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Road Traffic Performance in the Netherlands

Transmitted by Statistics Netherlands

Summary: Since 2004 Statistics Netherlands has been working on a new design for producing information on traffic performance by road vehicles. The design is split up in two parts: vehicles for goods transport and vehicles for passenger transport. Concerning goods transport the required information is obtained from the survey which is based on European Road Regulation 1172/98. The Dutch survey covers all company cars, including smaller vans.

Due to a Dutch legal act most passenger cars have to be inspected once a year by official service stations. These service stations record the number of kilometres of the inspected car each time and also at times of servicing and repair due to accidents. Statistics Netherlands buys this private database. There is no information on kilometres especially on Dutch territory. However, this information can be estimated by using models on traffic behaviour on tourism and business travels abroad.

Total vehicle kilometres can be calculated by combining both sources and estimations, without too much additional administrative burden. The compiled figures can be used for calculating total traffic performance in relation with other modes of transport and for environmental statistics, for example emissions as required in the Kyoto treaty.

Keywords: traffic performance, Road Regulation 1172/98, NAP-database, EUROSTAT exchange tables, Kyoto treaty, emissions.

1. INTRODUCTION

Due to the disappearance of some statistics at Statistics Netherlands there has been no more publication on traffic performance on Dutch roads since the year 2001. Until that time two different surveys were used to calculate road traffic performance. For business statistics a four-yearly survey was held to collect information. This included information about buses and smaller vans. The sample was relatively small, which caused some problems in reliability and continuity. Therefore, no details were published for this traffic category since 1994. For passenger transport a yearly panel survey was carried out. Both statistics used surveys with paper questionnaires to gather the essential information. The sampling unit was the vehicle, for which information was used from the Dutch Vehicle Registration (RDW-register). For business cars the last survey was held in 1999, for passenger cars the last year was 2000.

In earlier years the information of both surveys was combined and completed with estimations about traffic caused by foreign cars. For business cars this information was estimated from statistics on international trade by mode. For passenger cars information from tourism statistics was used to estimate the foreign part.

Information of all sources was put together and this total was related to traffic counts on governmental roads outside urban area. (See table 1).

Table 1. Total traffic performance by type of car, type of road and urbanisation.

Road traffic performance in the Netherlands 1996									
	Total	Light cars		Unarticulated vehicles		Articulated vehicles		Buses	Motorbikes
x mln km		Passenger cars	Small vans	Special vehicles	Lorries	Lorries + Trailers	Road tractor + semi trailers		
Total	110.778	89.661	11.769	327	2.927	875	3.138	646	1.435
Outside urban area	81.608	74.012		3.079		3.387		430	700
- Govnm. roads	47327	41.874		2.110		2.786		265	293
- Provinces	17618	16.231		663		416		106	202
- Other	16.662	15.907		306		185		59	205
Inside urban area	*29.171*	*27.418*		*175*		*626*		*216*	*735*

Information about traffic performance inside urban area was compiled by subtracting performance outside urban regions from the total traffic performance. For several years this worked very well. But from 1997 there was a negative figure for larger transport vehicles within urban regions. So, somewhere in the table there was an under or over estimation. Therefore, these figures were not published anymore.

In 2000, a major reorganization was carried out at Statistics Netherlands. The number of employees had to decrease and priorities were reorganized. Parallel to this some changes in policy urged for an overall decrease of administrative burden for companies. On 1 January 2004, a new statistical law was introduced in the Netherlands. From this date, Statistics Netherlands has the possibility to use all possibly available governmental registers. This also resulted in new

perspectives for compiling figures about traffic and transport, also in the field of statistics on traffic performance.

At the same time in 2004, several users of traffic performance data were pushing to set up a new system. They even promised financial support in some cases. Although the group of users is rather diverse the request is unanimous. Especially road performance information is wanted. The group of main users of the figures consists of:

1. Statistics Netherlands internal users for Statistics on Emissions and Energy Accounts.
2. Ministry of Transport and Water management for prognoses and policy on the amount of traffic and traffic accidents.
3. Ministry of Housing, spatial planning and the environment; especially for their study on calculations about stimulation scrap of older cars and stimulating buying cleaner, quieter and more efficient cars.
4. Netherlands Environmental Assessment Agency for research on spatial analyses, Traffic and Transport to deal with spatial structure, and the quality and spatial implications of the natural and human environment. Results are used to analyse and evaluate the consequences of Dutch environmental planning policy.

