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Developing a modelling system to supplement and distribute road traffic volumes from odometer readings

Final report to Eurostat

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Preface

The objective of the project described in this report has been to establish a modelling system that will provide annual road traffic volumes on the various levels of detail requested by the Statistical Office of the European Communities (Eurostat).

The report was written by senior adviser Vidar Lund at the Division for Transport, Tourism and ICT Statistics at Statistics Norway. Mr Lund was also responsible for carrying out the research and analysis connected to developing the Norwegian road traffic volume model outlined here.

Statistics Norway would like to thank the Swedish Institute for Transport and Communication Analysis, the Norwegian Public Roads Administration, the Norwegian Institute of Transport Economics and the Division for Economics, Energy and the Environment Statistics at Statistics Norway for valuable cooperation and input to the project. Statistics Norway would also like to thank Eurostat for contributing financial support.

Abstract

Statistics Norway has recently developed a database of road traffic volumes based on odometer readings. The database provides annual figures for the total vehicle-kilometres (VKms) performed by Norwegian passenger cars, buses and goods road vehicles on national and foreign territory.

In order to provide the information requested in Eurostat's annual collection of road traffic volumes, Statistics Norway will have to estimate total road traffic VKms for Norwegian motorcycles, mopeds, other motorized vehicles and bicycles. Additional information will also have to be obtained in order to distribute the total road traffic VKms by territory, nationality of vehicle, type of road and gender and age of driver.

The objective of the project described in this report has been to establish a modelling system that will enable Statistics Norway to provide information on the various levels of detail requested by Eurostat (as described in Appendix 1). The chosen method is a top-down model that combines annual figures for the total VKms from the database of road traffic volumes with information from other available data sources, such as transport surveys, travel surveys, traffic counts and the Norwegian Register of Driving Licenses.

The quality of the estimates of road traffic VKms derived from the top-down model will be dependent on the quality of the estimates of total road traffic VKms and the quality of the estimated distribution factors. The quality of the estimated total road traffic VKms is generally considered to be good, although changes in traffic volumes caused by economic or social trends may be slow to register.

The quality of the estimated distribution factors is dependent on the quality of the underlying data sources (as described in chapter 3 and chapter 4). Some of the main surveys that provide the necessary data for estimating the distribution factors, such as the Norwegian travel survey, are typically carried out every four years. By relying on estimated distribution factors that remain constant over several years, the top-down model for estimating road traffic VKms will not be sensitive to short term changes in driving patterns.

The main challenge when constructing the Norwegian road traffic VKm model has been to identify existing data sources for calculating distribution factors of good or fairly good quality. There is, for instance, a definite lack of good data sources for the road traffic volumes performed by Norwegian vehicles abroad and by foreign vehicles on Norwegian territory. Efforts should be made to replace distribution factors of poor quality with distribution factors based on more accurate and relevant data.

On the whole, the Norwegian road traffic VKm model is likely to produce road traffic volume estimates of adequate quality, although the quality assessments of individual estimates may range from good to uncertain. It is a strength that the model unites all the relevant data which are available about Norwegian road traffic volumes, and that the model is flexible enough to allow input data and distribution factors to be updated whenever more accurate or relevant data are available.

In 2010, both Eurostat and the United Nations Economic and Social Council (UNECE) adopted a modified structure of the tables in the voluntary data collection of road traffic volumes. The consequences of these modifications to the Norwegian road traffic volume model are discussed in chapter 6. Some measures planned by Statistics Norway in order to improve the availability and quality of road traffic volume data are outlined in chapter 7.

Contents

1. Introduction

This final technical implementation report has been prepared by Statistics Norway to meet reporting obligations towards the Statistical Office of the European Communities (Eurostat) as specified in grant agreement 30402.2009.005-2009.402.

Statistics Norway has recently developed a database of road traffic volumes based on odometer readings. The database provides annual figures for the total vehicle-kilometres (VKms) performed by Norwegian passenger cars, buses and goods road vehicles on national and foreign territory. The development of this database was co-financed by Statistics Norway and the Norwegian Ministry of Transport and Communications.

So far, annual statistics on road traffic volumes for the period 2005–2009 have been disseminated using the new database of road traffic VKms. By combining odometer readings with technical information from the Norwegian Register of Vehicles, Statistics Norway is able to disseminate fairly detailed statistics on road traffic VKms for Norwegian passenger cars, buses and goods roads vehicles distributed by type of vehicle, age of vehicle, type of fuel and residence county of vehicle owners.

In order to provide the information requested in the four tables that are specified in the grant agreement, Statistics Norway will have to estimate total road traffic VKms for Norwegian motorcycles, mopeds, other motorized vehicles and bicycles. Additional information will also have to be obtained in order to distribute the total road traffic VKms for all vehicle groups by territory, nationality of vehicle, type of road and gender and age of driver.

The objective of this action has been to establish a modelling system that will enable Statistics Norway to provide the information requested in the four tables specified in the grant agreement (as described in Appendix 1). The chosen method is a top-down model that combines statistics from the database of road traffic volumes with information from other available data sources, such as transport surveys, travel surveys, traffic counts and the Norwegian Register of Driving Licenses.

At the meeting in Geneva on 1-3 June 2010, the Working Party on Transport Statistics of the United Nations Economic and Social Council (UNECE) adopted a modified structure of the tables in the voluntary data collection of road traffic volumes. The modified tables where initially developed by the Eurostat Task Force on the measurement of road traffic volumes held in Luxembourg on 29 April 2010, and Eurostat is currently working to implement the revised tables in the Web Common Questionnaire. The consequences of these modifications for the Norwegian road traffic VKm model described in this report are discussed in chapter 6.

2. A general description of the top-down model

The newly developed database of road traffic volumes will be the main source of input data for the Norwegian road traffic volumes model. Since the database provides total figures for VKms performed by Norwegian vehicles on national and foreign territory, the input data will have to be divided into the more detailed levels that are requested in the four tables specified in the grant agreement.

The obvious approach is to develop a top-down model which uses various distribution factors to divide the aggregated statistics into more detailed figures. The general top-down model for annual road traffic VKms can be described as in equation (1).

$$VKms_{id} = VKms_i * \alpha_{id} \quad (1)$$

where $VKms_{id}$ is the vehicle-kilometres for vehicle type *i* on the level of detail *d,* $VKms_i$ is the total annual vehicle-kilometres for vehicle group *i* and α_{id} is the distribution factor for vehicle group *i* on the level of detail *d.*

The distribution factors can be estimated using data from road goods transport surveys, national travel surveys or other surveys conducted to obtain relevant information from enterprises or households. These estimated distribution factors can be described as in equation (2).

$$\hat{\alpha}_{id} = \frac{VKms^s_{id}}{VKms^s_i} \quad (2)$$

Where $\hat{\alpha}_{id}$ is the estimated distribution factor for vehicle group *i* on the level of detail *d*, $VKms^s_{id}$ is the vehicle-kilometres for vehicle type *i* on the level of detail *d* in the survey sample and $VKms^s_i$ is the total vehicle-kilometres for vehicle group *i* in the survey sample.

