. N2 – medium-sized goods vehicle (permissible maximum weight 3.5 - 10 t)
- 3. PN2 – trailers of medium-sized goods vehicles
- 4. N3 – heavy goods vehicles (permissible maximum weight of more than 10 t) including road tractors of semi-trailers
- 5. PN3 – trailers of heavy goods vehicles
- 6. NS – semi-trailers
- 7. A – buses
- 8. PA – trailers of buses
- 9. TR – agriculture tractors
- 10. PTR – trailers of agriculture tractors
- 11. O – passenger cars and vans, microbuses, motor cycles with a side-car
- 12. M – motor cycles
- 13. C – cyclists

The first column indicates the corresponding UNECE categories.

**Calculation method**

- calculation of vehicle-kilometres for roads where counts are conducted on total length is simply the sum of all vehicle – kilometres calculated for each counting section
- calculation of vehicle-kilometres on roads where counts are conducted only on part of them requires different approach
Calculation method (cont.)

Total Vehicle Kilometres = \( 365 \times \sum_{k=1}^{n} AADT_i \times L_k \)

Calculation method (cont.)

This calculation can be described as follows:

1. \( D = D_0 + \frac{D_1}{1 - E} \)
2. \( D_1 = \frac{D_0}{z} \)
3. \( E = \frac{1}{1 + \frac{D_0}{z}} \)
4. \( L = \sum_{i=1}^{n} L_i \)
5. \( L_1 = \frac{D_0}{E} \)

where:

- \( D \) is the total annual volume of traffic in vehicle-kilometres per 24 hours in the country or region
- \( D_0 \) is the total annual volume of traffic in vehicle-kilometres per 24 hours in the country or region minus the first and the last
- \( E \) is the total annual volume of traffic in vehicle-kilometres per 24 hours in the country or region minus the first and the last
- \( L \) is the length of the total road in the country or region
- \( L_1 \) is the length of the first road in the country or region
- \( L_2 \) is the length of the second road in the country or region

Calculation method (cont.)

The calculation for other (regional) roads for a country (or a region) is as follows:

\[ D_3 = \frac{2 \times 5 \times 10^4 \times a_i \cdot V_i}{d_i^3} \]

where:

- \( D_3 \) is the number of vehicle-kilometres on other (regional) roads in the country or region
- \( a_i \) is the number of vehicle-kilometres on other (regional) roads in the country or region
- \( V_i \) is the length of the road on which the number of vehicle-kilometres is given
- \( d_i \) is the length of the road on which the number of vehicle-kilometres is given
- \( a_i \) is the number of vehicle-kilometres on other (regional) roads in the country or region
Future?

New technology development - road pricing could be source of such a type of information

Traffic census 2005

Average intensity development on road network in the Czech Republic 1985 - 2005
UNECE tables

- Detailed description of data sent to the UNECE is in ECE/Trans/WP.6/AC.2/18

Report of the ad hoc group of experts on the E- Road Traffic Census 2010 at its ninth session

Odometer readings at technical inspections

- The method is not so widely spread so far as road traffic census
- The results received from it differ from those received from the road traffic census method.
Odometer readings (cont.)

- So it covers only national vehicles and does not follow territorial principle, it is not possible to get any information on traffic on specific roads, regions and not even countries. You can calculate (estimate) information on all the kilometres driven by all the vehicles registered in a country.

Odometer readings (cont.)

- Big advantage - this method is certainly cheaper than road traffic censuses because the input for it is an administrative source.
- The basic calculations are very simple: the average distance travelled by the vehicles inspected is determined and then multiplied by the number of road vehicles in a relevant category in that country. It is therefore possible to get quite a good and accurate data at a very detailed level.

Odometer readings (cont.)

- There are two essential data sources for calculating the total vehicle-kilometres from odometer readings:
  - regular odometer readings from technical inspections
  - the number of vehicles in the fleet at a given time.
Calculations can be based on odometer readings from the total vehicle fleet or from a sample.

Periodical roadworthiness tests are mandatory in all Member States in EU, problem might be with information from odometer.

For each vehicle the kilometres driven in a specific period are calculated and this figure is then converted into kilometres driven per day. If possible, the period between two tests is used; otherwise the age of the vehicle is used.

The average kilometres per day for all vehicles in question are calculated, and this figure is multiplied by the number of registered vehicles of the same type.

This gives the daily traffic volume (vehicle-kilometres per day) which is easily converted to yearly traffic volume by multiplying by the number of days in the year.

What is covered?

- All traffic by national vehicles due for a periodical test
- Kilometres driven in other countries are included.
- Foreign traffic is excluded.
- Vehicles that are not due for a roadworthiness test are not included.
**Odometer readings (cont.)**

Time period
- As odometer readings are taken continuously, a decision must be taken on which time period to use for the first and second readings.
- If possible a time when the vehicle is not used should be excluded from the calculation.

**Household survey**
- Household survey method is focused either on households only, in that case an information on passenger car use is only received.
- or covers resident nature persons or/and vehicle owners and resident legal persons (companies) and/or resident company vehicle owners and then we get information on all vehicle spectrum.

**Household survey**
- Another approach could be to sample vehicle fleet
- Some countries may not have access to an up-to-date population register, either because access is restricted or because the population censuses are not carried out every year.
- Such countries may base the survey on lists of households, of addresses or of telephone numbers.
**Household survey**

- Alternatively the territory may be split up into small districts, e.g. postal districts or streets, and either all persons or households in the sampling units may be surveyed.
- The survey costs depend on the set-up costs and the direct unit costs. In order to reduce survey costs, multi-purpose surveys might be considered.

---

**Household survey**

- The respondents can be contacted in several ways:
  - Postal survey;
  - Telephone survey;
  - Face-to-face interview.

---

**Household survey**

- Postal surveys are a very useful method for simple short questionnaires where respondents can fill in the requested information easily without having to read long explanatory notes about what to do and how to interpret the questions. It is best if the questions are selfexplanatory.
**Household survey**

- Telephone surveys can be kept short for units that possess no motor vehicle at all.
- Over the telephone it is possible to explain the purpose of the survey to the respondents and to motivate them to participate. Further guidance can be given about how to interpret the questions.
- Telephone interviews should not be too long or else respondents might refuse to complete the interview or might seek to find answers that will quickly bring the interview to an end.

**Household survey**

- Face-to-face interviews may be used to collect data. This type of survey is normally used for longer and more complicated interviews, where the benefits of direct personal contact can outweigh the relatively high costs of travel.

**Czech Republic experience**

- Carries road traffic census every 5 years
- Sends data regularly to UNECE
- Started to collect data on number of km driven from the companies (Czech Statistical Office)
- Will investigate possibility of odometer reading use for getting the data on road traffic
Eurostat follow up
- UNECE *Handbook on Statistics on Road Traffic* was taken as a basis
- Established Task Force which analysed the methods
- Pilot data collection
- On the basis of this data collection updating the tables
- Odometer reading – a way to go forward!

Thank you for your attention