All these developments have lead to the installation of a project group to study the possibilities for new statistics on traffic performance in the broadest perspective. This paper describes the ongoing work of this group to re-establish statistics on traffic performance.
In paragraph 2 the total model for road traffic performance is shown, followed by the current Dutch method for calculating distances between two points of interest. In paragraph 3 the new procedure for traffic performance by goods transport vehicles is presented. This also includes estimates for foreign vehicles. In paragraph 4 the parallel procedures for passenger transport are described. The last paragraph shows plans for the future to stabilize the new model and to publish on a regular base.

2. POPULATION AND CALCULATION OF DISTANCES

Before examining figures about traffic performance it should be clear what part of the vehicles is included in the new model. Therefore a population of motorized vehicles was defined. From this point of view it was studied for which part of this population information could be gathered.

Table 2: Total motorized vehicle population with regards to traffic performance on roads.

Type of transport	**Type of vehicle by weight and age class.**	**Nationality**	
Goods	Small vans	NL	Foreign
	Lorries and road tractors	NL	Foreign
	Other large vehicles	NL	Foreign
Passengers	Cars	NL	Foreign
	Buses	NL	Foreign
	Motorcycles	NL	Foreign
	Mopeds	NL	Foreign

Concerning the above mentioned population some primarily exclusions were defined, namely

- All cars in use by the Royal Family;
- All cars from the Corps Diplomatique;
- All military cars;
- All cars used for agricultural purposes.

For these cars an estimate will be made at a later stade.
The gathering of information from vehicles shown in table 2 in Italics should cause some major problems.
Another exclusion is passenger transport for subway, light rail and trams. Traffic performance for this type of transport is not yet observed.

2.1 Calculating distances

For information on traffic performance the primary variable is of course the distance covered by the vehicle between two points of interest. Concerning distance two types are of great importance. First off all, the total distance of the journey. Secondly, the distance travelled on Dutch territory in case of international transport and transit (and even in some cases of cabotage and cross trade). For calculating distance between two points Statistics Netherlands developed the following own method.

In case a road network is used with well known segments between the nodes in the network, the appropriate distance can be calculated using a derivative of the widely spread Dijkstra´s Algorithm. However, at this moment there is no capacity to implement this algorithm. Instead of calculating every distance separately, two existing basic distance tables are used.

- One detailed matrix for national transport. This matrix is based on postal codes at community-level and contains (780 x 780)/2 = 304200 cells.

- One for international traffic based on NUTS3 area's in Europe. For the 25 EU countries and regions in non-EU-countries a matrix of about (1300 x1300)/2 = 845000 distances is used. These distances have been calculated by a commercial firm and stored in a database. For each NUTS-region the major city is used for distance calculations.

In bilateral traffic between the Netherlands and a place outside the Netherlands, only 50000 relations can be retrieved directly from the database: 40 NUTS regions in NL * 1260 gives approximately 50000 relations. For better understanding: only 1260 locations have a connection with a NUTS region in the Netherlands. In the location database however, there are over 300,000 locations.

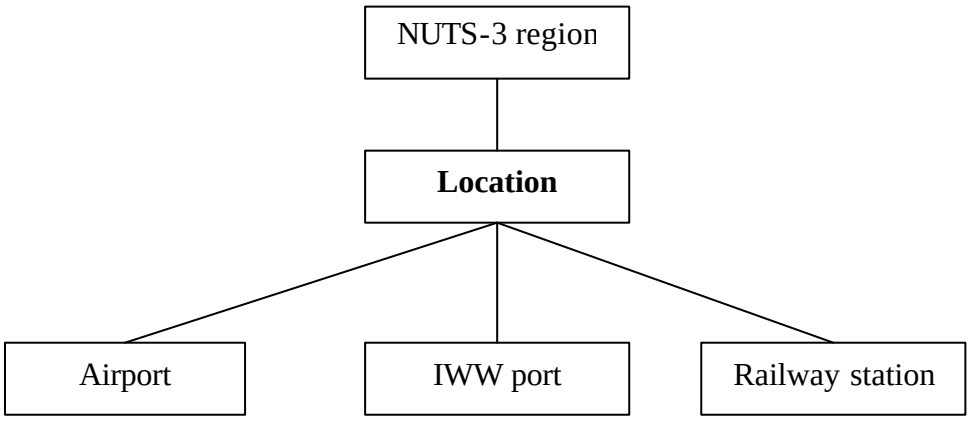
All locations are mapped to the NUTS-3 classification and for most of the locations, but not necessarily all, the coordinates (latitude and longitude) are known.

Locations that lack this information inherit latitude and longitude from either "neighbour" locations in the same NUTS-region or, if present, from "children" in the classification.