Finally, the estimated road traffic VKms in the top-down model can be derived from equation (3):

$$\hat{V}Kms_{id} = \hat{V}Kms_i * \hat{\alpha}_{id} \quad (3)$$

where $\hat{V}Kms_{id}$ is the estimated total VKms for vehicle group *i* on the level of detail *d* and $\hat{V}Kms_i$ is the estimated total road traffic VKms for vehicle group *i* collected from road traffic statistics based on odometer readings or other relevant data sources.

The structure of this top-down model is similar to the approach used for estimating road traffic VKms in both the emission model developed by Statistics Norway and the model for estimating road traffic VKms developed by Transport Analysis in Sweden (formerly known as the Swedish Institute for Transport and Communication Analysis).

3. Identifying existing data sources

The initial phase of the action was spent researching potential data sources for the input data and distribution factors needed for the top-down road traffic VKm model. Working sessions on road traffic data where held with the Norwegian Public Roads Administration (NPRA), the Norwegian Institute of Transport Economics (ITE) and the Division for Economics, Energy and the Environment Statistics at Statistics Norway.

A joint seminar was also arranged with the Swedish Institute for Transport and Communication Analysis in Östersund in Sweden in order to exchange experiences with using various data sources for road traffic volumes and discuss best practises for estimating road traffic VKms.

3.1. Total road traffic VKms

The main input data in the road traffic VKm model are the total mileages of various vehicle groups, which are to be divided into more detailed sub-categories.

Passenger cars, buses and goods road vehicles

The database of road traffic volumes based on odometer readings provides annual road traffic VKms performed by Norwegian passenger cars, buses and goods road vehicles on national and foreign territory (Statistics Norway 2009). The odometer readings are collected by the NPRA from the various inspection bodies that conduct periodical roadworthiness tests.

In principle, the volume of off-road traffic should be estimated from other sources and subtracted from the total (UNECE 2007). The volume of off-road traffic with Norwegian passenger cars, buses and goods vehicles is, however, considered to be negligible.

By combining the odometer readings with technical information from the Norwegian Register of Vehicles, the database is able to supply annual road traffic VKms for passenger cars, buses and goods road vehicles divided into all the requested sub-categories of vehicle types, fuel types and weight classes.

Data sources:

- Odometer readings (collected by the NPRA)
- The Norwegian Register of Vehicles (administered by the NPRA)
- The Norwegian Database of Road Traffic Volumes (compiled by Statistics Norway)

Frequency of updates:

- Annually

Data coverage:

- Total VKms performed by national vehicles on national and foreign territory

Motorcycles and mopeds

Motorcycles and mopeds are not included in the database of road traffic VKms, since odometer readings are not collected for such vehicles in Norway. Annual road traffic VKms for these vehicle groups will therefore have to be estimated using other data sources.

The ITE is currently disseminating estimates for total VKms for Norwegian motorcycles and mopeds through its annual statistics on transport volumes in Norway, in co-operation with Statistics Norway. In these statistics, the total VKms are estimated by combining average figures of yearly distances travelled by motorcycles and mopeds from the Norwegian travel survey with the registered stock of motorcycles and mopeds (ITE 2009a).

Data sources:

- The Norwegian Travel Survey (carried out by the ITE)
- The Norwegian Register of Vehicles (administered by the NPRA)

Frequency of updates:

- Every four years (travel survey)
- Annually (register of vehicles)

Data coverage:

- Total VKms performed by national vehicles on national territory

Other motorized vehicles

There are few data sources available for estimating the road traffic VKms performed by other motorized vehicles, a vehicle group which in Norway is mainly made up by agricultural tractors, construction machinery, snow scooters and army vehicles. The annual stock of vehicles is available from the Norwegian Register of Vehicles, but these vehicle types are not included in the national travel survey.

The total annual emissions from other motorized vehicles are estimated in the Norwegian emission model, based on fuel sales. Since these kinds of vehicles are mostly driven off-road, however, any estimate of the total use of other motorized vehicles will therefore have to be divided into off-road and on-road use. Unfortunately, the traffic counts carried out by the NPRA do not distinguish between types of vehicles, only between vehicles of different sizes.

As a result of this, Statistics Norway has not been able to identify adequate sources for data on the total annual VKms performed by other motorized vehicles in Norway at the present time. The volume of on-road driving performed by other motorized vehicles on Norwegian and foreign roads is, however, considered to be quite small.

Data sources:

- Not available.

Bicycles

The average annual distance travelled on bicycles by Norwegians over the age of 12 can be estimated using data from the Norwegian Travel Survey (ITE 2006). By combining this estimate with the number of people in Norway over the age of 12 from the annual population statistics, it is possible to give a rough estimate of the total VKms performed by bicycles on Norwegian roads. In this context, it is assumed that most of the cycling reported in the national travel survey is done on-road.

Data sources:

- The Norwegian Travel Survey (carried out by the ITE)
- Population statistics (compiled by Statistics Norway)

Frequency of updates:

- Every four years (travel survey)
- Annually (population statistics)

Data coverage:

- Total VKms performed by national bicycles on national territory

3.2. Nationality and territory

In order to supply the requested road traffic volumes for foreign vehicles on national territory and national vehicles on foreign territory in table 1 of the voluntary data collection, it is necessary to supplement the total road traffic VKms for each vehicle group with additional information. As described in chapter 2, this is done by calculating the various distribution factors that are needed to divide the estimated total road traffic VKms into sub-categories for nationality and territory.

Unfortunately, there is not a lot of reliable information available on road traffic volumes performed by foreign vehicles on Norwegian territory or Norwegian vehicles on foreign territory at the moment. As a result of this, one of the key realizations of this action has been the need to develop more comprehensive data on road traffic volumes divided by nationality and territory (more on this in chapter 7).

It is, however, possible to piece together a rough picture of the volume of VKms performed by foreign vehicles on Norwegian roads and Norwegian vehicles on foreign roads using the information available today. In order to make the model coherent, it is necessary to make the traditional assumption that the road traffic VKms performed by foreign vehicles on Norwegian territory is equal to the road traffic VKms performed by Norwegian vehicles on foreign territory. This assumption should be abandoned as more comprehensive data on nationality and territory are available for the various vehicle groups.

Passenger cars

In the annual statistics on transport volumes in Norway, the ITE assumes that 2.5 per cent of the total road traffic VKms of Norwegian passenger cars is performed on foreign territory. The source of this assumption is a passenger car survey carried out by Statistics Norway in 1995.

