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Uncertainty Estimates and Guidance for Road Transport Emission Calculations

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Executive Summary

This is the final report of the study entitled "Uncertainty estimates and guidance for road transport emission calculations performed by EMISIA[1] (www.emisia.com) on behalf of the Joint Research Centre. This study had the following objectives:

1. Evaluate the uncertainty linked with the various input parameters of the COPERT 4 model,
2. assess the uncertainty of road transport emissions in two test cases, at national level,
3. include these uncertainty estimates in the COPERT 4 model, and
4. prepare guidance on the assessment of uncertainty for the Tier 3 methods (COPERT 4) and to provide uncertainty estimates for the Tier 2 method, to be included in the road transport chapter of the AEIG.

The uncertainty analysis covers CO, VOC, NOx, PM10 (including exhaust, tyre, and break wear), fuel consumption and GHGs (CO_2, CH_4 and N_2O). The approach and the results to meet these four objectives are presented in this report. Two countries were selected for the analysis. One was Italy, since this is a country with very good road transport and vehicle stock statistics, down to technology level. The intention with selecting Italy was to estimate total model uncertainty when input uncertainty is at a minimum. The other country was Poland, as an example of country with less detailed vehicle stock statistics. Poland has a very good knowledge of the total stock of vehicles but information on the classification to vehicle technologies is more scarce, as Poland relatively recently became fully aligned to the European type-approval system. Therefore, Poland represents one of the countries with a certain range in its input data. Comparison of Italy and Poland can provide a measure of the model uncertainty induced by the input data.

Uncertainty of model items

The model output uncertainty depends on the uncertainty of the model internal parameters and the uncertainty of the input data (both referred to as items). Both have been quantified in detail in this study (chapter 2). In total, the uncertainty of 22 different items was quantified (Table 1), with several of them consisting of large matrices of uncertainty indicators. For example, the uncertainty of hot emission factors appears as one item in Table 1 but this consists of 8 pollutants, 14 speed classes, and 241 vehicle technologies, i.e. a total of 26992 individual standard deviation values that had to be assessed.

The estimation of the uncertainty of the internal parameters (emission factors) has been based on experimental data. For hot emission factors and fuel consumption, log-normal probability distributions were developed around the factors for fourteen different speed classes. In the absence of robust experimental data for cold start, the standard deviation over mean of the hot emission factors has been also used for cold-start ones, also assuming log-normal probability functions.

The uncertainty of the stock data has been assessed by collecting information from different sources and by building detailed models to disseminate this uncertainty down to technology level. The details of the models are given in chapter 2. In Italy, the uncertainty in the stock was limited and originated from the allocation of some unidentified vehicles to the different classes, as well as uncertainty in the allocation of heavy duty vehicles to the different weight categories. In Poland, uncertainty also incurred due to the unknown age distribution of vehicles. The age distribution of all categories was modeled by a Weibull function within given age distribution boundaries.

[1] The first 4 authors, i.e. Charis Kouridis, Dimitrios Gkatzoflias, Ioannis Kioutsioukis, Leonidas Ntziachristos are affiliated to Emisia.

Table 1: Summary of COPERT items (input variables or internal parameters) for which uncertainty has been assessed.

Item	Description	Item	Description
Ncat	Vehicle population at category level	LFHDV	Load Factor
Nsub	Vehicle population at sub-category level	tmin	Average min monthly temperature
Ntech	Vehicle population at technology level	tmax	Average max monthly temperature
Mtech	Annual mileage	Mm,tech	Mean fleet mileage
UStech	Urban share	RVP	Fuel reid vapour pressure
Hstech	Highway share	H:C	Hydrogen-to-carbon ratio
RStech	Rural share	O:C	Oxygen-to-carbon ratio
USPtech	Urban speed	S	Sulfur level in fuel
HSPtech	Highway speed	ehot, tech	Hot emission factor
RSPtech	Rural speed	ecold/ehot,tech	Cold-start emission factor
Ltrip	Mean trip length	b	Cold-trip distance

Mileage uncertainty has been also assessed by collecting information from different sources. However, mileage is one of the so-called 'soft' parameters, i.e. it is one of the first values to tune in order to come up with the statistical fuel consumption value. Of particular importance was to estimate the function of annual mileage with vehicle age. This was also approached with a Weibull function of age. The boundaries of this function were assessed on the basis of information collected from different countries (8 countries in total). The range of functions collected was assumed as a good indicator of the age function uncertainty.

Finally, the uncertainty of other parameters and variables (speeds, shares, temperatures, etc.) was assessed on the basis of data, where available, or were approximated with best guesses when no other information was available.

Approach for uncertainty and sensitivity analysis

Various methods are available to evaluate the model output uncertainty and quantify the importance of the input factors. The selection of the appropriate method is a function of the system's uncertainty and the stakes involved. For the case of models with a direct policy orientation like COPERT, global sensitivity analysis methods are preferable. The global sensitivity analysis methods involve multiple evaluations of the model where the input factors are selected according to specific sampling strategies. Here, we have adopted variance-based techniques that display a number of attractive features like the exploration of the whole range of variation of the input factors and the consideration of interaction effects. The design of the sensitivity experiment as well as the concept of parameterization of the whole range of input uncertainty to a limited number of input factors are introduced in chapter 3.

In principle, the analysis has been performed in two steps. First, a screening analysis (Morris) identified the most influential input parameters. Then, a variance based sensitivity analysis technique (FAST) quantified the uncertainty of the road transport emissions.

Fifty-one uncertainty inputs were finally introduced in the screening tests of COPERT 4 uncertainty. These 51 inputs were produced from the 22 items in Table 1. The reason for this number increase is because models have been used for some of the items, which require more than one inputs to model. For example, the modelling of Ntech requires two inputs (Beta and Tau). Similarly, modelling of tmin requires three inputs (A, H, and d), and so on. The uncertainty inputs are classified as follows:

(a) Four inputs corresponding to meteorological and temporal parameters: three related to the temperature time series (*A*, *H, d)* and one for the Reid Vapour Pressure *(eRVP)*.

(b) Fifteen inputs corresponding to activity and traffic: nine related to the fleet breakdown model (*PC, LDV, HDV, UB, MOP, MOT,* τ, δ, and σ) and six to the parameterization of the annual mileage (*milPC, milLDV, milHDV, milUB, milMO, eM0*).

(c) Thirty inputs corresponding to model parameters: ten related to the urban and highway driving shares (Rural is calculated from the residuals) (*UPC, ULDV, UHDV, UUB, UMO, HPC, HLDV, HHDV, HUB, HMO*), fifteen related to the velocity profiles per category under all driving modes (*VUPC, VULDV, VUHDV, VUUB, VUMO, VRPC, VRLDV, VRHDV, VRUB, VRMO, VHPC, VHLDV, VHHDV, VHUB, VHMO*), one for the Load factor of the Heavy Duty Vehicles (*LF*), one for the average trip length (*ltrip*) and three for the fuel properties (*H2C, O2C, S*).

(d) Two parameters corresponding to experimental data: one for the hot emission factors (e_{EF}) and one for the cold emission factors (eEFratio).

The exact application and the error ranges of these 51 uncertainty inputs is given in Chapter 3 of this report.

Software implementation

The COPERT 4 software was modified in order to be able to execute the Mont Carlo simulations. All software modifications were conducted after the original software and calculations were performed. This makes sure that all COPERT 4 calculations were performed as in the original software. Chapter 4 describes the software application that was used for the implementation of this project. Specifically it is discussed how COPERT 4 application was modified and customized for the needs of this project. Then the new user interface is presented. Also detailed instructions are cited on how the user can fill the necessary data and how to use the software in order to complete all the necessary steps.

Results

The procedure to estimate the uncertainty of the inventory for the two countries as well as its sensitivity to the different variables was examined in a three major steps process. First, the screening test identified the influential from the non-influential variables. In the case of Italy 16 items were identified and were found responsible for ~90% of the total uncertainty. Seventeen items had to be selected in the case of Poland and where responsible again for ~90% of the total uncertainty. In both cases, the emission factors and the cold-start overemission were identified as influential ones. In the case of Italy for which a robust input dataset is available, these two items explained most of the uncertainty. Other items of significance were the population of different vehicle categories and their annual mileage, and the travelling speed of passenger cars. In Poland, emission factors and cold start overemissions were also influential variables but explained much less of the uncertainty of the total calculation. User-defined variables such as the distinction of vehicles to different types and technologies, the mileage function with age, the mean trip distance, etc. were responsible for most of the uncertainty of the total calculation.

At a second step, the uncertainty of the total emission inventory was assessed by means of an integrated uncertainty analysis. About 6000 runs by varying the values of the influential items were prepared for each of the countries and were simulated with COPERT 4. This produced the total variance of the model output. However, these simulations also led to calculated fuel consumption values which substantially deviated from the statistical fuel consumption values reported by the countries. In a real application of the COPERT 4 software, these results would not have been acceptable by the inventory compiler. Therefore, the model output variance calculated in this way is much larger than the variance that would be acceptable in real application of the software. Therefore, as a third step, a filtered uncertainty analysis was performed where only the runs producing a fuel consumption within a plus/minus standard deviation from the statistical fuel consumption were kept. This led to a decreased but more realistic uncertainty of the results.

Table 2 summarizes the results of the simulations. The following remarks may be drawn from the comparison:

Table 2: Summary of coefficients of variation for Poland and Italy. Two cases are shown, one w/o correction for fuel consumption, and one with correction for fuel consumption

Case	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{ex}	FC	CO_2	CO_{2e}
Italy w/o FC	30	18	44	15	33	13	13	14	7	7	7
Italy w. FC	19	12	34	10	26	9	8	9	3	4	4
Poland w/o FC	20	18	57	17	28	18	17	19	11	11	12
Poland w. FC	17	15	54	12	24	13	12	14	8	8	8

(a) The most uncertain emissions calculations are for CH_4 and N_2O followed by CO. For CH_4 and N_2O it is either the hot or the cold emission factor variance which explains most of the uncertainty. However, in all cases, the initial mileage value considered for each technology class is a significant user-defined parameter, that explains much of the variance. Definition of mileage functions of age is therefore significant to reduce the uncertainty of those pollutants.

(b) CO_2 is calculated with the least uncertainty, as it directly depends on fuel consumption. It is followed by NOx and PM2.5 which are calculated with a coefficient of variance of less than 15%. The reason is that these pollutants are dominated by diesel vehicles, with emission factors which are less variable than gasoline ones.

(c) The correction for fuel consumption within plus/minus one standard deviation of the official value is very critical as it significantly reduces the uncertainty of the calculation in all pollutants. Therefore, good knowledge of the statistical fuel consumption (per fuel type) and comparison with the calculated fuel consumption is necessary to improve the quality of the inventories. Particular attention should be given when dealing with the black market of fuel and road transport fuel used for other uses (e.g. off-road applications).

(d) The relative level of variance in Poland appears lower than Italy in some pollutants (CO, N_2O), despite the allocation to vehicle technologies in Poland is not well known compared to Italy. This is for three reasons, (a) the stock of Poland is older than the Italian one and the variance of the emission factors of older technologies was smaller than new technologies, (b) the colder conditions in Poland make the cold-start of older technologies to be dominant, (c) partially this is an artefact of the method as the uncertainty was not possible to be quantified for the emission factors of some older vehicle technologies. As a result, the uncertainty of the Polish calculation which is shifted to older technologies may have been artificially reduced.

(e) Despite the relatively larger uncertainty in CH_4 and N_2O emissions, the uncertainty in total Greenhouse Gas emissions (CO_{2e}) is dominated by CO_2 emissions in both countries. Therefore, improving the emission factors of N_2O and CH_4 would not offer an improved calculation of total GHG emissions. This may change in the future as CO_2 emissions from road transportation decrease.