"Children" in this context are railway stations, inland waterway ports and airports. These location types are mapped to the NUTS region through the "neutral" concept "location". Each location can have one ore more children. The location without coordinates inherits the average of the coordinates of the children. To get the best results, the most effort is put in locations that occur

frequently in the data. For these locations, the coordinates are assumed to be of a better quality than the more distant or rare ones.

Figure 1: Relation between location types



In case coordinates for location pairs are available, it is possible to calculate the direct distance (as the crow flies) between two locations.
This leads to the straightforward algorithm to estimate the distance for all location pairs.
steps:

1. Find a location pair (A_m and Z_m) in the distance matrix that is identical with the location pair A and Z or that matches the most with A and Z. Subsequently, use this distance (Matrix distance A_mZ_m). Matching is based on shortest distance using the latitude and longitude.
2. Determine for both pairs (AZ and A_mZ_m) the most direct route distance (Direct Distance AZ and Direct Distance A_mZ_m).
3. Use the relative difference between AZ and A_mZ_m to correct the matrix distance. If the two pairs are identical the correction factor is 1.

$$\text{Distance AZ} = \frac{\text{Direct Distance AZ}}{\text{Direct Distance } A_mZ_m} * \text{Matrix Distance } A_mZ_m$$

The described method is of course not as accurate as the most versatile algorithms. However, for statistical purposes it gives distances between two places in Europe within an average margin of 5%. Even if a natural barrier lies between two locations such as a lake or a river, the method gives satisfying distances. The basic matrix contains distances of the real road network.
The above explained method is also used for calculating the distance on Dutch territory. However, this can only be done in case the point(s) of border-crossing are available. At this moment this information is only available for goods transport vehicles. More to this calculation in paragraph 3.2.

3. TRAFFIC PERFORMANCE FOR GOODS TRANSPORT VEHICLES.

For goods transport traffic performance statistics are based on two different sources, namely:

1. Information from the Dutch road transport survey according to Road Regulation 1172/98;
2. Estimates for foreign vehicles based on Eurostat information.

In 2003, a new road transport questionnaire was introduced in the Netherlands. The trigger for the change was the new European Regulation 1172/98 for statistics on road transport. Additional to all mandatory variables some extra variables were put into the questionnaire. For example, the point of border-crossing was added to the questionnaire to be able to make estimates about vehicle kilometres on Dutch territory. For many years, an average distance of 105 kilometres was used in case of international transport. The point of border crossing in the new questionnaire offered the opportunity to make more realistic estimates.

3.1 Data-sources

Figures about traffic performance in case of goods transport are derived from Dutch as well as from foreign road transport statistics mainly based on Regulation 1172/98. For the Netherlands, there is a complete view for the use of company cars, also for smaller vans and company cars not suitable for transport. This special category of vehicles is included in the regular survey. However, the questionnaire in case of these vehicles is not as extensive as the one for larger company cars. The survey for these special vehicles is on a voluntary base and encompasses approximately 2% of the respective population (for questionnaire see Annex A). However, EUROSTAT receives only information from vehicles appropriate for transport with loading capacity above 2 tonnes.

So, apart from the total view on Dutch company cars, the problem was how to calculate traffic performance for foreign company cars using Dutch roads. For this part, information from the NEW CRONOS database about loaded and unloaded tonnes in the Netherlands was used to estimate traffic performance for the year 2003. The relative proportion of foreign tonnes loaded and unloaded (concerning the Netherlands) to Dutch tonnes in international transport was used to complete information about traffic performance by foreign vehicles. Also some additional extra estimates were made for traffic from outside European Member States. The enlargement of the European Union urges New Members to fulfil the request according to Regulation 1172/98. This will hopefully result in better estimates for the total traffic performance from the year 2004.
In case of an international journey 105 kilometres is used as the average distance on Dutch territory. This number was the outcome of an analysis in the eighties. This distance is also used for cross trade by foreign companies in relation with the Netherlands. The following comprehensive table shows possible relations and flows of interest for calculating traffic performance on Dutch roads. Information about travelled kilometres is not available and usable for all flows.

Table 3: Distances for traffic flows in relation with Dutch territory

.	Dutch vehicles	Foreign vehicles
National transport	Distance NL	Distance NL
International bilateral	105 km	105 km
Cabotage	? (possible transit)	Distance NL
Cross trade	? (possible transit)	105 km
Transit	?	?