Data from the national travel survey suggest that this estimate may be quite high. According to the travel survey carried out in 2005, only 0.2 per cent of the number of car travels started or ended abroad. The main bulk of Norwegian car travels abroad are made in connection with cross-border shopping in Sweden. Even though these travels tend to be longer than the average travels done by car, most of the road traffic VKms related to cross-border shopping travels are actually performed on Norwegian territory.

At the moment, there is no reliable information available on road traffic volumes performed by foreign passenger cars on Norwegian territory.

Data sources:

- The Norwegian Travel Survey (carried out by the ITE)
- Passenger car survey (carried out by Statistics Norway in 1995)

Frequency of updates:

- Every four years (travel survey)
- Uncertain (passenger car survey)

Data coverage:

- Share of VKms performed by national vehicles on foreign territory

Buses and coaches

At the present time, there is no reliable information available on road traffic volumes performed by Norwegian buses and coaches on foreign territory or road traffic volumes performed by foreign buses and coaches in Norway.

For modelling purposes, it is assumed that the distribution factors for coaches are similar to the distribution factors for heavy goods vehicles, while the distribution factors for minibuses ("other buses") are similar to the distribution factors for light goods vehicles. The road traffic volumes of both Norwegian buses on foreign territory and foreign buses on Norwegian territory are considered to be negligible.

Light and heavy goods road vehicles

Statistics Norway carried out a special survey of transport by vans and small lorries in 2008. According to this survey, less than one per cent of the total VKms of Norwegian light goods vehicles were performed on foreign territory (Statistics Norway 2008). Light goods road vehicles with owners living in counties bordering on Sweden were responsible for all the VKms performed by these vehicles on foreign roads in 2008.

There is no reliable information available on road traffic volumes performed by foreign light goods vehicles on Norwegian roads at the moment.

The ITE has recently estimated the percentage of the total road traffic VKms of heavy goods vehicles in Norway which is performed by foreign lorries and road tractors. The estimates are based on an analysis of data supplied by Statistics Norway and Eurostat under Regulation 1172/98 (road goods transport surveys). Similar estimates can be made for road traffic VKms performed by Norwegian heavy goods vehicles abroad, using data from the Norwegian Road Goods Transport Survey. Statistics Norway is currently looking into the methodology of this kind of analysis.

The reattribution of road freight transport performances from nationality of vehicle to territory has also been one of the main tasks of the Modal Split Indicators (IMS) project at Eurostat. If the IMS project is successful in reattributing the information supplied by European countries under Regulation 1172/98, using regional data on a NUTS 3 level, it could be a valuable source for estimating distribution factors of transport volumes performed by European heavy goods vehicles on national and foreign territory.

Data sources:

- The Norwegian Road Goods Transport Survey (carried out by Statistics Norway)
- Survey on transport by vans and small lorries (carried out by Statistics Norway)

Frequency of updates:

- Every quarter (road goods transport survey)
- Every four or five years (survey on transport by vans and small lorries)

Data coverage:

- Share of VKms performed by national vehicles on foreign territory (light goods vehicles and heavy goods vehicles)
- Share of VKms performed by foreign vehicles on national territory (heavy goods vehicles)

Motorcycles, mopeds, other motorized vehicles and bicycles

Reliable information on the road traffic volumes performed by Norwegian motorcycles, mopeds, other motorized vehicles and bicycles on foreign territory and vice versa is not available at the present time. For modelling purposes, it is

assumed that the distribution factors for motorcycles are similar to the distribution factors for passenger cars.

The road traffic volumes of Norwegian mopeds, other motorized vehicles and bicycles on foreign territory and vice versa are considered to be negligible.

3.3. Type of road

The Division for Transport, Tourist and ICT Statistics and the Division for Economics, Energy and the Environment Statistics at Statistics Norway have done a joint analysis of transport volumes by type of road. The analysis was carried out by combining detailed volume data from traffic counts with a map model of the Norwegian road network, using GPS-coordinates as the identifier.

The model of the Norwegian road network is able to distinguish between motorways, other roads within built-up areas and other roads outside built-up areas, as requested in table 2 of the voluntary data collection. There are currently no Norwegian road corridors included in the Trans-European Networks (TEN-T).

The traffic counts carried out by the NPRA do not distinguish between types of vehicles, only between vehicles that are longer or shorter than 5.6 metres. This roughly translates to vehicles with a gross vehicle weight over or under 3.5 tonnes. As a result of this, it is possible to calculate two sets of distribution factors for type of road; one for light vehicles (passenger cars, light goods road vehicles, motorcycles and mopeds) and one for heavy vehicles (heavy goods road vehicles, buses and coaches).

The traffic counts carried out by the NPRA are primarily focused on motorways and other state roads. Municipality roads are ordinarily not included in the traffic counts. The current method for estimating distribution factors for road traffic volumes by type of road may therefore underestimate the VKms performed on smaller roads.

Data sources:

- Traffic counts (carried out by the NPRA)
- Model of the Norwegian road network (administered by Statistics Norway)

Frequency of updates:

- Annually (traffic counts)
- Annually (road network model)

Data coverage:

- Share of VKms performed on motorways, other roads within built-up areas and other roads outside built-up areas (for vehicles longer and shorter than 5.6 metres)

3.4. Age of vehicle

The distribution factors that are necessary to divide the total road traffic VKms into the age groups specified in table 3 of the voluntary data collection are easily available from the database of road traffic volumes for most of the requested vehicle groups. The only exception is motorcycles, since odometer readings for this vehicle group are not collected by Norwegian authorities.

The Swedish statistics on road traffic volumes do, however, include traffic volumes for Swedish motorcycles based on odometer readings. Assuming that the age distribution of VKms for motorcycles is similar in Norway and Sweden, which is a fairly reasonable assumption, the distribution factors for motorcycles can be estimated using data based on the Swedish odometer readings.

For modelling purposes, it is also necessary to assume that the age distribution of VKms performed by foreign vehicles on Norwegian roads is identical to the age distribution of VKms performed by Norwegian vehicles.

Data sources:

- The database of Norwegian road traffic VKms (developed by Statistics Norway)
- Swedish statistics on road traffic volumes (compiled by Traffic Analysis in Sweden)

Frequency of updates:

- Annually (database of road traffic VKms)
- Annually (Swedish statistics on road traffic volumes)

Data coverage:

- Share of VKms performed by type and age of vehicle

3.5. Gender and age of driver

There are several data sources available in order to estimate the distribution factors that are necessary to divide the total road traffic VKms on the gender and the age of the vehicle drivers.