Guidebook update

The results of this study as well as the recommendations were transferred to the road transport chapter of the EMEP/EEA Air Pollutant Emissions Inventory, in section "4.5 Uncertainty Assessment".

1 Introduction

1.1 Project ID

This is the final report of the project entitled "Uncertainty estimates and guidance for road transport emission calculations". The project was initiated in December 17, 2008 and lasted for nine months. The final report includes the method, the uncertainty of the input data, the final results, and recommendations for the EMEP/EEA air pollutant emission inventory guidebook.

1.2 Background

Road-transport is a significant source of air pollution and greenhouse gas emissions. According to European Environment Agency data, road transport is responsible for 22.4%, 39.8%, 42.7% and 16.2% of total CO_2, NOx, CO and PM10 emitted in the EEA32 territory. Since many years the European Commission (EC) has been defining and implementing policies which aim at organising and controlling transport in such a manner that it services its purpose with minimum impacts. Key policy papers in this respect are:

- 2001 National Emission Ceilings Directive (2001/81/EC)
- 2002 Sixth Environment Action Programme
- 2005 Green Paper on Energy Efficiency
- 2005 Thematic Strategy on Air Pollution (COM(2005)446)
- 2005 Directive on Ambient Air Quality and Cleaner Air for Europe (COM(2005)447)
- 2009 Reducing CO_2 emissions from light-duty vehicles (Regulation (EC) No 443/2009)

Based on these policy papers a package of measures and initiatives have been adopted in recent years, e.g. as laid down in the papers related to the Community strategy on CO_2 Emission Reduction from Passenger Cars, the Clean Air for Europe (CAFÉ) Programme, the Action Plan for Energy Efficiency, the European Climate Change Programme (ECCP) and so on. These packages contain bundles of individual measures.

As part of these key policies, the European Commission and the Council have set forward a Directive which sets National Emission Ceilings (NECD – 2001/81/EC) to regulate the total amount of pollutants that can be produced annually in each country, which targets year 2010. The Commission is also working on the revision of this directive, which would target year 2020 and the inclusion of PM2.5 ceilings.

The first step in assessing the impact of different policies is to establish an accurate picture of today's emission inventories. Detailed models are used in different member states to estimate the contribution of road-transport to total emissions. Austria uses GLOBEMI, Finland uses LIPASTO, Germany uses TREMOD, the Netherlands uses VERSIT+ and Sweden uses a specially developed ARTEMIS version. However, most of the European countries (22 out of the 27) use the COPERT model which has been developed as a cooperative effort from many research institutes around Europe. COPERT is also part of the EMEP/EEA Air Emissions Inventory Guidebook while COPERT-derived emission factors of greenhouse gases are also used in the IPCC 2006 revised guidelines. The development of COPERT has been supported by the European Environment Agency through funds delivered via the European Topic Centre on Air and Climate Change. COPERT is also part of the TREMOVE software which is used by the European Commission to provide input to impact assessment studies related to transport policy measures. Recently, the Joint Research Centre / Institute for Environment and Sustainability have clearly demonstrated their interest in further promoting the scientific value of COPERT.

1.3 COPERT 4

COPERT is a software programme that is based on a methodology to estimate vehicle fleet emissions on a country-level. The methodology tries to balance the need for detailed emission calculations on one hand and use of few input data on the other. Three different modes of emissions are taken into account, that is hot emissions, cold-start emissions, and emissions due to gasoline evaporation. The latest COPERT 4 version (7.0) also includes non-exhaust PM emissions (tyre, break). COPERT methodology consists of vehicle-specific emission factors which are combined with activity data to calculate total emissions. The main activity data comprise number of vehicles distinguished into different emission categories/technologies, the travelling speed under urban, rural and highway conditions and the mileage driven over the same driving conditions. The main methodological elements of COPERT have been developed in the framework of several scientific projects, including:

- The CORINAIR Working Group on Emissions Factors for Calculating 1985 Emissions from Road Traffic (Eggleston S., N. Gorißen, R. Joumard, R.C. Rijkeboer, Z. Samaras and K.-H. Zierock (1989), Volume 1: Methodology and Emission Factors).

- The CORINAIR Working Group on Emissions Factors for Calculating 1990 Emissions from Road Traffic (Eggleston S., D. Gaudioso, N. Gorißen, R. Joumard, R.C. Rijkeboer, Z. Samaras and K.-H. Zierock (1993), Volume 1: Methodology and Emission Factors).

- The COST 319 action on The Estimation of Emissions from Transport

- MEET (Methodologies to Estimate Emissions from Transport), a European Commission (DG VII) sponsored project in the framework of the 4th Framework Programme in the area of Transport

- The Inspection and Maintenance programme, a European Commission (DG XI, DG VII, DG XVII) sponsored project in the framework of the 4th Framework Programme in the area of Transport

- The European Commission (DG Transport) ARTEMIS project, which was funded to develop a new database of emission factors of gaseous pollutants from transport (http://www.trl.co.uk/artemis).

- The European Commission (DG Transport) PARTICULATES project, which was funded to develop a new database of PM emission factors and particle characteristics of exhaust emissions from road transport (http://lat.eng.auth.gr/particulates).

- A European Commission (DG Enterprise) study on potential options for emission standards of Euro 3 mopeds

- The joint EUCAR/JRC/CONCAWE programme on the effects of gasoline vapour pressure and ethanol content on evaporative emissions from modern cars.

Over the last 8 years, Emisia personnel, through their link to the Laboratory of Applied Thermodynamics, are responsible for the maintenance and further development of COPERT and the road transport methodology chapter of the EMEP/EEA Air Emission Inventory Guidebook.

1.4 Uncertainty estimations

As COPERT is used from many countries for the reporting of official information in the framework of UNFCCC and CLRTAP, there is an increasing need to calculate uncertainties related to the development of the emission inventory.

The 2006 revised IPCC guidelines explicitly consider that "it is good practice to uncertainty estimation to confirm that calculations are correct and data and calculations well documented". There is also a separate General Guidance chapter on Uncertainty characterisation. This chapter generally considers two methods for uncertainty

characterisation, namely the error propagation analysis (for non-complex models) and the Monte-Carlo simulations (for complex models). The chapter also in detail defines uncertainties related to the conceptualisation of the inventory and the model uncertainty, in case that a model has been used to make calculations. The conceptualisation uncertainty is linked to the inherent structure of the inventory approach and it is difficult to quantify with conventional statistical methods. The model uncertainty is associated with how the conceptualisation of a process has been transferred to the model. This is again difficult to quantify by typical statistical methods and expert judgement is necessary to estimate uncertainty.

In addition, the UNECE Guidelines for Estimating and Reporting Emission Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/2008/4) mandate Parties to "quantify uncertainties in their emission estimates using the most appropriate methodologies available, taking into account guidance provided in the Guidebook. Uncertainties should be described in the IIR." (section B.24). Therefore, appropriate guidance and tools to quantify uncertainty of national road transport emission inventories are required.

In the past, JRC has participated in the ARTEMIS project with the main goal to identify the sources of uncertainties in COPERT III and to make quantitative statements about the error ranges of emission estimates (Kioutsioukis et al., 2004). The characterisation of uncertainty was based on Monte Carlo simulations, using appropriate assumptions for the variability of emission factors and input data. In that work, influential and less influential variables were identified by means of a sensitivity analysis and global uncertainty ranges were calculated. Since 2004, when this study was completed, a great deal of elements have changed on COPERT, including inter alia, emission factors for post-Euro 2 vehicle technologies, a new evaporation methodology based on an extended database of evaporation measurements, non-exhaust PM emission factors, N_2O and NH3 emission factors, and others. Therefore, there is a clear need to update these Monte Carlo simulations, taking into account new experimental and variability information available.

It should be made clear that the current study does not address neither conceptualisation nor model uncertainty, as both can only be addressed with expert judgment or, more effectively, by conducting further experimental campaigns to understand the fundamentals of vehicle emissions. Hence, the COPERT 4 model is considered unchanged and the Monte-Carlo simulation is applied on the given model structure.

1.5 Objectives of the study

The objectives of this study were the following:

- Evaluate the uncertainty linked with the various input parameters of the COPERT 4 model.
- Assess the uncertainty of road transport emissions in two test cases, at national level.
- Include these uncertainty estimates in the COPERT 4 model
- Prepare guidance on the assessment of uncertainty for the Tier 3 methods (COPERT 4) and to provide uncertainty estimates for the Tier 2 method, to be included in the road transport chapter of the AEIG.

2 Uncertainty ranges of input data and modelling variables

2.1 General

This chapter presents a description of the input and internal variables and parameters to COPERT. All data are presented in a tabulated form, where the use, range and hints for the quantification of the variability are given. In the sensitivity and uncertainty calculations performed, input data and internal variables were treated in the same way, i.e. they both contribute to the uncertainty of the total calculation in the same manner. For purely clarification reasons, we split in this chapter the input data and variables in three individual sections, one discussing the uncertainty in the calculation of the vehicle stock, one that discusses the uncertainty of the emission factors, and a last one discussing the uncertainty of other variables and parameters.

The uncertainty has been calculated for year 2005 in the cases of Italy and Poland. Year 2005 was selected as this is a rather recent year, in the sense that uncertainty calculations for the Year 2005 should be similar to today. On the other hand, it is already old enough so all relevant databases with information should have been updated for the particular year. It should be repeated that this project was initiated in 2008. The selection of Italy and Poland was made in an effort to simulate two cases, one with detailed statistical information (Italy) and another one with more poor data (Poland). The latter is a consequence of the fact that eastern European countries joined the EU-standards of motor vehicle emission control at a later stage than their introduction in Europe. For example, catalyst vehicles were first introduced in the Polish stock only in the period 1995-1997 (Glen, 1994). In addition, pre-catalyst vehicles did not follow the ECE standards but a national-based system. The conversion of these old vehicles to the COPERT classification increases this uncertainty. Therefore, we expect that comparison of the Italian and Polish calculations will provide a measure of the uncertainty due to the stock of vehicles.

2.2 Uncertainty of the vehicle stock

In order to estimate the uncertainty of the COPERT stock, we based our calculations to the database of the FLEETS project. FLEETS is a short name for a project funded in 2008 by the European Commission (DG Environment), with the task to collect detailed stocks and activity data of vehicles for all EU27 member states, and in addition, Croatia, Norway, Switzerland, and Turkey (Ntziachristos et al., 2008). The stock data in that project were collected from several national and international sources and, in particular, the experts of the Task Force of Emission Inventories and Projections, Eurostat, ACEA, ACEM, and national statistical authorities. As one might expect, not all sources contained the same value of stock vehicles for the above countries. However, in the framework of the FLEETS project, these data were streamlined by means of mathematical processing and a consolidated dataset was presented. In the current report, we look back to the individual sources of information to quantify uncertainty of the data. The final dataset from the FLEETS has only been taken as the 'central' estimate of the calculation.