Due to the fact that tonnes loaded and unloaded are not really a good help in estimating vehicle kilometres and because there still are some gaps in observation (see table 3), it was decided to study the exchange of other Eurostat data, the D-tables. These tables consists of information on vehicle kilometres (laden and empty) including cabotage, cross trade and transit. So, in future these tables will for this purpose be preferred above data from NEW CRONOS about loaded and unloaded goods. However, there is still the problem of underestimation because of the

lack of information on foreign smaller company vehicles. Furthermore, an essential part of traffic from foreign vehicles from outside EU is still missing.
The chosen mean distance of 105 kilometres caused a lot of discussion within the Netherlands. Therefore, a study was initiated in 2005, which is presented in the next subparagraph.

3.2 Average distance on Dutch territory.

For calculating the mean distance on Dutch territory a new model is used which is based on information about border crossing from the road transport survey. Nevertheless, the point of border crossing is an optional variable; a lot of information can be gained from the road survey. For setting up a new model information on place of loading and unloading, NUTS 3 level is used. For the Netherlands, there are 40 regions on this level. These are combined with 97 appropriate regions outside the country to build up an OD-matrix. This leads to 3880 cells. However, information on border crossing is not available for every cell in the survey data. For the year 2003 there was information about at least one point of border crossing for 2368 cells. Cells for which no information was available were collapsed with relative comparable cells.
For every usable cell within the matrix the frequency of border crossing points is derived from Dutch international bilateral journeys. According to these frequencies a chance model is built up for every pair. By using this chance model a point of border crossing can be estimated for all pairs for which this information is missing. In this way, the border crossing point is imputated in the road survey records. Because of the fact that every Dutch border crossing point is added to the distance matrix (see paragraph 2.1), every record could be completed with the distance travelled on Dutch territory. This process is repeated many times to calculate the effect of imputation. After imputation of the border-crossing point, an overall mean distance can be estimated at any time by:

$$\bar{a} = \frac{\sum_{i=1}^{N} (f_i * r_i * a_i)}{\sum_{i=1}^{N} (f_i * r_i)}$$

f = weighting factor
r = number of identical journeys
a = distance within the Netherlands
N = number of journeys that fit into the model

This model can be used for Dutch and foreign data about international transport and for cross trade by foreigners. The distance in case of cabotage by foreign vehicles is measured by the inland distance. Cabotage and cross trade by Dutch vehicles could be treated as transit. For this last category a study is started.
First calculations show that the applied 105 kilometres as an average distance is too high. The new calculated distance lies between 90 and 96 kilometres. So, by using this new distance the total traffic performance by company cars will decrease. At this moment new calculations are made for 2004. According to the outcome all time series have to be adapted to the new estimates.

4. PASSENGER TRANSPORT

Since the year 2001, there were no data sources available for passenger transport. In earlier years there was a vehicle based panel survey and a motorbike survey from which vehicle kilometres could be estimated. Information about vehicle kilometres in case of transport by buses was derived from a 4-yearly additional survey among company cars.
At this moment, Statistics Netherlands is analyzing a database which is bought from a private foundation NAP (Stichting Nationale AutoPas). This foundation covers the branches of car service stations in the Netherlands. These service stations note the number of kilometres at a certain time for all vehicles. It includes information from passenger cars, motorbikes and buses. The information is gathered during the yearly obligatory service turn of vehicles older than or equal to three years. The information is also provided in case of an unexpected service turn to repair damage due to accidents.

Statistics Netherlands will receive information from a sample of approximately 500,000 vehicles with their number of kilometres since the year 2000. Statistics Netherlands created this sample by using the available Dutch Vehicle Registration (RDW). Therefore, the next steps were carried out:

1. Stratify the total registered vehicle population by type of vehicle first according to passenger cars, buses and motorbikes.
2. Stratify in the next step according to fuel type (petrol, diesel and LPG), age class, weight class and region (province).

For every stratum the sampling was carried out and the registration numbers of the vehicles (License plate numbers) were sent to the NAP. They will return the dataset inclusive of the numbers of kilometres for every vehicle at several specific moments in time. From this information, the total number of kilometres could be estimated for every year. So, this leads to total traffic performance for vehicles in use for Dutch passenger transport.

Additional information about traffic performance by mopeds is derived from the Dutch mobility household survey, which is held by the Ministry of Transport and Water management. This survey is not used for other vehicles because of the lack of information about technical aspects of the vehicles. In case of mopeds, this is not a major problem.

Concluding, still two additional estimates for passenger transport vehicles should follow this analysis. First, the number of kilometres on Dutch territory for all Dutch passenger vehicles should be estimated. Secondly, additional estimates for foreigners on Dutch territory should complete the total traffic performance on Dutch roads.