The age and gender distribution of the total VKms performed by drivers of passenger cars, motorcycles, mopeds and bicycles can be estimated by using data from the Norwegian Travel Survey (ITE 2006). Unfortunately, the sample of motorcyclists is quite small in the travel survey. A special survey of 10 000 motorcyclist carried out by the ITE in 2008 in order to calculate road traffic exposure and risk among high-risk groups does however provide high quality distribution factors for the VKms performed by motorcyclists in 2008 (ITE 2009b).

The distribution factors that are needed to divide the total VKms performed by drivers of heavy goods road vehicles and buses into the requested gender and age groups can be estimated based on data from the Norwegian Register of Driving Licenses. Since the mandatory driving licenses for heavy goods road vehicles and buses must be renewed every five years for people under the age of 70 and every year for people over the age of 70, the number of people carrying driving licenses in each of the requested sub-categories should be a fairly good approximation of the total VKms performed by drivers in the same sub-categories.

No special driving license is required to drive a light goods road vehicle with a gross vehicle weight of 3.5 tonnes or less. For modelling purposes, the distribution factors for drivers of light goods vehicles are therefore assumed to be identical to the distribution factors for drivers of passenger cars.

Data sources:

- The Norwegian Travel Survey (carried out by the ITE)
- Survey on VKms performed by motorcycles (carried out by the ITE in 2008)
- The Norwegian Register of Driving Licenses (administered by the NPRA)

Frequency of updates:

- Every four years (travel survey)
- Uncertain (survey on motorcyclists)
- Annually (register of driving licenses)

Data coverage:

- Share of VKms performed by gender and age of driver (passenger cars, motorcycles, mopeds and bicycles)
- Share of number of people with driving licenses by gender and age of driver (heavy goods road vehicles and buses)

4. Assessing the quality of the estimated distribution factors

The main challenge of the top-down approach is to secure accurate and relevant estimates of the various distribution factors that are needed to divide the total VKms into the specified sub-categories.

As described in chapter 3, the distribution factors will be estimated based on information from several different data sources. Since the data sources are varying in accuracy and relevance, the quality of the estimated distribution factors will vary accordingly. In some cases, assumptions will have to be made in lack of relevant data. The quality of distribution factors based on such assumptions is naturally hard to estimate with any degree of certainty.

In order to give an overview of the accuracy of the estimates of road traffic VKms produced by the top-down model, the estimated distribution factors are divided into three quality groups depending on the accuracy and relevance of the underlying data.

Quality classifications:

A: Distribution factors that are based on data for road traffic VKms performed by the relevant sub-category of the statistics, taken from a data source that is updated at least annually.

B: Distribution factors that are either: 1) based on data for road traffic VKms performed by the relevant sub-category of the statistics, taken from a data source that is updated regularly (at least every four or five years) or 2) based on an approximation of road traffic VKms performed by the relevant sub-category of the statistics, taken from a data source that is updated at least annually.

C: Distribution factors which to a large degree are based on assumptions about traffic volumes or road traffic VKm distribution patterns.

Depending on the quality classification, the accuracy and relevance of the distribution factors and the resulting VKm estimates can be regarded as good (A), fairly good (B) or uncertain (C). If the resulting estimates of road traffic VKms are to be considered accurate or fairly accurate, most distribution factors used in the top-down model should be classified as being of A or B quality. In order to improve the quality of the estimates produced by the top-down model, measures should be taken to replace distribution factors classified as being of C quality with distribution factors based on more accurate and relevant data.

4.1. Nationality and territory

Table 4.1 gives an overview of the current quality classifications of the distribution factors that are needed to produce the requested VKm estimates for table 1 in the voluntary data collection of road traffic volumes for the statistical year 2008.

As shown in the table, most of the distribution factors for nationality and territory in the Norwegian road traffic VKm model are based on assumptions rather than accurate and relevant data sources. The exceptions are some of the distribution factors for light and heavy goods road vehicles, which are based on recent surveys or new analysis of available data (as described in section 3.2).

However, the volumes of road traffic VKms performed in Norway by foreign cars and on foreign territory by Norwegian cars are quite small compared with the total VKms performed on Norwegian territory and the total VKms performed by Norwegian cars. The estimates for VKms performed on national territory in all and by national vehicles in all are therefore likely to be fairly accurate, even though there is a certain degree of uncertainty attached to most of the distribution factors.

Table 4.1 Distribution factors for nationality and territory in the Norwegian road traffic VKm model. Variable identifiers and quality classification of estimates

Type of vehicle	Distribution factors for foreign vehicles on national territory (of total VKms performed on national territory)	Distribution factors for national vehicles on foreign territory (of total VKms performed by national vehicles)	Distribution factors for foreign vehicles on national territory (of total VKms performed on national territory)	Distribution factors for national vehicles on foreign territory (of total VKms performed by national vehicles)
	- Variable identifier -		- Quality classification1 -	
Passenger cars	SUM	SUM	C	C
- petrol	a1	a2	C	C
- diesel	a3	a4	C	C
- other fuel	a5	a6	C	C
Buses and coaches	SUM	SUM	C	C
- Buses	a7	a8	C	C
- Coaches	a9	a10	C	C
- Others (mini-buses/mini-coaches)	a11	a12	C	C
Motorcycles and mopeds	SUM	SUM	C	C
- Motorcycles	a13	a14	C	C
- Mopeds	a15	a16	C	C
Goods vehicles	SUM	SUM	C	B
- Goods vehicles <= 3.5 tonnes	SUM	SUM	C	B
- petrol	a17	a18	C	B
- diesel	a19	a20	C	B
- other fuel	a21	a22	C	B
- Goods vehicles > 3.5 tonnes	SUM	SUM	B	C
- petrol	a23	a24	B	C
- diesel	a25	a26	B	C
- other fuel	a27	a28	B	C
- > 3.5 tonnes <= 6 tonnes	SUM	SUM	B	C
- petrol	a29	a30	B	C
- diesel	a31	a32	B	C
- other fuel	a33	a34	B	C
- > 6 tonnes	SUM	SUM	B	C
- Lorries and road trains	a35	a36	B	C
- Road tractors and articulated vehicles	a37	a38	B	C
Other motorized vehicles	a39	a40	N. A.	N. A.
Bicycles	a41	a42	C	C

Abbreviations: SUM - Sum of underlying cells, N. A. - VKm estimates not available
[1]Quality classification of estimates are based on assesment of current data source

4.2. Type of road

Table 4.2 gives an overview of the current quality classifications of the distribution factors that are needed to produce the requested VKm estimates for table 2 in the voluntary data collection of road traffic volumes.

Even though the traffic counts that are used to estimate the distribution factors only distinguishes between vehicles that are longer or shorter than 5.6 metres (as described in section 3.3), most of the distribution factors for passenger cars and goods road vehicles are judged to be fairly good due to the scope of the underlying data. However, since it is not possible to identify buses, coaches, motorcycles and mopeds in the traffic counts, the distribution factors for these vehicle groups are considered to be of C quality.