Symbol:	Ncat	**Name:**	Vehicle population at category level
Type:	Check item	**units:**	vehs.
Description:	The number of operating vehicles in the country, falling in one of the five categories (passenger cars, light duty trucks, heavy duty trucks, busses, power two wheelers). The number of operating vehicles should in principle correspond to the number of registered vehicles of the national fleet in the country. Deviations from this rule include vehicles registered but not operating or partially operating (e.g. abandoned or old cars), unregistered or falsified registration vehicles (stolen, illegal imports). Vehicles registered in a different country do not correspond to the national fleet of the country inventoried and should, in principle, be taken into account in the inventory of the country of registration.		
Sources:	The number of registered vehicles is known in national authorities. These also report data to Eurostat (online database under Transport-> Road Transport-> Road Transport equipment - stock of vehicles). There are also independent (market) sources of such information, such as the national associations of car importers in each country. A summary of this work has been conducted by ANFAC on behalf of ACEA (http://www.acea.be/index.php/news/news_detail/vehicles_in_use/).		
Typical Range:	There is no typical range, as parc size depends on the country. For passenger cars, one should estimate between 400 and 600 cars per thousand citizens. For power two wheleers, the range is even larger, between 30 to 200 vehicles per thousand citizens. Trucks range between 10 and 25 trucks per thousand citizens.		
Quantification of variability (Italy & Poland):	The uncertainty per vehicle category has been characterized by collecting data on the Italian fleet from four different sources. These include Eurostat, ANFAC (from the ACEA site), ACEM and ACI. Most of the variability in the reported values occurs for mopeds, while this is practically zero for cars. In the case of Poland, the same international sources have been used and, in addition, Statistics Poland.		

The uncertainty of the Ncat parameter has been quantified on the basis of information collected from different sources. This is shown in Table 2-1 for Italy and

Table 2-2 for Poland. It is shown that the total stock of vehicles in the different categories is rather well known in both countries.

Table 2-1 Vehicle population from different sources, mean value and standard deviation for Italy

ITALY	ACEA 2005	ACEM 2005	ACI 2005	Eurostat 2005	μ	σ
Passenger Cars	34 667 485		34 667 485	34 636 400	34 657 123	17 947
Light Duty Vehicles	3 257 525			3 633 900	3 445 713	266 137
Heavy Duty Vehicles	1 070 308			958 400	1 014 354	79 131
Buses	94 437		94 437	94 100	94 325	195
Mopeds		5 325 000	4 560 907		4 942 954	540 295
Motorcycles		4 938 359	4 938 359	4 933 600	4 936 773	2 748

Table 2-2 Vehicle population from different sources, mean value and standard deviation for Poland

POLAND	ACEA 2005	ACEM 2005	Poland 2005	Eurostat 2005	μ	σ
Passenger Cars	12 339 353		12 339 000	12 339 000	12 339 118	204
Light Duty Vehicles	1 717 435		2 304 500	2 178 000	2 066 645	308 968
Heavy Duty Vehicles	587 070			737 000	662 035	106 017
Buses	79 567		79 600	80 000	79 722	241
Mopeds		337 511			337 511	0
Motorcycles		753 648		754 000	753 824	249

The second variable that determines the stock of vehicles is their split in the different subsectors Nsub.

Symbol:	Nsub	**Name:**	Vehicle population at sub-category level
Type:	Check item	**units:**	vehs.
Description:	This is the population of vehicles in one of the 39 COPERT 4 sub-categories. The sum of these vehicles should amount to the sum of Ncat as well. The subcategory level distingusihes vehicles per fuel used (gasoline, diesel, LPG, CNG, biodiesel, hybrids), engine size (for passenger cars, and motorcycles), and vehicle weight (heavy duty vehicles).		
Sources:	Some classification of vehicles in these classes is availabe in Eurostat, however not as detailed as required by COPERT for the emission estimation. More detailed classification can be found in national statistics.		
Typical Range:	The classification of vehicles range between countries. In several central European countries (AT, BE, FR) the stock of gasoline and diesel cars is about the same, with the latter in an ,increasing trend over the last years. In other countries, the passenger car stock is dominated by gasoline cars (FI, GR, SE). Trucks are dominated by diesel vehicles and motorcycles are solely gasoline.		
Quantification of variability (Italy & Poland):	To quantify the variability national statistics were gathered. For Italy in particular such data was available in detail containing not inly the total number of vehicles classified by vehicle category but also the uknown vehicles not currently classified. For Poland however national statistics do not contain sufficient information, and data are not dissagregated in the form required for the calculations. For this reason the uncertainty was estimated based on the available data. Poland was selected for this particular reason, to demosntrate the uncertainty of the calculations when sufficient information is not available.		

Table 2-3 shows the statistical data for Italy, separated in known and unknown values. The unknown values are vehicles in the ACI database which are not identified to any of the subsectors. To calculate the maximum range of uncertainty that this leads to, it was decided to produce 3 alternative datasets. The first one allocates all unknown values to the vehicle categories with the smallest engine capacity (cars, motorcycles) or the smallest vehicle weight (trucks); the second one allocates the same values to the largest engine capacity or the largest vehicle weight and the third one allocates these values homogenously to all vehicle categories within the same vehicle sector. The standard deviation that this leads to is shown in Chapter 3.

Table 2-4 shows the average value and the standard deviation for the vehicle categories in Poland. The average value was derived from Poland's national statistics. In the absence of more detailed data, assumptions were made to estimate the standard deviation. In the case of passenger cars the standard deviation was calculated by estimating the standard deviation as one third of the difference of the national statistics and FLEETS project data for each subsector. In case of Light Duty Vehicles the uncertainty was calculated from national statistics and was proportionally allocated to the stock of diesel and gasoline trucks. For all other vehicle categories the standard deviation was estimated 7% of the average value.

For both countries, data from the four weight categories to the fourteen weight categories of diesel trucks was made with the conversion file which is available at http://lat.eng.auth.gr/copert/BugsFaqs.htm

Table 2-3 Vehicle population per subsector category for Italy for known and unknown values

Sector	Subsector	Known Values	Unknown values
Passenger Cars	Gasoline <1,4 l	18.025.703	627
Passenger Cars	Gasoline 1,4 - 2,0 l	5.090.465	
Passenger Cars	Gasoline >2,0 l	408.278	
Passenger Cars	Diesel <2,0 l	7.987.956	145
Passenger Cars	Diesel >2,0 l	1.822.935	
Passenger Cars	LPG		
Passenger Cars	2-Stroke		
Light Duty Vehicles	Gasoline <3,5t	280.005	7.580
Heavy Duty Vehicles	Gasoline >3,5 t	4.343	
Light Duty Vehicles	Diesel <3,5 t	2.695.478	35.174
Heavy Duty Vehicles	Diesel 3,5 - 7,5 t	190.842	
Heavy Duty Vehicles	Diesel 7,5 - 16 t	187.804	
Heavy Duty Vehicles	Diesel 16 - 32 t	206.345	
Heavy Duty Vehicles	Diesel >32t	1.905	
Buses	Urban Buses	2.281	92
Buses	Coaches	66.548	
Mopeds	<50 cm³		
Motorcycles	2-stroke >50 cm³	1.397.575	927
Motorcycles	4-stroke <250 cm³	1.545.423	
Motorcycles	4-stroke 250 - 750 cm³	1.488.571	
Motorcycles	4-stroke >750 cm³	505.863	

Table 2-4 Vehicle population per subsector category for Poland

		Poland	
Sector	Subsector	μ	σ
Passenger Cars	Gasoline <1,4 l	5.890.018	194.212
Passenger Cars	Gasoline 1,4 - 2,0 l	2.853.116	187.552
Passenger Cars	Gasoline >2,0 l	253.264	38.415
Passenger Cars	Diesel <2,0 l	1.660.117	113.710
Passenger Cars	Diesel >2,0 l	314.139	60.785
Passenger Cars	LPG	992.755	231.352
Light Duty Vehicles	Gasoline <3,5t	980.551	9.244,7
Heavy Duty Trucks	Gasoline >3,5 t	108.400	1.022,0
Light Duty Vehicles	Diesel <3,5 t	732.359	7.323,6
Heavy Duty Trucks	Rigid <=7,5 t	73.538	5.147,7
Heavy Duty Trucks	Rigid 7,5 - 12 t	53.445	3.741,1
Heavy Duty Trucks	Rigid 12 - 14 t	25.422	1.779,5
Heavy Duty Trucks	Rigid 14 - 20 t	31.993	2.239,5
Heavy Duty Trucks	Rigid 20 - 26 t	28.597	2.001,8
Heavy Duty Trucks	Rigid 26 - 28 t	7.342	513,9
Heavy Duty Trucks	Rigid 28 - 32 t	8.928	625,0
Heavy Duty Trucks	Rigid >32 t	10.925	764,7
Heavy Duty Trucks	Articulated 14 - 20 t	10.741	751,8
Heavy Duty Trucks	Articulated 20 - 28 t	9.284	649,9
Heavy Duty Trucks	Articulated 28 - 34 t	15.037	1.052,6
Heavy Duty Trucks	Articulated 34 - 40 t	35.608	2.492,6
Heavy Duty Trucks	Articulated 40 - 50 t	8.083	565,8
Heavy Duty Trucks	Articulated 50 - 60 t	3.461	242,3
Buses	Urban Buses Midi <=15 t	1.813	126,9
Buses	Urban Buses Standard 15 - 18 t	35.035	2.452,5
Buses	Urban Buses Articulated >18 t	25.575	1.790,3
Buses	Coaches Standard <=18 t	15.944	1.116,0
Buses	Coaches Articulated >18 t	2.216	155,1
Mopeds	<50 cm^3	337.511	0,0
Motorcycles	2-stroke >50 cm^3	454.508	31.815,5
Motorcycles	4-stroke <250 cm^3	75.694	5.298,6
Motorcycles	4-stroke 250 - 750 cm^3	128.674	9.007,2
Motorcycles	4-stroke >750 cm^3	94.124	6.588,7

The last variable that determines vehicle stock is the split into the different technology classes (N_{tech}).

Symbol:	Ntech	**Name:**	Vehicle population at technology level
Type:	Input Variable	**units:**	vehs.
Description:	This is the population of vehicles classified to one of the 241 different vehicle technologies in COPERT 4. The technology level per "Euro" standard for passenger cars is more or less available in national statistics. For earlier years (non-catalyst cars or first generation of catalysts), the distinction was not as detailed and some uncertainty may exist. Also, uncertainties may exist for heavy duty vehicles.		
Sources:	The information (in particular for passenger cars) should be available in national statistics. For categories where such information is not available, one may consider an age distribution according to year of first registration and take into account the emission standard implementation matrix, to construct a technology classification. In order to estimate the age distribution, we follow the TRENDS methodology, i.e. the vehicle survival probablity is considered to follow a Weibull curve with a high probability at young age, decreasing as the vehicles become older. The Weibull distribution is defined by two parameters: The "beta" parameter defines the steepness of the probability drop with age. The "tau" parameter defines a characteristic service lifetime of a vehicle. By editing these two parameters, one has clearly defined the survival probability. The age distribution for the reporting year may then be calculated starting from an initial (rough) age distribution at a historic year and respecting the new registrations the the stock increase over the period from the historic year to the reporting year.		
Typical Range:	The classification to vehicles classes is country specific. A good indication of the classification to difference classes is the mean vehicle age which ramges between 7 and 12 years for passenger cars.		
Quantification of variability (Italy & Poland):	The distribution of cars into different technologies is largely known in Italy, as vehicles are registered according to the emisssion standard. There is only a small fraction of cars which are reported as unidentified in the ACI classification, which is less than 1% for the Italian fleet (30 thousand cars in a stock of more than 30 million). Data was considered to be known and the national statistics was used to perform the calculations.The variance In Poland, this information is more scarce. Therefore, the beta and tau parameters for Poland have been calculated in a wider range. It was assumed that the values would wange between an uncertainty of +-5% for the age of 5 years and a +-10% for the age of 15.		