5. FUTURE PLANS

In future the Dutch model could be extended and refined by solving some lack of information. The easiest way would be to state some legal acts as well for goods as for passenger traffic. However, this is a very difficult way as well on national as on European level. Nevertheless, the following sub-paragraphs give an overview of the work that still should be carried out. Also some wishes and recommendations are pointed out to increase the quality of figures about road traffic performance.

5.1 Goods transport

Statistics Netherlands would be interested in using the so called exchangeable D-tables according to Regulation 1172/98 from EUROSTAT for calculating traffic performance. From these tables, almost all inland and international traffic in relation to a Member State can be subtracted. The tables give a complete view of traffic because also empty journeys, cabotage, cross trade and transit are included for every Member State. The only problems are smaller vans, because of the simple fact that they are not covered by the Regulation.

Information about traffic performance on national territory is used to compile figures about emissions and pollution. This information is requested to establish whether a country is in line with the Kyoto Treaty or not. So, to raise the quality of this information, it would be very desirable to complete the figures about traffic performance with information about the weight class or loading capacity, axle configuration or age class of the vehicles used.
Concluding the topic of traffic performance by company cars Statistics Netherlands would be pleased if EUROSTAT would be willing to:

1. request all Member States to join the data exchange of D-tables.
2. add some extra variables to the D-tables to be able to split up traffic performance according to weight classes, age classes and possibly axle configuration.

5.2 Passenger transport

For passenger transport, a primary study will focus on setting up a model for distances travelled on Dutch territory by Dutch vehicles. This study will be carried out at the end of 2005 and during the first months of 2006. Probably, information from several tourism statistics will be used to make estimates of kilometres travelled abroad by Dutch people for holiday purposes. Additionally, the study will be enlarged by analyzing information about occasional business travels at borderlines. These two parts of information must be combined with the information from the NAP vehicle database. This will hopefully lead to figures about the distance travelled on Dutch territory by Dutch people on a yearly base.

The last step in completing figures on traffic performance concerns foreigners travelling in the Netherlands. For this purpose, information about incoming tourism will be examined. Additional to the mentioned study, a further search for extra data sources will be started. In this case, maybe the European project Dateline could eventually lead to extra information.

5.3 Conclusions

In spite of the problems faced during the last years, there is a good perspective for new figures on road traffic performance in the Netherlands. It will probably last some time to setup new tables in relation with traffic counts. However, the need for complete basic information is essential.

Regular study of methodologies in other Member States can be of great help. Due to the fact that the European Commission and United Nations require information on traffic performance, an international legal act would be appreciated. The freight transport sector is almost covered by European legal acts. For passenger transport this would also be of great help.

ANNEX A

Statistics Netherlands

Survey company vehicles

Type of vehicle: **pre-printed**
Number of License plate: **pre-printed**

Please return questionnaire within 14 days after survey week

Please fill in for survey week, unless otherwise specified 43 (24-29 th October) 2005)

1. Do you still use the vehicle with above specified number? ☐ yes ☐ no
   If not, end of survey. Please return questionnaire!

2. Is the vehicle:
   - property? ☐ yes ☐ no
   - hired? ☐ yes ☐ no
   - leased? ☐ yes ☐ no

3. Was the vehicle in use during the survey week? ☐ yes ☐ no
   If no, end of survey. Please return questionnaire!

	Total	Off which, outside NL
4. How many kilometres has the vehicle driven during the survey week?	☐ km	☐ km
5. How many litres of fuel uses the vehicle for a distance of 100 km in average over a year?	☐ litres	

6. Was the vehicle in use only on private ground (building area, airport) during ☐ yes ☐ no
   If yes, end of survey. Please return questionnaire!

7. What was the main purpose for use of the vehicle (**please chose only one category**):
   - ☐ Public
   - ☐ Other services
   - ☐ Parcel service/postal transport
   - ☐ Goods transport
   - ☐ Animal transport
   - ☐ Passenger
   - ☐ Privat transport **If yes, end of survey**
   - ☐ Others, please specify:

8. Did you use a license for hire and reward or for own account to drive with the
   a. Hire and reward ☐ yes ☐ no
   b. Own account ☐ yes ☐ no

9. How many laden journeys were made during the survey week? ☐

10. How many empty journeys were made during the survey week? ☐

11. Where was the vehicle mainly used during survey week?
    (**please chose one or more categories)**

☐ Groningen	☐ Noord-Holland
☐ Friesland	☐ Zuid-Holland
☐ Drenthe	☐ Zeeland
☐ Overijssel	☐ Noord-Brabant
☐ Gelderland	☐ Limburg
☐ Flevoland	☐ More than 4
☐ Utrecht	☐ Outside NL