Since the current method for estimating distribution factors for road traffic volumes by type of road may underestimate the VKms performed on smaller roads, the underlying distribution factors for other roads are considered to be of C quality. There are currently no Norwegian road corridors included in the Trans-European Networks (TEN-T). Subsequently, there is no uncertainty attached to the fact that the distribution factors for TEN-T roads in Norway are equal to zero for all vehicle groups.

Table 4.2. Distribution factors for type of road. Variable identifiers and quality classification of estimates

Type of vehicle	Motorways	Other roads	Other roads within built-up areas	Other roads outside built-up areas	Trans-European Networks (TEN-T)
		- Variable identifier -			
Passenger cars	b1	b2	b3	b4	b5
Buses and coaches	b6	b7	b8	b9	b10
Motorcycles and mopeds	b11	b12	b13	b14	b15
Goods vehicles	SUM	SUM	SUM	SUM	SUM
- Goods vehicles <= 3.5 tonnes	b16	b17	b18	b19	b20
- Goods vehicles > 3.5 tonnes	SUM	SUM	SUM	SUM	SUM
- > 3.5 tonnes <= 6 tonnes	b21	b22	b23	b24	b25
- > 6 tonnes <= 12 tonnes	b26	b27	b28	b29	b30
- > 12 tonnes	b31	b32	b33	b34	b35
Other motorized vehicles	b36	b37	b38	b39	b40
		- Quality classification[1] -			
Passenger cars	B	B	B	B	A
Buses and coaches	C	C	C	C	A
Motorcycles and mopeds	C	C	C	C	A
Goods vehicles	B	B	C	C	A
- Goods vehicles <= 3.5 tonnes	B	B	C	C	A
- Goods vehicles > 3.5 tonnes	B	B	C	C	A
- > 3.5 tonnes <= 6 tonnes	B	B	C	C	A
- > 6 tonnes <= 12 tonnes	B	B	C	C	A
- > 12 tonnes	B	B	C	C	A
Other motorized vehicles	N. A.	N. A.	N. A.	N. A.	N. A.

Abbreviations: SUM - Sum of underlying cells, N. A. - VKm estimates not available
[1] Quality classification of estimates are based on assesment of current data source

4.3. Age of vehicle

The distribution factors that are needed to divide the total road traffic VKms on the age groups specified for most of the vehicle groups in table 3 of the voluntary data collection are calculated from data available directly from the database of road traffic volumes (as described in section 3.4). As a result of this, most of the distribution factors for table 3 are considered to be of A quality (table 4.3).

The distribution factors for motorcycles are calculated using data taken from Statistic Sweden's statistics on road traffic volumes. Since this relies on the assumption that the age distribution of VKms for motorcycles is similar in Norway and Sweden, these distribution factors are considered to be of C quality.

On the whole, the current distribution factors that are used to divide the total road traffic VKms into vehicle age groups are considered to be of good quality, and the resulting road traffic VKm estimates should be among the most accurate produced by the Norwegian road traffic VKm model.

Table 4.3. Distribution factors for age of vehicle. Variable identifiers and quality classification of estimates

	Age of vehicle (years)								
Type of vehicle	0	1	2	3	4-5	6-7	8-9	10-11	12 or more
	- Variable identifier								
Passenger cars	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
- petrol	c1	c2	c3	c4	c5	c6	c7	c8	c9
- diesel	c10	c11	c12	c13	c14	c15	c16	c17	c18
- other fuel	c19	c20	c21	c22	c23	c24	c25	c26	c27
Buses and coaches	c28	c29	c30	c31	c32	c33	c34	c35	c36
Motorcycles	c37	c38	c39	c40	c41	c42	c43	c44	c45
Goods vehicles <= 6 tonnes	c46	c47	c48	c49	c50	c51	c52	c53	c54
Goods vehicles > 6 tonnes	c55	c56	c57	c58	c59	c60	c61	c62	c63
	- Quality classification[1] -								
Passenger cars	A	A	A	A	A	A	A	A	A
- petrol	A	A	A	A	A	A	A	A	A
- diesel	A	A	A	A	A	A	A	A	A
- other fuel	A	A	A	A	A	A	A	A	A
Buses and coaches	A	A	A	A	A	A	A	A	A
Motorcycles	C	C	C	C	C	C	C	C	C
Goods vehicles <= 6 tonnes	A	A	A	A	A	A	A	A	A
Goods vehicles > 6 tonnes	A	A	A	A	A	A	A	A	A

Abbreviations: SUM - Sum of underlying cells

[1] Quality classification of estimates are based on assesment of current data source

4.4. Gender and age of driver

Table 4.4 displays the current quality classifications of the distribution factors that are needed to produce the requested VKm estimates for table 4a and 4b in the voluntary data collection. Even though these distribution factors are derived from three different data sources (as described in section 3.5), most of the current distribution factors are considered to be of B quality.

The only exception is the distribution factors for light goods road vehicles. Since it is assumed that the distribution factors for light goods road vehicles are identical to the distribution factors for passenger cars, the distribution factors for this vehicle group are considered to be of C quality.

On the whole, the distribution factors necessary for distributing total road traffic VKms on the gender and age of vehicle drivers are considered to be fairly good, and the resulting road traffic VKm estimates should therefore be expected to be fairly accurate.

Table 4.4. Distribution factors for age and gender of driver. Variable identifiers and quality classification of estimates

Type of vehicle	Age of driver (male/female)				
	< 18 years	18-24 years	25-34 years	35-64 years	65 + years
	- Variable identifier -				
Passenger cars	d1a/d1b	d2a/d2b	d3a/d3b	d4a/d4b	d5a/d5b
Buses and coaches	d6a/d6b	d7a/d7b	d8a/d8b	d9a/d9b	d10a/d10b
Motorcycles and mopeds	SUM	SUM	SUM	SUM	SUM
- Motorcycles	d11a/d11b	d12a/d12b	d13a/d13b	d14a/d14b	d15a/d15b
- Mopeds	d16a/d16b	d17a/d17b	d18a/d18b	d19a/d19b	d20a/d20b
Goods vehicles	SUM	SUM	SUM	SUM	SUM
- Goods vehicles <= 3.5 tonnes	d21a/d21b	d22a/d22b	d23a/d23b	d24a/d24b	d25a/d25b
- Goods vehicles > 3.5 tonnes	d26a/d26b	d27a/d27b	d28a/d28b	d29a/d29b	d30a/d30b
Bicycles	d31a/d31b	d32a/d32b	d33a/d33b	d34a/d34b	d35a/d35b
	- Quality classification[1] -				
Passenger cars	B	B	B	B	B
Buses and coaches	B	B	B	B	B
Motorcycles and mopeds	B	B	B	B	B
- Motorcycles	B	B	B	B	B
- Mopeds	B	B	B	B	B
Goods vehicles	C	C	C	C	C
- Goods vehicles <= 3.5 tonnes	C	C	C	C	C
- Goods vehicles > 3.5 tonnes	B	B	B	B	B
Bicycles	B	B	B	B	B

Abbreviations: SUM - Sum of underlying cells

[1] Quality classification of estimates are based on assesment of current data source

5. The structure and quality of the Norwegian road traffic VKm model

The Norwegian road traffic VKm model is a top-down model which uses various distribution factors to divide aggregated statistics on road traffic volumes into more specific sub-categories (as described in general in chapter 2). A detailed description of how the model is constructed in order to provide the information requested in the four tables specified in the grant agreement is given in appendix 1 of this report (page 20).