To calculate the technology split for each country and vehicle category, the following procedure was followed. First, the probability of vehicles to remain in the stock, as a function of their age, was approached with a Weibull distribution. In fact, the Weibull distribution provides the survival probability for each vehicle category with age φi(age), and this can be used to calculate the age distribution of the fleet. This probability is given by the following equation:

- $$\varphi_i(age) = \exp - \left[\left(\frac{age + Beta_i}{Tau_i} \right)^{Beta_i} \right]$$ where φ(0) = 1 • (2-1)

The probability uses two parameters, (Beta and Tau). The two parameters do not have an exact physical meaning. However, it can be considered that they approximate the useful life of the vehicle (Tau) and a characteristic (Beta) of the rate by which the probability decreases. By taking an initial age distribution at a historical year (in our case: 1995) and by introducing the new registrations per year (vehicles of age 0) and the Weibull scrappage probability, one may calculate the age distribution of the vehicles at any given year. We calculated the age distribution for the year 2005 by introducing to our calculations the stock and new registrations from the FLEETS project.

A more detailed description of the methodology used can be found in the Detailed Report 1 for the Road Transport Module of the Project "Development of a Database System for the Calculation of Indicators of Environmental Pressure Caused by Transport" (TRENDS) (Giannouli et al., 2006) and does not need to be repeated here.

At a second step, the technology split for each country is calculated by applying the technology implementation matrix of the particular country to the age distribution. The technology implementation matrix contains the distribution of new registrations of different years to the various technologies. An example of an implementation matrix in the case of Poland (Gasoline passenger cars <1.4 l) is shown in Table A 1. Its data originate from the FLEETS project.

In the case of Italy, the technology classification was considered exact, i.e no variability was introduced for the variable Ntech. The only variability in the stock was introduced from the uncertainty in the Ncat and Nsub variables. However, in the case of Poland, the uncertainty in classification to different technologies was translated to a problem of age distribution. The central estimate for the age distribution of vehicles of Poland was based on the FLEETS data and the Beta and Tau parameters were calculated on this basis. Then, an artificial uncertainty range was assigned to the probability function of Poland. This artificial uncertainty is schematically shown in Figure 2-1. It was in principle assumed that the survival probability for vehicles with age of five and fifteen years ranges between +/- 5 and +/- 10 percentage units respectively from the central value. Figure 2-1 shows the original Weibull distribution function for gasoline passenger cars <1.4 l, the range assumed for the uncertainty of the survival probability, and three alternative curves which fulfill the selected uncertainty range.

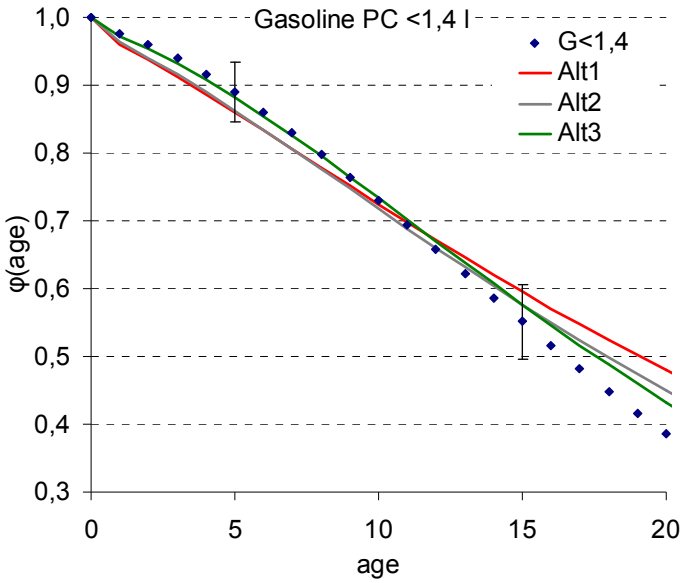


Figure 2-1 Weibull distribution function in the case of Poland, Gasoline cars <1.4 l, and three alternative solutions that fulfill the artificial uncertainty introduced

By using the above methodology a number of Beta and Tau pairs were calculated for each vehicle category, that fulfilled the uncertainty range introduced. From these couples, 100 were finally selected by sampling percentiles from the joint probability distribution

function of Beta and Tau. They served as data pool providing each time the required couple of values used for the calculations. The 100 Beta and Tau couples per category can be found in Table A 2.

As an example of this method, Figure 2-2 shows the distribution of the vehicle stock of Euro 1 gasoline cars <1.4 l used in the runs for Poland. The values form a normal distribution with a standard deviation which is 3.7% of the mean value. Similar distributions have been produced for all vehicle technologies in the case of Poland. The influence of this uncertainty to the calculations is represented by reference to the tau value.

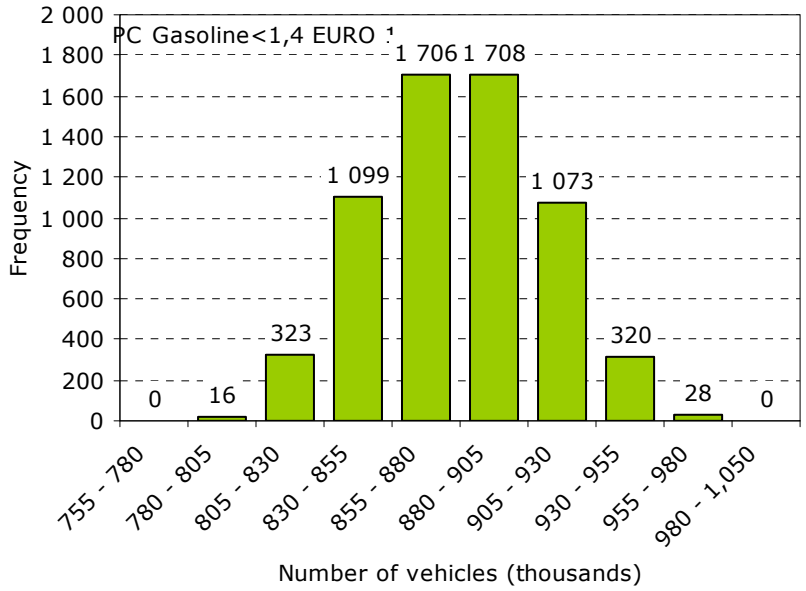


Figure 2-2: Probability distribution of the vehicle stock of Gasoline Euro 1 passenger cars <1.4 l used in the runs for Poland

2.3 Emission factors and parameters

The uncertainty of emission factors is a major part of the uncertainty in all transport emission models, as they constitute the core of the emission calculation. The uncertainty of the emission factors originates from the variability of the underlying experimental data, i.e. the variability in the emission level of each individual vehicle which has been included in the sample of vehicles used to derive the emission factors. A typical range of the variability of individual measurements for emission factors is shown in Figure 2-3 for gasoline passenger cars of Euro 3 technology. In COPERT, there are two sets of emission factors, the hot ones and the cold-start ones. The hot emission factors originate from individual measurements of vehicles/engines mainly conducted in the Artemis project. Some older measurements were based in previous projects, such as CORINAIR89, COST319, MEET, etc. The uncertainty of old emission factors has not changed since the previous Monte Carlo exercise conducted in Copert 3. However, emission factors for Euro 1 and later technologies are solely based on Artemis. Emission factors on non-exhaust PM and the related uncertainty has been taken from the relevant chapter in the Atmoshperic Emission Inventory Guidebook. The N_2O and CH_4 uncertainty has been based on work conducted at the Laboratory of Applied Thermodynamics. The uncertainty of cold-start emission factors was more difficult to assess, as the values used in COPERT are a hybrid of the Artemis and the older CORINAIR methodologies. In the absence of detailed data and in order not to neglect the contribution of cold start variability, we assumed that the ratio of standard deviation over mean for the cold emission factors is equal to the hot ones. This is an approximation which was introduced in the absence of more detailed data.

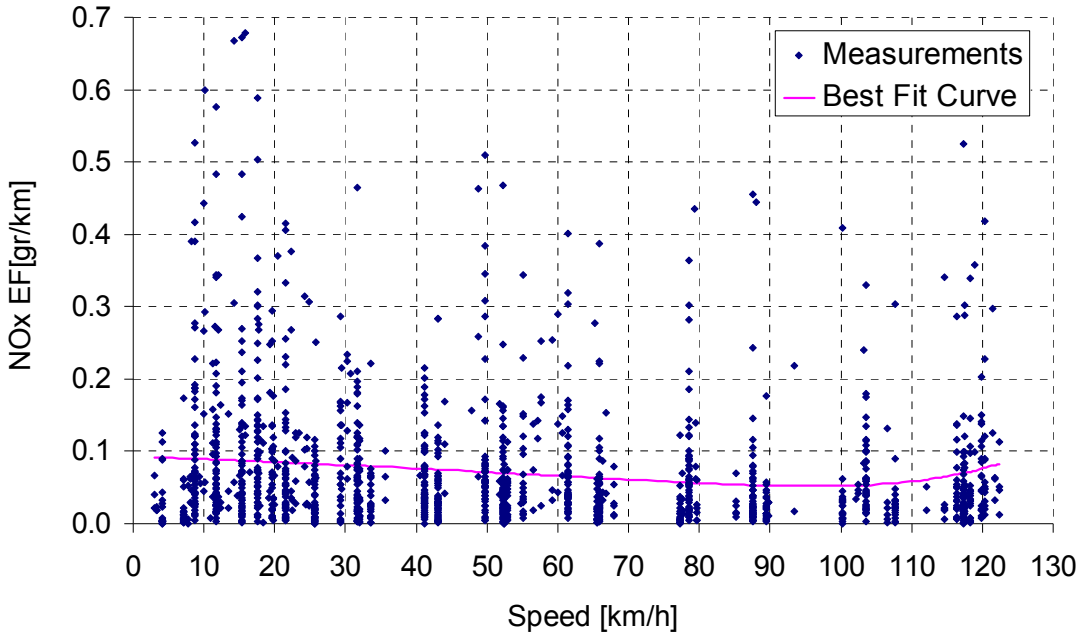


Figure 2-3: Example of variability of individual measurements for the derivation of emission factors. Gasoline Euro 3 passenger cars. Source: ARTEMIS database.

Symbol:	ehot, tech	**Name:**	Hot emission factor
Type:	Model parameter	**units:**	g/km
Description:	The emission rate of vehicles of a specific technology in g/km, under thermally stabilised engine operation. In COPERT the emission factors are expressed as a function of mean travelling speed. In cases with limited information, emission factors are expressed as a function of the drving mode (urban, rural, highway).		
Sources:	Hot emission factors have been derived from measurements conducted in several research programmes. The most important ones include COST319, FP4 MEET, and FP6 ARTEMIS. Vehicles are driven over specific driving cycles, considered representative of actual driving conditions and the emission level is associated with the mean travelling speed over the cycle. A function is then drawn using regression analysis to associate emission level with travelling speed.		
Typical Range:	There is no typical range, as this depends on the uncertainty of the experimental data used to develop the emission factor.		
Quantification of variability (Italy & Poland):	For all pollutants and fuel consumption, the uncertainty range has been expressed as standard deviation of the experimental data per 10-km/h speed class intervals. The uncertainty has then been modelled with a lognormal around the emission factor value at the mean speed of each speed class interval. The lognormal model has been selected as the uncertainty is assymetric, i.e. there are no experimental data below 0, while ultra-emitters may emit several times above the average.		

The standard deviation of the hot emission factors is shown in Table A 4 to Table A 11 for the different pollutants and fuel consumption. The fourteen classes in these tables correspond to fourteen classes of 10-km/h speed intervals (from 0 to 140 km/h). The uncertainty of the emission factors per class is approached with a log-normal model, having as a mean the emission factor value at the mean of the speed class (i.e. for class 1 is 5 km/h, class 2 is 15 km/h, etc.) and as a standard deviation, the one given in these Tables.

Symbol:	ecold/ehot,tech	**Name:**	Cold-start emission factor
Type:	Model parameter	**units:**	-
Description:	The ratio expressing cold-start over hot emission. Cold-start emissions lead to higher emissions as both the engine and the emission control system have not reached their normal operation temperature.		
Sources:	The over-emission ratio in COPERT has been derived as computed value out of a detailed cold-start study conducted in the framework of FP4 MEET and further elaborated in FP6 ARTEMIS (Andre and Joumard, INRETS report LTE 0509). Since these are computed values, it is difficult to obtain independent (literature) sources to quantify it.		
Typical Range:	There is no typical range, as this depends on the uncertainty of the experimental data used to develop the emission factor.		
Quantification of variability (Italy & Poland):	Cold emission factors in Copert have been produced as a hybrid of the Copert II, MEET and ARTEMIS methodologies, using approximations to convert the MEET approach (as corrected in ARTEMIS) to the older CORINAIR cold-start approach. Cold-start modelling is one of least elaborate items of Copert 4. As it was not possible to estimate the uncertainty of the emission factors from the uncertainty in the experimental data, we have assumed that the standard deviation over mean for ecold/ehot is the same with the standard deviation over mean of the hot emission factor. In this way, the contribution of cold-start to undertainty is estimated in a realistic (albeit not exact) way.		

Three more variables are used in COPERT 4 to calculate emission relevant information. These are summarized in Table 2-5 and in the remaining tabulated forms.

Table 2-5 Variables used in COPERT to calculate emissions

Symbol	Parameter Description
b	Cold-trip distance
Dftech	Degradation factor
Ltrip	Mean trip length

Symbol:	b	**Name:**	Cold-trip distance
Type:	Model parameter	**units:**	-
Description:	The fraction of total annual mileage driven before the engine and the emission control system have reached their normal operation temperature. The cold-trip distance depends on the distirbution of trip lengths (short trips lead to relatively higher cold-trip fractions), and the vehicle emission standard (new concepts reach their operation temperature faster).		
Sources:	COPERT 4 suggests a cold-trip distance function, which has been based on older observations. The cold-trip distance requires specific studies to assess, as driving conditions (mean speed, ambient temperature) and driving pattern (short frequent trips or longer, e.g. intercity, trips) affect its value. COPERT provides some guidance on what is the average time it takes to reach normal operation temperature, for each technology concept. This can be used as a reference to estimate the cold-trip distance.		
Typical Range:	The mileage fraction under cold-start conditions is in the rnge of 10-30% depending on the trip distribution, the ambient temperature and the gasoline vehicle technology considered.		
Quantification of variability (Italy):	It depends on the vehicle technology and the driving profile. No huge uncertainty expected at a fleet level. Proposal: 3s=0,13×μ		

Symbol:	Dftech	**Name:**	Degradation factor
Type:	Model parameter	**units:**	-
Description:	The degradation of emissions with vehicle age. This should in principle take into account two effects: First, the effect of normal degradation of emission components on increasing emissions, and second the effect of malfunctions (ultra and high emitters) on increasing the average emission level.		
Sources:	COPERT provides values based on a study conducted in the framework of the FP4 MEET project. Alternative sources of information include published studies by EPA and CARB and some technical papers.		
Typical Range:	The degradation factor depends on vehicle technology and mileage. The maximum degrdation factor may be 2 or even higher for old vehicles.		
Quantification of variability (Italy):	No explicit calculation available. Although potentially important, no uncertainty range is proposed for DF due to absence of experimental data		

Symbol:	Ltrip	**Name:**	Mean trip length
Type:	Input Variable	**units:**	km
Description:	The average distance travelled by a trip of passenger cars in a country. Probably the best definition of a trip is as "a one-way course of travel having a single main purpose". This means that a trip is a not a complete journey, which may involve several stops and may serve for different purposes. A trip is an activity with an origin, a destination, and a purpose. For example, a trip from home to work, or a businees or leisure trip from one city to another. A trip is not split by intermediate stop-overs. For example, a ten-minute break in a travel between two cities does not split the trip in two. If we would allow for this, this would mean that the purpose of the first trip was to leave the origin city and reach a destination to have a break. However, the purpose of this trip is to reach the destination city. However, if the first stop is an overnight stay in some intermediate city, then the trip is actually split because the target of the first trip would be to reach a city to have a break and then continue with a second trip in the following day. The value in COPERT refers to passenger cars as this is the only category where detailed statistics are required to calculate cold-start emissions.		
Sources:	The trip length can be found from national surveys but also from international statistics (some countries). International statistics sources include		
Typical Range:	The European-wide average value is 12.4 km		
Quantification of variability (Italy):	s = 0,2×μ, according to French COPERT Uncertainty report		

2.4 Uncertainty of mileage variables

Symbol:	Mtech	**Name:**	Annual mileage
Type:	Input Variable	**units:**	km/a
Description:	This is the annual mileage driven by vehicles of a specific category and technology level, at a national level. Currently, there is a discussion on whether this mileage should relfect the mileage of the national stock vehicles in the national territory or including abroad travelling. Also, the discussion should extend to whether this should cover foreign vehicles travelling in the national territory (see discussion in ECE/EB.AIR/GE.1/2007/15). For consistency, this mileage should refer to the fuel sold in the country. Problems arise when there is significant tank tourism (different country of refuelling and different country of consumption - usually to benefit from price differences) and the fuel consumed may be entirely different than the fuel sold. In the case of Italy, where no significant tank tourism exists, the annual mileage is compatble with fuel sold in the country. Relevant data for Poland are not available. Annual mileage differs with different technology and vehicle age, as older vehicles are used less with time.		
Sources:	Annual mileage per vehicle type may be found from national statistics on mobility. The effect of mileage with vehicle age can be inferred from questionnaires, field campaigns (e.g for trucks and busses) or review of inspection and maintenance data (mainly of passenger cars). These data can be obtained either from private (dealer) stations of vehicle manufacturers, or from stations used for the regular I&M inspection of vehicles in the country.		
Typical Range:	The annual mileage ranges between 10000-25000 km for passenger cars, 20000-35000 for light duty trucks, 40000-100000 for trucks and busses and 2000-8000 for motorcycles.		
Quantification of variability (Italy & Poland):	Mileage in COPERT calculation is considered to decrease exponentially with age. In Italy, mileage data was aquired from national statistics since such strong data existed with a small uncertainty. In Poland such data was not available, so mileage values were estimated using quality data from near by countries or countries with similar vehicle fleet. The uncertainty in the mileage was estimated as s=0,1xμ. Data was delivered per vehicle type. The correlation between the mileage and the vehicle age was also estimated. The correction factor, applied to the mileage, was calculated using a Weibull function. The uncertainty of these Weibull function parameters (bm and Tm) which influence the mileage was calculated with post analysis of the data. The same approach was used in both countries.		

The calculation of the annual mileage for a particular vehicle technology (Mtech) is a function of the annual mileage of a new vehicle (M0) and a correction function for the effect of vehicle age (φ(age)). The decrease of annual mileage with age has been approached by a Weibull function. This reflects the fact that new cars are driven more than old ones. The shape of the curve is considered to be a good approximation of the actual shape of the mileage reduction with age. An example of actual mileage degradation with age, which is based on recordings of Inspection and Maintenance data from the Italian passenger car fleet is shown in Figure 2-4 (Caserini et al., 2007). It is evident that the curves flat out after some years. The equation of the Weibull function used is given in (2-2) and (2-3). The modeling parameters (bm, Tm) and M0 are specific to country and vehicle subsector considered.

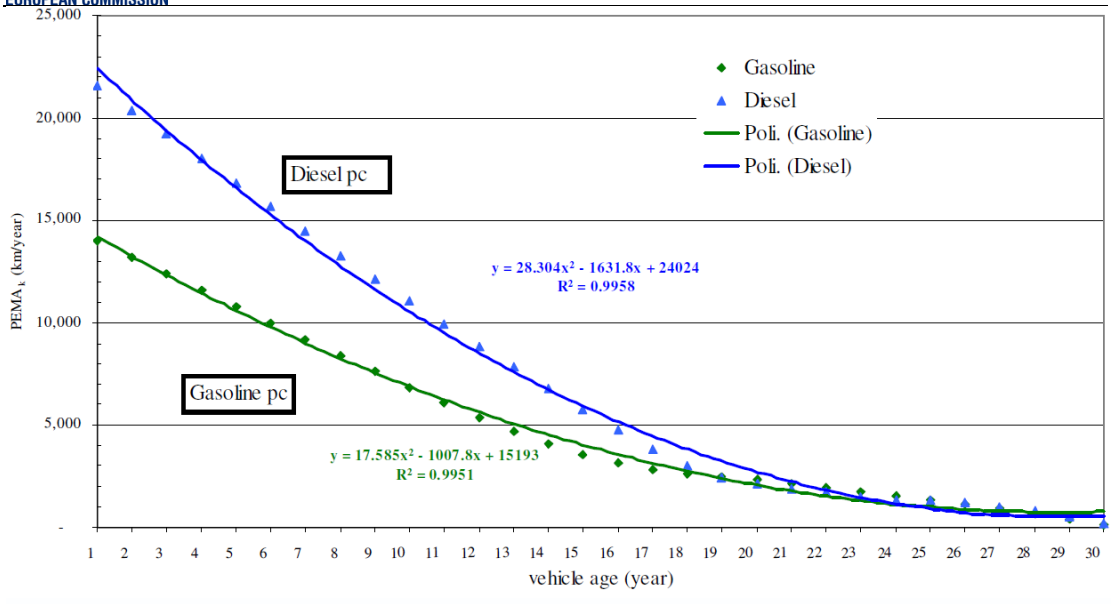


Figure 2-4: Annual mileage as a function of vehicle age for the Italian passenger car fleet.
Source: (Caserini et al., 2007).

$$\varphi(age) = \exp - \left[\left(\frac{age + b_m}{T_m} \right)^{b_m} \right] \quad \text{(2-2)}$$

$$M_{tech}(age) = \phi(age) \cdot M0 \quad \text{(2-3)}$$

The uncertainty in the calculation of the Mtech parameter originates from the uncertainty in bm, Tm and M0. In the case of Italy, central values for the three parameters were available from the FLEETS database. In case of Poland, no data were available. In order to estimate the central parameters in this case, all countries with detailed data of the FLEETS project (8 countries) were pooled together in a single dataset, and the averaged values that were derived in this way were used for Poland. Due to the robust dataset in Italy, the M0 value was considered of zero uncertainty. In case of Poland, the uncertainty of M0 was an estimation (s=0,1xμ).

The φ(age) is also assumed to range between a minimum and a maximum. These boundaries are defined from the extents of φ(age) functions of all countries that submitted such detailed data to FLEETS. These extents, for the example of gasoline passenger cars of <1,4 l are shown in Figure 2-5. It was therefore assumed in our case, that φ(age) can receive any value within these two boundaries. We then calculated all (bm, Tm) pairs that satisfied this limitation. With this procedure, a large number of bm and Tm couples were derived, different for each vehicle category. From these couples 100 were finally selected by sampling percentiles from the joint probability distribution function of bm and Tm. They served as data pool providing each time the required couple of bm and Tm used for the calculations. The 100 bm and Tm couples can be found in Table A 3.