The quality of the estimates of road traffic VKms derived from the top-down model will be dependent on the quality of the estimates of total road traffic VKms and the quality of the estimated distribution factors.

The annual estimates of total road traffic VKms taken from the database of road traffic volumes are based on odometer readings from a large number of Norwegian passenger cars, buses and goods road vehicles. The quality of these estimates is generally considered to be good, although changes in traffic volumes caused by economic or social trends may be slow to register, as some of the odometer readings used for estimating total road traffic VKms may be up to two years old at the time of estimation (UNECE 2007). The quality of the estimates of total road traffic VKms derived from other statistics is dependent on the quality of the underlying data sources of those statistics.

However, the main source of error in the estimates of road traffic VKms derived from the top-down model is likely to be the estimated distribution factors. The quality of these estimates is dependent on the quality of the underlying data sources (as described in chapter 3 and chapter 4). If the estimated distribution factors are accurate, the estimated road traffic VKms will probably be quite accurate using this

model. If, on the other hand, the quality of the distribution factors is poor, the derived road traffic VKms will probably be closer to "guesstimates" than estimates.

Some of the main surveys that provide the necessary data for estimating the distribution factors in the top-down model, like the Norwegian travel survey, are typically carried out every four years. By relying on estimated distribution factors that remain constant over several years, the top-down model for estimating road traffic VKms will not be sensitive to short term changes in driving patterns.

On the whole, the Norwegian road traffic VKm model is likely to produce road traffic volume estimates of adequate quality, although the quality assessments of individual estimates may range from good to uncertain. It is a strength that the model unites all the relevant data which is available about Norwegian road traffic volumes, and that the model is flexible enough to allow input data and distribution factors to be updated whenever more accurate or relevant data are available.

The main challenge when constructing the Norwegian road traffic VKm model has been to identify existing data sources for calculating distribution factors of good or fairly good quality (as described in chapter 4). For instance, there is a definite lack of good data sources for the road traffic volumes performed by Norwegian vehicles abroad and by foreign vehicles on Norwegian territory (as described in section 3.2). Efforts should be made to replace these and other distribution factors which are classified as being of C quality with distribution factors based on more accurate and relevant data.

Some measures that are planned by Statistics Norway in order to improve the availability and quality of Norwegian road traffic volume data are outlined in chapter 7.

6. Changes to the pilot questionnaire adopted by Eurostat and UNECE in 2010

At the meeting in Geneva on 1-3 June 2010, the Working Party on Transport Statistics of the United Nations Economic and Social Council (UNECE) adopted a modified structure of the tables in the voluntary data collection of road traffic volumes. The modified tables are intended to be determinant for the tuning of a future mandatory collection of road traffic volumes which is under consideration (UNECE 2010).

The modified structure of the tables where initially developed by Eurostat prior to the Task Force on the measurement of road traffic volumes held in Luxembourg on 29 April 2010, and the participants in the Task Force agreed on the revised set of tables. Eurostat is currently working to implement the revised tables in the Web Common Questionnaire.

There are some significant changes in the modified tables compared with the four original tables of the voluntary data collection of road traffic volumes that were agreed upon in the 2007 meeting of the Coordination Committee for Statistics on Transport (CCST), which were featured in the technical annex of the grant invitation that form the basis for this action.

Table 1 has been changed in such a way that only road traffic VKms performed by all vehicles (national and foreign) on national territory and by national vehicles on national territory are requested for the specified vehicle groups in the modified table. This represents a slight simplification compared with the original table, although the need for data to calculate the necessary distribution factors is approximately the same as before.

In table 2, the level of detail has been increased for buses and motor coaches and somewhat decreased for goods vehicles in the modified table. The data needed to accommodate these modifications is available from the database of road traffic

VKms, and the changes do consequently not require any additional data sources to be developed.

The level of detail requested for table 3 has been quite considerably expanded in the modified table. Firstly, more age groups have been added. This technical information is available from the database of road traffic VKms, and consequently these changes do not require any additional data sources to be developed. Secondly, the level of detail requested for all vehicle groups has been considerably expanded, both in terms of vehicle type and type of fuel.

The requested level of detail regarding fuel type is currently not available from the Norwegian Register of Vehicles, although this may change in the coming years. In order to accommodate this level of detail for fuel types, the NPRA will have to change the routines for recording the fuel type of vehicles in the register. Statistics Norway is therefore unable to provide information on road traffic volumes on the requested level of detail for fuel types in the modified version of table 3 (more on this in chapter 7). At the present time, however, the road traffic volumes performed by vehicles not powered by the fuel types currently registered in Norway are quite small and can in most cases be considered to be negligible.

Table 4a and 4b in the original tables of the voluntary data collection of road traffic volumes are dropped in the modified set of tables. This represents a certain reduction in the number of data sources needed to produce the requested road traffic volume statistics for the pilot survey. However, Statistics Norway has quite easily been able to calculate the distribution factors that are needed to produce table 4a and 4b based on existing data sources of fairly good quality (as described in section 4.4).

In conclusion: With the exception of the abovementioned level of detail regarding fuel types, the Norwegian road traffic VKm model described in this report can quite easily be adjusted to accommodate the modified tables of the voluntary data collection of road traffic volumes (UNECE 2010).

7. Status and plans for further development

The Norwegian top-down model for road traffic VKms is able to generate the required estimates in all four tables specified in the grant agreement for most of the required vehicle groups. The only exceptions are the requested figures other motorized vehicles in table 1 and table 2. Unfortunately, there are no adequate data sources available for the total annual VKms performed by other motorized vehicles in Norway at the present time.

The quality of the estimates of road traffic VKms generated by the model is considered to be adequate, although the quality assessments of individual estimates ranges from good to uncertain. Provided the estimates are approved for dissemination by the internal approbation bodies, Statistics Norway should be able to submit almost complete road traffic VKm estimates for the statistical years 2008 and 2009 through the next edition of the common questionnaire for transport statistics.