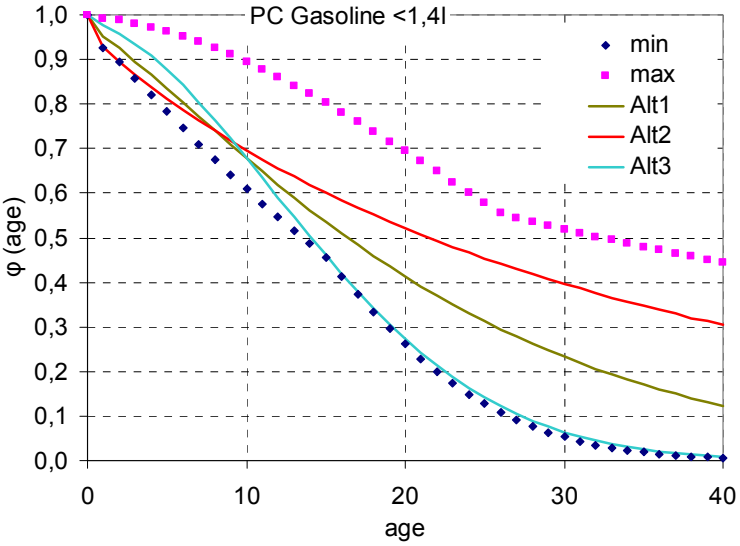


Figure 2-5: Example of b_m and T_m values fulfilling the selected criteria (min and max)

Symbol:	Mm,tech	**Name:**	Mean fleet mileage
Type:	Input Variable	**units:**	km
Description:	The mean cumulative mileage of vehicles of a particular technology. This is the average odometer reading of vehicles of a particular technology. This mileage increses with vehicle age and is used as input to calculate the degradation in the emission performance of vehicles as they grow older. This is an input to calculate the emission degradation and is only relevant for gasoline passenger cars and light duty trucks. The reason of focussing on gasoline cars only is that they are equipped with exhaust aftretreatment (three-way catalysts) which are the main source of emission degradation. The effect will become potentially important also for diesel vehicles, as they are also gradually equipped with exhaust aftertreatment.		
Sources:	This value is calculated by using the average vehicle age and the annual mileage driven for each vehicle technology.		
Typical Range:	This is specific to vehicle technology. Assuming that a car runs for 12000 km annualy over its lifetime, a Euro 1 car (1992) will have an average mileage of ~200000km, while a Euro 4 car (2007) will have about 25000 km looking at the odometer in year 2009.		
Quantification of variability (Italy & Poland):	This is calculated by the uncertainty in the bm and Tm values, and the uncertainty in the annual vehicle mileage.		

The Mean fleet mileage (Mm,tech) expresses the average odometer reading of a vehicle of a particular technology. This is a value calculated by using the average vehicle age and the average annual vehicle mileage. For this reason no separate uncertainty had to be estimated, as this was already derived from the annual mileage values used to calculate emissions. The formula used to calculate the mean fleet mileage is the following:

- $$Mm,tech = \sum_{age=0}^{average\_age} M0 \cdot \phi(age)$$ (2-4)

2.5 Other Parameters / Variables

Table 2-6 summarizes the remaining parameters used by COPERT to calculate emissions. Each of them is summarized in the subsequent tabulated forms. The "French uncertainty report" that is mentioned in several of the forms, is the comprehensive study of (Duboudin et al., 2002) on the uncertainty and sensitivity analysis of COPERT. Although this has been specific to French conditions, the uncertainty ranges assumed for several of the parameters hold true for other countries as well

Table 2-6: Input variables used in COPERT to calculate emissions

Symbol	Parameter Description
H:C	Hydrogen-to-carbon ratio
HSPtech	Highway speed
Hstech	Highway share
LFHDV	Load Factor
O:C	Oxygen-to-carbon ratio
RSPtech	Rural speed
RStech	Rural share
RVP	Fuel reid vapour pressure
S	Sulfur level in fuel
tmax	Average max monthly temperature
tmin	Average min monthly temperature
TStech	Total share
USPtech	Urban speed
UStech	Urban share

Symbol:	H:C	**Name:**	Hydrogen-to-carbon ratio
Type:	Input Variable	**units:**	-
Description:	The ratio of atoms of hydrogen over carbon in the fuel molecule. Road transport fuels are blends of organic species and mostly contain carbon, hydrogen and oxygen. This ratio is the average for all molecule types in the blend. It can be determined by elemental analysis of the fuel. The exact H:C ratio may vary depending on the fuel origin (e.g. middle east, north sea, etc.) and processing (e.g. cracking, aromatics processing). The H:C ratio is required to estimate CO2 emissions on the basis of fuel consumption and is different for each of the fuel types (diesel, gasoline, natural gas, liguid petroleum gas).		
Sources:	The H:C ratio may be found by contacting refineries in the country and reqesting this information. In general, a high heating value of the fuel means a higher ratio of H:C.		
Typical Range:	Typically 1.8-2.1		
Quantification of variability (Italy & Poland):	Similar uncertainty for both Gasoline and Diesel. The ratio is expected to vary from 1.8 to 2.1, therefore, 3s = 0.15.		

Symbol:	HSPtech	**Name:**	Highway speed
Type:	Input Variable	**units:**	km/h
Description:	The mean travelling speed of a vehicle category in highway conditions, over the period considered in an inventory (year). In general, the mean travelling speed involved in highway conditions exceeds 75 km/h. The mean speed differs with vehicle category, with motorcycles and cars achieveing a higher mean speed than trucks.		
Sources:	Highway management authorities have precise recordings of mean travelling speed in several parts of the highways. These can provide a good estimate of the mean speed. In parallel, the speed limits existing in several highway s give a constrating that cannot be exceeded.		
Typical Range:	Typical highway speeds are between 70 to 120 km/h, depending on vehicle class		
Quantification of variability (Italy & Poland):	3s = 0,1×μ, according to French COPERT Uncertainty report		

Symbol:	Hstech	**Name:**	Highway share
Type:	Input Variable	**units:**	%
Description:	This is the share of annual mileage (in percentage units) driven in highways. The mean travelling speed under highway conditions in general exceeds 75 km/h.		
Sources:	The mileage over highways (motorways, autobahnen, autostrada, autoroutes, …) can be estimated from data of the authorities managing the highways. The length of highways is known and the vehicle volume is monitored in different parts of the highway. This gives a very precise value of the total veh.km (per vehicle category) performed in the highways of a country over a year. By division of this value with the total national stock number, and the mean mileage per year, one obtains a representative figure of the mileage share in highway conditions.		
Typical Range:	The share of highway mileage ranges between 10% and 25% for cars and light duty vehicles, 40-60% for trucks, and very low for motorcycles.		
Quantification of variability (Italy & Poland):	3s = 0,1×μ, according to French COPERT Uncertainty report		

Symbol:	LFHDV	**Name:**	Load Factor
Type:	Input Variable	**units:**	%
Description:	The loading as a fraction (in percentage units) of the total carrying capacity of trucks and busses. The correction is only introduced for heavy duty vehicles. The reason is that the difference between a loaded and an empty truck/bus is large, compared to passenger cars. For example, a truck may carry as much or even more weight than its empty weight, while a car cannot carry more than 30-35% of its weight. The large carrying capacity has a big effect on the emissions and consumption of a laoded vs. empty truck.		
Sources:	COPERT 4 suggests a 50% loading factor for trucks and busses. This can be modified by using appropriate statistics. Both ton-km by trucks and p-km by busses should be relatively well known in countries, as they are both recorded for taxation or business development purposes. If these are not known, then these can be found in models (e.g. PRIMES, GAINS, ...). The veh-km reported by trucks in COPERT, multiplied by the carrying capacity of each truck category and the loading factor should give the total ton-km in the country. Respectively, the veh-km by busses multiplied by an average carrying capacity per bus (in persons) and the loading factor should give the total p-km carries by busses in the country.		
Typical Range:	Typical ranges should be in the order of 40-80%.		
Quantification of variability (Italy & Poland):	There is no statistics on its value. A guess is 3s = 0,2×μ		

Symbol:	O:C	**Name:**	Oxygen-to-carbon ratio
Type:	Input Variable	**units:**	-
Description:	The ratio of atoms of oxygen over carbon in the fuel molecule. Oxygen carriers (oxygenates) in the fuel have been used for several years. Oxygenates (ethers) have been historically used in gasoline as octane number enhancers. More recently, they have been added in gasoline with the addition of (bio-)ethanol. In diesel, oxygen has been introduced with the biodiesel (esters) blends. The O:C ratio is required to estimate CO2 emissions on the basis of fuel consumption and is different for each of the fuel types (diesel, gasoline, natural gas, liguid petroleum gas). In principle, natural gas and liguid petroleum gas should only contain traces of oxygen.		
Sources:	The O:C ratio may be found by contacting refineries in the country and reqesting this information. In addition, information on the biofuel blends may provide relevant information.		
Typical Range:	Zero for non-oxygenated fuels. Up to 0.1 for typixal oxygenated ones.		
Quantification of variability (Italy & Poland):	Similar uncertainty for both Gasoline and Diesel. The ratio is expected to vary from 0 to 0.1, therefore, 3s = 0.05		

Symbol:	RSPtech	**Name:**	Rural speed
Type:	Input Variable	**units:**	km/h
Description:	The mean travelling speed of a vehicle category in rural conditions, over the period considered in an inventory (year). In general, the mean travelling speed involved in rural conditions is in the order of 60 km/h.		
Sources:	The precise rural driving speed is difficult to estimate as, often, there are limited statistics in non urban or highway areas. On top of this, rural networks involve a variety of roads with different characteristics. An approach in estimating rural speeds is to consider the proportion of rural roads with different speed limits (usually 50, 60, 70 and 80 km/h). By estimating the activity in the different roads and with the constraint that the mean speed cannot exceed the speed limit, one may produce an estimate of the mean rural driving speed.		
Typical Range:	Typical rural speeds are between 55 and 80 km/h.		
Quantification of variability (Italy & Poland):	3s = 0,2×μ, according to French COPERT Uncertainty report		

Symbol:	RStech	**Name:**	Rural share
Type:	Input Variable	**units:**	%
Description:	The share of annual mileage driven in rural conditions. Rural areas are in principle defined as what is not urban and not highway. The rural share is calculated as the difference of the sum of urban and highway conditions over 100.		
Sources:	This is difficult to estimate independetly. Unless there are detailed statistics in a country, a reasonable approach in estimating the rural share is to subtract the urban and highway shares from 100.		
Typical Range:	The share of rural mileage ranges between 30% and 50% for cars, and variable range for the other vehicle classes.		
Quantification of variability (Italy & Poland):	3s = 0,2×μ, according to French COPERT Uncertainty report		

Symbol:	RVP	**Name:**	Fuel reid vapour pressure
Type:	Input Variable	**units:**	kPa
Description:	The vapour pressure of gasoline (defined by a test at 38 oC). The vapour pressure is a measure of the fuel volatility. The higher the vapour pressure, the easier the fuel evaporates at a given temperature. The vapour pressure is important to calculate NMVOC emissions due to evaporation losses. These are only relevant for gasoline, due to the low volatility of the diesel fuel.		
Sources:	The maximum RVP is defined by the regulations. Some detailed data on RVP for different countries and relevant information and sources may be found in http://ec.europa.eu/environment/air/pdf/fqm_summary_2004.pdf.		
Typical Range:	The typical range in Europe is 60 kPa (summer grade) to 90 kPa (winter grade).		
Quantification of variability (Italy & Poland):	Limited uncertainty expected, as fuels are centrally produced and the refineries need to follow the regulations. Assumption 3s = 0,05×μ		

Symbol:	S	**Name:**	Sulfur level in fuel
Type:	Input Variable	**units:**	ppm
Description:	The content of sulfur in the fuel. Sulfur carriers are present in the crude oil before distillation and are removed during the fuel processing. Sulfur is converted to sulfur dioxide during combustion but it also accelerates the degradation of aftertreatment devices. Maximum levels of sulfur in the fuel is regulated throughout Europe.		
Sources:	Fuel sulfur in each country cannot exceed the levels set by the regulations. Refineries usually put a safety margin and actual sulfur levels are in the order of 10-20% lower than the regulatory limits. Refineries have detailed information the sulfur levels of the fuels delivered to the market.		
Typical Range:	For 2009 fuel specifications, about 8 ppm for Diesel and 40 ppm for gasoline		
Quantification of variability (Italy & Poland):	Sulfur is controlles by regulations in both gasoline and diesel fuel. Therefore, uncertainty is very low: 3s = 0,05×μ		

Symbol:	tmax	**Name:**	Average max monthly temperature
Type:	Input Variable	**units:**	oC
Description:	The average of the maxima in daily temperature for a duration of a month. This maximum temperature is required as input to both evaporation and cold-start calculations. For countries with significant temperature differences over their area (e.g. south and north), the temperature should correspond to the average (possibly weighted average) of areas where most of the traffic is located. For example, in the case of Italy, it should correspond mostly to the northern half of the country, as the total activity in the southern part is weak compared to the north.		
Sources:	Historic information on temperatures may be received from the meteorological insitutes in each country. Internet datavases (i.e. www.weatherbase.com) also include detailed data for major cities in Europe.		
Typical Range:	Country and month specific. Average max temperature ranges between 12 - 31 C, depending on the month in Southern Europe to -3 to +21 in Northern Europe.		
Quantification of variability (Italy & Poland):	An uncertainty range required to cover national differences between north and south. 3s=3C		

Symbol:	tmin	**Name:**	Average min monthly temperature
Type:	Input Variable	**units:**	oC
Description:	The average of the minima in daily temperature for a duration of a month. This minimum temperature is required as input to both evaporation and cold-start calculations. For countries with significant temperature differences over their area (e.g. south and north), the temperature should correspond to the average (possibly weighted average) of areas where most of the traffic is located. For example, in the case of Italy, it should correspond mostly to the northern half of the country, as the total activity in the southern part is weak compared to the north.		
Sources:	Historic information on temperatures may be received from the meteorological insitutes in each country. Internet datavases (i.e. www.weatherbase.com) also include detailed data for major cities in Europe.		
Typical Range:	Country and month specific. Average min temperature ranges between 6 - 22 C, depending on the month in Southern Europe to -9 to +11 in Northern Europe.		
Quantification of variability (Italy & Poland):	An uncertainty range required to cover national differences between north and south. 3s=3C		

Symbol:	TStech	**Name:**	Total share
Type:	Check item	**units:**	%
Description:	The sum of shares in urban, rural and highway driving.		
Sources:	Equal to 100%		
Typical Range:	The share of highway mileage ranges between 10% and 25% for cars, 40-60% for trucks, and very low for motorcycles.		
Quantification of variability (Italy & Poland):	0		

Symbol:	USPtech	**Name:**	Urban speed
Type:	Input Variable	**units:**	km/h
Description:	The mean travelling speed of a vehicle category in urban conditions, over the period considered in an inventory (year). In general, the mean travelling speed involved in urban conditions does not exceed 35 km/h. The mean speed differs with vehicle category, with motorcycles usually achieveing a higher mean speed than passenger cars.		
Sources:	City planning and traffic management authorities have good estimations of the mean speed, via field campaigns they have conducted, orreal-time monitors of mean speed installed in key areas around the city.		
Typical Range:	Typical urban speeds are between 18 to 35 km/h		
Quantification of variability (Italy & Poland):	3s = 0,2×μ, according to French COPERT Uncertainty report		

Symbol:	UStech	**Name:**	Urban share
Type:	Input Variable	**units:**	%
Description:	This is the share of annual mileage (in percentage units) driven under urban conditions in a city. The definition of an urban area for a road transport inventory concerns the road network managed by the city authorities in each country.		
Sources:	The urban mileage is different for each vehicle category. Urban busses and mopeds are in principle 100% driven in cities while heavy duty trucks only operate in cities over a very small portion of their mileage (if at all). In order to estimate the urban share for passenger cars and light duty trucks (where it is more relevant) one needs to estimate the total activity in, at least, the major cities in the country from data of the local authorities (planning and traffic management authorities in each city). This should be complemented with assumptions on the activity in more minor cities. The activity will be different per vehicle category. The summation of all major cities and several of the minor ones will provide a reliable estimate of the activity in urban areas per vehicle category.		
Typical Range:	The share of urban mileage ranges between 30% and 40% for cars, 100% for urban busses and mopeds, and 10-20% for trucks, depending on their size.		
Quantification of variability (Italy & Poland):	3s = 0,2×μ, according to French COPERT Uncertainty report		

3 Modelling Theory / Approach

3.1 General

Uncertainty analysis is the study of the variation in model output resulting from the collective variation in the model inputs. The objective of uncertainty analysis is to:

1. quantify the uncertainty in the model output, given the uncertainty in the inputs,
2. develop confidence intervals about the mean or distribution function of the model output.

Sensitivity analysis quantifies the relative contribution of the input factors in forming the uncertainty in the model output. The output uncertainty is mapped back to the input factors to identify the ones that are mainly responsible for that output uncertainty. The objectives of sensitivity analysis are:

1. identify input variables that have a large influence on the output uncertainty (for subsequent calibration / optimisation tasks, or prioritisation of research);
2. identify non relevant variables (for model reduction purposes);
3. improve the understanding of the model structure (highlighting interactions among variables, combinations of variables that result in high / low values for the model output);
4. model verification and corroboration (to check whether the model behaviour is in line with scientist expectations);
5. model quality assessment (to check whether the model output uncertainty depends on hard science, e.g. lack of knowledge in data, or on soft-science, e.g. subjective preferences and assumptions), etc.

A number of sensitivity analysis methods can be used to accomplish such task and, consequently, many techniques have been proposed (e.g. linear regression or correlation analysis, measures of importance, sensitivity indices, screening, etc.). A thorough description of such techniques can be found in Saltelli et al. (2000). Here we will focus on two of them, which have been extensively used in this project: the screening technique of Morris (Morris, 1991) and the variance-based methods, these latter being implemented via the extended FAST (Saltelli et al., 1999).

3.2 Methods

The COPERT 4 model is a complex model that involves a large number of input factors. The choice of a well-designed experiment is essential in order to identify the most important factors among a large number and quantify their importance.

Global sensitivity analysis using variance-based methods considers the full range of variation of the input parameters along their joint distribution. Variance-based methods seek to decompose the total output variance into its contributions from each input factor. The importance of a given input factor can be measured via the so-called sensitivity index, which is defined as the fractional contribution to the model output variance due to the uncertainty in the input factor. These methods involve Monte-Carlo (MC) sampling of the input factors according to specific sampling strategies. Thus they reflect the full range of variation of the input factors. Because the factors are varied simultaneously, this involves a multidimensional averaging. The apparent drawback of variance based methods is the so-called curse of dimensionality, which is palpable when the number of factors becomes large: the number of terms in the decomposition of the output variance grows exponentially with the number of factors. In cases where the model contains a large number of factors or/and it is computationally too expensive, the application of variance based methods like FAST or Sobol' is not possible.

Screening designs are a convenient choice when the objective is to identify the subset of input factors that can be fixed at any given value over their range of uncertainty without

reducing significantly the output variance (i.e. identify non-influential factors). The screening methods provide a list of factors ranked in order of decreasing importance allowing the modeller to identify the subset of less influential ones. Screening designs like the Morris method are computationally cheap and model free. As a drawback, these methods tend to provide qualitative sensitivity measures, i.e. they rank the input factors in order of importance, but do not quantify how much a given factor is more important than another. Nevertheless, it does not supply the variance decomposition obtained with the variance-based measures.

For these reasons, the analysis has been performed in two steps. First, a screening analysis (Morris) identified the most influential input parameters. Then, a variance based sensitivity analysis technique (FAST) quantified the uncertainty of the road transport emissions.

3.2.1 Variance-Based Methods

In variance-based methods the output variance V(Y) can be decomposed in the sum of a top marginal variance and a bottom marginal variance. Specifically,

$$V(Y) = V[E(Y|U)] + E[V(Y|U)] \quad (3\text{-}1)$$

where U is a group of one or more elements Xi. The top marginal variance from U is the expected reduction of the variance of Y in case U becomes fully known and is fixed at nominal values, whereas other inputs remain variable as before. The bottom marginal variance from U is defined as the expected value of the variance of Y in case all inputs but U become fully known, U remaining as variable as before.

The main effect or first order sensitivity index Si, representing the sensitivity of Y to the factor Xi, is defined as the top marginal variance divided by the total variance, where the subset U reduces to the single factor Xi:

$$S_i = \frac{V[E(Y|U = x_i^*)]}{V(Y)} \quad (3\text{-}2)$$

and represents the average output variance reduction that can be achieved when Xi becomes fully known and is fixed. Estimation procedures for Si are the Fourier Amplitude Sensitivity Test, FAST, the method of Sobol', and others. Higher order sensitivity indices, which quantify the sensitivity of the model output to interactions among subsets of factors, can be estimated using similar formula. For instance, the second order sensitivity index Sij, representing the sensitivity of Y to the interaction between Xi and Xj, is:

$$S_{ij} = \frac{V[E(Y|X_i = x_i^*, X_j = x_j^*)] - V[E(Y|X_i = x_i^*)] - V[E(Y|X_j = x_j^*)]}{V(Y)} \quad (3\text{-}3)$$

From the definitions in equations. (3.2) and (3.3), a complete series development of the output variance can be achieved:

$$1 = \sum_i S_i + \sum_{i<j} S_{ij} + \sum_{i<j<m} S_{ijm} + \ldots + S_{12\ldots k} \quad (3\text{-}4)$$

where higher order terms are defined in a similar way to eq. (3.3).

Given that the estimation of each sensitivity index, be it Si, Sij or higher order, might require a significant number of model executions, the analysis is rarely carried further after the computation of second order indices (their number is k(k-1)), as the related computational load might be impracticable.

The investigation of higher order effects is computationally cheaper if total sensitivity indices are employed. The total sensitivity index STi for the factor Xi collects in one single

term all the interactions involving Xi. It is defined as the average output variance that would remain as long as Xi stays unknown (i.e. the bottom marginal variance with U grouping all factors but Xi):

$$S_{Ti} = \frac{E[V(Y|X_{-i} = x^*_{-i})]}{V(Y)} \quad (3\text{-}5)$$

The term X-i indicates all the factors but Xi. The usefulness of the STi is in that they can be computed without necessarily evaluating the single indices Sijm…, thus making the analysis affordable from a computational point of view.

Estimating the pair (Si, STi) is important to appreciate the difference between the impact on Y of the factor Xi alone (the Si) and the overall impact on Y of factor Xi through interactions with the others (the STi). Such property is particularly interesting in a calibration framework, where high order interactions are usually encountered. Efficient estimators of the pair (Si, STi) are provided by variance-based techniques such as the extension of the Fourier Amplitude Sensitivity Test (xFAST) and the Sobol's method.

The extended FAST (Saltelli et al., 1999) yields estimates of the total sensitivity indices, STi, defined as the sum of all the indices (Si and higher orders) where the variable Xi is included. The STi concentrates in one single term all the effects of Xi on Y. For additive models (no interactions), Si = STi for all the Xi. The estimation of the total sensitivity indices STi makes the analysis affordable from a computational point of view, as only k total indices are needed to account completely for the total output variance V. Furthermore, the extended FAST allows the simultaneous evaluation of the first and total effect indices. The estimation of the pair (Si, STi) is important to appreciate the difference between the impact of Xi alone on Y (i.e. Si) and the overall impact of factor Xi through interactions with the other input variables on Y (i.e. STi). Clearly the Si1, i2, …,is add up to one; this is not true for the STi's.