With some minor exceptions, the Norwegian road traffic VKm model can quite easily be adjusted to accommodate the modified structure of the tables in the voluntary data collection of road traffic volumes that was adopted by UNECE in 2010 (as described in chapter 6).

Statistics Norway is currently working on several measures which hopefully will expand the amount of accurate and relevant data available for use in the road traffic VKm model. One of the main target areas of these efforts is to secure more accurate data on the road traffic VKms performed by Norwegian vehicles on foreign territory and the road traffic VKms performed by foreign vehicles on Norwegian territory.

Statistics Norway is planning a new survey on households' use of passenger cars, which could be carried out quarterly from 2011 or 2012. This survey will include questions on road traffic VKms performed by Norwegian passenger cars on foreign territory.

Statistics Norway is also following with great interest the attempts of the IMS project at Eurostat to reattribute road freight transport performances supplied by European countries under Regulation 1172/98 from nationality of vehicle to territory. If successful, this could be a valuable source for estimating distribution factors of transport volumes performed by European heavy goods vehicles on national and foreign territory.

In addition to this, Statistics Norway is working closely with the NPRA on projects seeking to expand the amount of information registered in traffic counts and utilize the information which is registered when vehicles are passing toll booths or similar road traffic registration devices. One of the main targets of this will be to identify vehicles of different types, such as passenger cars, light goods road vehicles, heavy goods road vehicles, buses, motorcycles, mopeds, other motorized vehicles and bicycles, and hopefully also the nationality of the vehicles.

Statistics Norway will also initiate talks with the NPRA in order to coordinate the work done in order to expand the classifications of fuel types that are available from the Norwegian Register of Vehicles. However, such changes in the fuel type classifications will primarily apply to new vehicles when implemented.

All new data sources will be included in the Norwegian road traffic VKm model as they become available.

References

ITE (2006). Norwegian Travel Survey - key results.
http://www.toi.no/article18963-29.html

ITE (2009a). Transport volumes in Norway 1946-2008.
http://www.toi.no/article27980-29.html

ITE (2009b). Road traffic exposure and risk among high risk groups in Norway.
http://www.toi.no/article27979-29.html

Statistics Norway (2008). Transport by vans and small lorries.
http://www.ssb.no/transpsg_en/

Statistics Norway (2009). Registered distances covered by vehicles.
http://www.ssb.no/klreg_en/

UNECE (2007). Handbook on statistics on road traffic.
http://www.unece.org/trans/doc/2007/wp6/handbook_final.pdf

UNECE (2010). Pilot questionnaire on road traffic performance.
http://www.unece.org/trans/doc/2010/WP6/ECE-TRANS-WP6-2010-05e.pdf

Appendix 1 – A detailed description of the Norwegian road traffic VKm model

Table A.1 Road traffic by type of vehicle

	Road traffic by				
	National vehicles on national territory (1)	Foreign vehicles on national territory (2)	**Total vehicles on national territory (3) = (1) + (2)**	National vehicles on foreign territory (4)	National vehicles total (5) = (1) + (4)
	- Million vehicle-kilometres -				
TOTAL (a+b+c+d+e)	SUM (a+b+c+d)	SUM (a+b+c+d)	**SUM (a+b+c+d)**	SUM (a+b+c+d)	SUM (a+b+c+d)
Type of vehicle:					
Passenger cars (a)	SUM	SUM	**SUM**	SUM	SUM
- petrol	= (5) – (4)	= (3) – (1)	**= (1) / (1-a1)**	= VKm * a2	**VKm**
- diesel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a3)**	= VKm * a4	**VKm**
- other fuel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a5)**	= VKm * a6	**VKm**
Buses and coaches (b)	SUM	SUM	**SUM**	SUM	SUM
- Buses	= (5) – (4)	= (3) – (1)	**= (1) / (1-a7)**	= VKm * a8	**VKm**
- Coaches	= (5) – (4)	= (3) – (1)	**= (1) / (1-a9)**	= VKm * a10	**VKm**
- Others	= (5) – (4)	= (3) – (1)	**= (1) / (1-a11)**	= VKm * a12	**VKm**
Motorcycles and mopeds (c)	SUM	SUM	**SUM**	SUM	SUM
- Motorcycles	**VKm**	= (1) / (1 – a3)	**= (1) + (2)**	= (5) – (1)	= (1) / (1-a14)
- Mopeds	**VKm**	= (1) / (1 – a15)	**= (1) + (2)**	= (5) – (1)	= (1) / (1-a16)
Goods vehicles (d)	SUM	SUM	**SUM**	SUM	SUM
- Goods vehicles ≤ 3.5 tonnes	SUM	SUM	**SUM**	SUM	SUM
• petrol	= (5) – (4)	= (3) – (1)	**= (1) / (1-a17)**	= VKm * a18	**VKm**
• diesel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a19)**	= VKm * a20	**VKm**
• other fuel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a21)**	= VKm * a22	**VKm**
- Goods vehicles > 3.5 tonnes	SUM	SUM	**SUM**	SUM	SUM
• petrol	= (5) – (4)	= (3) – (1)	**= (1) / (1-a23)**	= VKm * a24	**VKm**
• diesel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a25)**	= VKm * a26	**VKm**
• other fuel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a27)**	= VKm * a28	**VKm**
- >3.5 and ≤ 6 tonnes	SUM	SUM	**SUM**	SUM	SUM
• petrol	= (5) – (4)	= (3) – (1)	**= (1) / (1-a29)**	= VKm * a30	**VKm**
• diesel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a31)**	= VKm * a32	**VKm**
• other fuel	= (5) – (4)	= (3) – (1)	**= (1) / (1-a33)**	= VKm * a34	**VKm**
- > 6 tonnes	SUM	SUM	**SUM**	SUM	SUM
• Lorries and load trains	= (5) – (4)	= (3) – (1)	**= (1) / (1-a36)**	= VKm * a36	**VKm**
• Road tractors and articulated vehicles	= (5) – (4)	= (3) – (1)	**= (1) / (1-a37)**	= VKm * a38	**VKm**
Other motorized vehicles (e)	N. A.	N. A.	**N. A.**	N. A.	N. A.
Bicycles	**VKm**	= (1) / (1 – a41)	**= (1) + (2)**	= (5) – (1)	= (1) / (1-a42)

Abbreviations: SUM – Sum of underlying cells, VKm – Input data of total vehicle-kilometres estimated from various sources, N. A. – VKm estimates not available for vehicle group, a1 … a42 – distribution factors as described in table 4.1.

Table A.2 Road traffic on national territory by type of vehicle and type of road

	Type of road				TOTAL	
	Motorways (1)	**Other roads (2) = (3)+(4)**	Other roads within built-up areas (3)	Other roads outside built-up areas (4)	**Total (1+2)**	Of which on Trans-European Networks (TEN-T)
	- Million vehicle-kilometres -					
TOTAL (a+b+c+d+e)	SUM (a+b+c+d)	SUM (a+b+c+d)	SUM (a+b+c+d)	SUM (a+b+c+d)	VKm	-
Type of vehicle:						
Passenger cars (a)	VKm * b1	VKm * b2	VKm * b3	VKm * b4	VKm	-
Buses and coaches (b)	VKm * b6	VKm * b7	VKm * b8	VKm * b9	VKm	-
Motorcycles and mopeds (c)	VKm * b11	VKm * b12	VKm * b13	VKm * b14	VKm	-
Goods vehicles (d)	SUM	SUM	SUM	SUM	VKm	-
- Goods vehicles ≤3.5 tonnes	VKm * b16	VKm * b17	VKm * b18	VKm * b19	VKm	-
- Goods vehicles > 3.5 tonnes	SUM	SUM	SUM	SUM	VKm	-
- >3.5 and ≤ 6 tonnes	VKm * b121	VKm * b22	VKm * b23	VKm * b24	VKm	-
- > 6 and ≤ 12 tonnes	VKm * b26	VKm * b27	VKm * b28	VKm * b29	VKm	-
- > 12 tonnes	VKm * b31	VKm * b32	VKm * b33	VKm * b34	VKm	-
Other motorized vehicles (e)	N. A.	N. A.	N. A.	N. A.	VKm	-

Abbreviations: SUM – Sum of underlying cells, VKm – Input data of total vehicle-kilometres estimated from various sources, N. A. – VKm estimates not available for vehicle group, b1 … b34 – distribution factors as described in table 4.2.

Table A.3. Road traffic on national territory by type and age of vehicle

	Road traffic by									
	Age of vehicle (years)									**TOTAL (1+2+3+4+5+6+7+8+9)**
	0 (1)	1 (2)	2 (3)	3 (4)	4-5 (5)	6-7 (6)	8-9 (7)	10-11 (8)	12 or more (9)	
	- Million vehicle-kilometres -									
Type of vehicle: Passenger cars	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	VKm
- petrol	VKm*c1	VKm*c2	VKm*c3	VKm*c4	VKm*c5	VKm*c6	VKm*c7	VKm*c8	VKm*c9	VKm
- diesel	VKm*c10	VKm*c11	VKm*c12	VKm*c13	VKm*c14	VKm*c15	VKm*c16	VKm*c17	VKm*c18	VKm
- other fuel	VKm*c19	VKm*20	VKm*c21	VKm*c22	VKm*c23	VKm*c24	VKm*c25	VKm*c26	VKm*c27	VKm
Buses and coaches	VKm*c28	VKm*29	VKm*c30	VKm*c31	VKm*c32	VKm*c33	VKm*c34	VKm*c35	VKm*c36	VKm
Motorcycles	VKm*c37	VKm*38	VKm*c39	VKm*c40	VKm*c41	VKm*c42	VKm*c43	VKm*c44	VKm*c45	VKm
Goods vehicles ≤ 6 tonnes	VKm*c46	VKm*47	VKm*c48	VKm*c49	VKm*c50	VKm*c51	VKm*c52	VKm*c53	VKm*c54	VKm
Goods vehicles > 6 tonnes	VKm*c55	VKm*56	VKm*c57	VKm*c58	VKm*c59	VKm*c60	VKm*c61	VKm*c62	VKm*c63	VKm

Abbreviations: SUM – Sum of underlying cells, VKm – Input data of total vehicle-kilometres estimated from various sources, c1 … c63 – distribution factors as described in table 4.3.

Table A.4a Road traffic on national territory by type of vehicle and age of driver (Male)

	Road traffic by					
	Age of driver - Male					TOTAL (1+2+3+4+5)
	< 18 years (1)	18 – 24 years (2)	25 – 34 years (3)	35 – 64 years (4)	65 + years (5)	
	- Million vehicle-kilometres -					
Type of vehicle:						
Passenger cars	VKm * d1a	VKm * d2a	VKm * d3a	VKm * d4a	VKm * d5a	VKm
Buses and coaches	VKm * d6a	VKm * d7a	VKm * d8a	VKm * d9a	VKm * d10a	VKm
Motorcycles and mopeds	SUM	SUM	SUM	SUM	SUM	VKm
- Motorcycles	VKm * d11a	VKm * d12a	VKm * d13a	VKm * d14a	VKm * d15a	VKm
- Mopeds	VKm * d16a	VKm * d17a	VKm * d18a	VKm * d19a	VKm * d20a	VKm
Goods vehicles	SUM	SUM	SUM	SUM	SUM	VKm
- Goods vehicles ≤ 3.5 tonnes	VKm * d21a	VKm * d22a	VKm * d23a	VKm * d24a	VKm * d25a	VKm
- Goods vehicles > 3.5 tonnes	VKm * d26a	VKm * d27a	VKm * d28a	VKm * d29a	VKm * d30a	VKm
Bicycles	VKm * d31a	VKm * d32a	VKm * d33a	VKm * d34a	VKm * d35a	VKm

Table A.4b Road traffic on national territory by type of vehicle and age of driver (Female)

	Road traffic by					
	Age of driver - Female					TOTAL (1+2+3+4+5)
	< 18 years (1)	18 – 24 years (2)	25 – 34 years (3)	35 – 64 years (4)	65 + years (5)	
	- Million vehicle-kilometres -					
Type of vehicle:						
Passenger cars	VKm * d1b	VKm * d2b	VKm * d3b	VKm * d4b	VKm * d5b	VKm
Buses and coaches	VKm * d6b	VKm * d7b	VKm * d8b	VKm * d9b	VKm * d10b	VKm
Motorcycles and mopeds	SUM	SUM	SUM	SUM	SUM	VKm
- Motorcycles	VKm * d11b	VKm * d12b	VKm * d13b	VKm * d14b	VKm * d15b	VKm
- Mopeds	VKm * d16b	VKm * d17b	VKm * d18b	VKm * d19b	VKm * d20b	VKm
Goods vehicles	SUM	SUM	SUM	SUM	SUM	VKm
- Goods vehicles ≤ 3.5 tonnes	VKm * d21b	VKm * d22b	VKm * d23b	VKm * d24b	VKm * d25b	VKm
- Goods vehicles > 3.5 tonnes	VKm * d26b	VKm * d27b	VKm * d28b	VKm * d29b	VKm * d30b	VKm
Bicycles	VKm * d31b	VKm * d32b	VKm * d33b	VKm * d34b	VKm * d35b	VKm

Abbreviations: SUM – Sum of underlying cells, VKm – Input data of total vehicle-kilometres estimated from various sources, d1a … d35a and d1b … d35b – distribution factors as described in table 4.4.

List of tables