3.2.2 Screening Methods

Screening methods are useful in the modelling practice to investigate which factors - among the many potentially important factors - are really important. This could help in coming up with a short list of influential factors.

Screening methods deal with models containing hundreds of input variables, and/or with very computationally expensive models. They are economical from a computational point of view, but as a drawback, they provide qualitative sensitivity measures (i.e. they rank the input variables in order of importance, but do not quantify how much a given variable is more important than another). There is clearly a trade-off between computational cost and information. Several approaches to the problem of screening have been proposed in the literature.

A brief description of the one-at-a-time (OAT) method proposed by Morris is given hereafter. This method is one of the most widespread. The method of Morris varies one factor at a time across a certain number of levels selected over the space of the input variables. For each variation ΔXi, an estimate of the effect is computed (ΔY). The average μ of all ΔY for a given factor Xi is then computed (so to lose the dependence of the specific point at which the measure was computed) that yield a global "first order" effect of Xi; by computing the standard deviation of the same set of ΔY one obtains an estimate of non linear and interaction effects. The method requires a total number of model evaluations that is of the order of k, O(k), where k is the number of model inputs.

3.3 Parameterisations

COPERT 4 estimates emissions of all regulated air pollutants (CO, NOx, VOC, PM among others) produced by six principal vehicle categories (PC: Passenger Cars, LDV: Light Duty Vehicles, HDV: Heavy Duty Vehicles, UB: Urban Busses and Coaches, MOP: Mopeds, MOT:

Motorcycles) under three driving modes (U: Urban, R: Rural, H: Highway), as well as CO_2 emissions on the basis of fuel consumption. Furthermore, emissions are calculated for an extended list of non regulated pollutants, including methane (CH_4), nitrous oxide (N_2O), ammonia (NH3), sulphur dioxide (SO2) heavy metals, polycyclic aromatic hydrocarbons (PAHs) and persistent organic pollutants (POPs). Finally, the software provides non-methane NMVOC emissions distinguished into several individual species. In general, the quality and the availability of experimental data is better for the emission factors of regulated pollutants (CO, VOC, NOx, PM) and falls for non-regulated ones (NMVOC speciation, NH3, …). In order to focus to the most important outputs of COPERT, we calculated the uncertainty of regulated pollutants, greenhouse gases (CO_2, CH_4, N_2O), and fuel consumption.

Emission estimates are generally distinguished into three sources: emissions produced during thermally stabilised engine operation (hot emissions), emissions occurring during engine start from ambient temperature (cold-start and warming-up effects) and NMVOC emissions due to fuel evaporation. The total emissions are calculated as a product of activity data provided by the user and speed-dependent emission factors calculated by the software.

The most important inputs to COPERT 4 are meteorological parameters and parameters with temporal variation (like Temperature, Canister Efficiency and Reid Vapour Pressure), the activity data (like Vehicle Population and Vehicle Mileage), the traffic and model parameters (like Vehicle Velocity, driving shares among the cycles, load factor for heavy duty vehicles, average trip length and fuel properties) and the emission factors. Many input parameters are usually multi-dimensional arrays. For example, the emission factor is a 5-dimensional variable, depending on the Vehicle Category (PC, LDV, etc), Technology (Euro 1, Euro 2, etc), Engine Size (<1.4lt, >2.0lt, etc), Pollutant, and Velocity.

The "total error", ε_{total}, of emission estimates from transport results from an entire "chain of errors". This total error consists of four error contributions:

(a) ε_{METEO} denotes the error associated with the meteorological conditions, or parameters with a temporal profile which are generally expressed in terms of a set of suitably defined parameters;

(b) $\varepsilon_{TRAFFIC}$ denotes the error which comes along with the estimation of the total amount of stock, the break-down of the total stock into different vehicle categories (passenger cars, light-duty vehicles, etc.) and technological concepts (Euro 1, 2, 3, etc.);

(c) ε_{MODEL} represents uncertainty in the model parameters, such as velocity values for all categories of vehicles, poorly known load factors for duty vehicles, gradients, etc.;

(d) ε_{LAB} denotes the uncertainty associated with the parameterisation of emission factors based on laboratory (experimental) measurements.

In the Monte Carlo version of COPERT 4, we wish to acknowledge the uncertainty in all these inputs. The process of considering uncertainty in 0-D variables (e.g., average speed of PC in urban conditions) is straightforward through their statistical distribution (although perhaps not easy to quantify). The process is however not easy for multi-dimensional input variables, for which we need to identify, via a statistical model, a suitably small set of parameters that describe well the multi-dimensional system. By associating a proper uncertainty to these model parameters, we can then represent and characterise the uncertainty in the multi-dimensional system.

The parameterization of the contribution of all sources of uncertainty in COPERT 4 resulted in a significant reduction of the total uncertainty inputs to only 51 (Table 3.1). Specifically:

(a) 4 parameters corresponding to ε_{METEO}: three related to the temperature time series (*A*, *H, d)* and one for the Reid Vapour Pressure *(eRVP)*.

(b) 15 parameters corresponding to $\varepsilon_{TRAFFIC}$: nine related to the fleet breakdown model (*PC, LDV, HDV, UB, MOP, MOT,* τ, δ, and σ) and six to the parameterization of the annual mileage (*milPC, milLDV, milHDV, milUB, milMO, eM0*).

(c) 30 parameters corresponding to ε_{MODEL}: ten related to the urban and highway driving shares (Rural is calculated from the residuals) (*UPC, ULDV, UHDV, UUB, UMO, HPC, HLDV, HHDV, HUB, HMO*), fifteen related to the velocity profiles per category under all driving modes (*VUPC, VULDV, VUHDV, VUUB, VUMO, VRPC, VRLDV, VRHDV, VRUB, VRMO, VHPC, VHLDV, VHHDV, VHUB, VHMO*), one for the Load factor of the Heavy Duty Vehicles (*LF*), one for the average trip length (*ltrip*) and three for the fuel properties (*H2C, O2C, S*).

(d) 2 parameters corresponding to ε_{LAB}: one for the hot emission factors (e_{EF}) and one for the cold emission factors ($e_{EFratio}$).

The details of this process are given in the next section for the different types of multi-dimensional inputs.

3.4 Sub-models

3.4.1 Parameterisation of ε_{METEO}

COPERT 4 requires the monthly average minimum and maximum temperatures. Its Monte Carlo version instead, parameterises the actual temperature time-series via a statistical error model, which reproduces the available experimental data through the following formulas:

$$T^{MIN}(imonth) = \left(A + H * \exp\left(f\left(imonth\right)\right)\right) \quad (3\text{-}6)$$

$$T^{MAX}(imonth) = T^{MIN}\left(imonth\right) + d\min + \left(d - d\min * \exp\left(f\left(imonth\right)\right)\right) \quad (3\text{-}7)$$

where

$$f\left(imonth\right) = -\frac{\left(imonth - peak\right)^2}{\left(sigma\right)^2} \quad (3\text{-}8)$$

The uncertainty into the temperature values is then lumped to the three parameters A (lowest minimum temperature), H (highest minimum temperature minus lowest minimum temperature) and d (highest maximum temperature minus highest minimum temperature). It has been statistically tested that the distributions of A, H and d are normal.

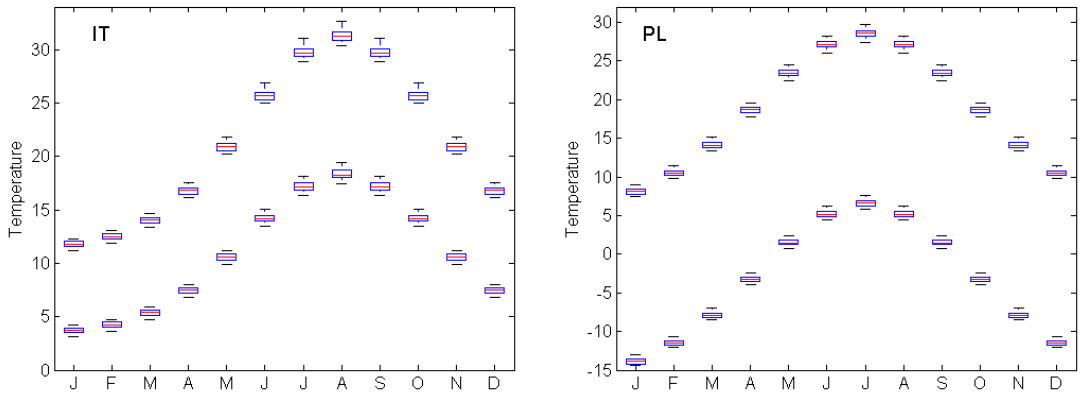


Figure 3-1: The parameterization of the time series of the minimum and maximum temperature.

Further, the Reid vapour pressure is parameterized with reference to its mean monthly values RVP_0 (J F M A M J J A S O N D) = [90 90 90 60 60 60 60 60 60 90 90 90] as:

$$RVP(imonth) = RVP_0(imonth) * (1 + 0.015 * eRVP)), \text{ i=1,2,...,12} \quad (3.9)$$

3.4.2 Parameterisation of $\varepsilon_{TRAFFIC}$

FLEET

The uncertainty of the stock parameters was quantified as described in section 2.2. The decomposition of the total amount of vehicles into the subcategories (according to the engine capacity, the fuel type and the technology) required by COPERT 4 is performed with a stochastic Fleet Breakdown Model (FBM). Given the total volume of traffic, the FBM provides values for the percentages of vehicles of a given category and such percentages are affected by uncertainty.

The FBM results for Italy are parameterised on the basis of nine parameters:

- [PC, LDV, HDV, UB, MOP, MOT] the total population of passenger cars, light duty vehicles, heavy duty vehicles, urban buses-coaches, mopeds & motorcycles
- δ: steers the *diesel share* of PC and LDV; when $\delta \rightarrow 0$ it represents a fleet where all the non-identified, whether gasoline or diesel, vehicles within the category are considered as diesel.
- σ: steers the *engine size* or *weight* distribution of PC, LDV, HDV, UB & MOT, HDV, when $\sigma \rightarrow 0$ it represents a fleet where all the non-identified, whether low or high engine size or weight, vehicles within the category are considered as high engine size or weight.
- τ: indicates which of the *Beta* and *Tau* values will be used to calculate the technology split as mentioned in section 2.2 by providing the index of the required *Beta* and *Tau* pair.

At the first step, the model splits the non-identified vehicles within a vehicle category to gasoline or diesel. The value of δ times the non-identified as gasoline or diesel vehicles corresponds to the non-identified clustered as gasoline. Similarly, we obtain the non-

identified that are clustered as diesel. Next, we have to allocate the non-identified vehicles within a vehicle category to the multiple engine-size or weight sub-categories. This was implemented with a full factorial design; the value of σ was used to sample a realisation from the design and calculate the population at the subsector level. At the last step, the population at the subsector level is split into technologies according to the methodology described in section 2.2 following the selection of the Beta and Tau pair based on the value τ. Eleven discrete levels have been used in the full factorial design for the inputs (within specific subcategories) to sample all possible combinations of levels and inputs and allocate the non identified vehicles to different engine size or weight realizations.

In the case of Poland, a simplified approach was used, as the standard deviation was already produced from the initial processing of the data (section 2.2). In this case, the variance of the data was modelled assuming that one third originates from the δ parameterisation and two thirds originate from the σ parameterisation.

MILEAGE

The annual mileage is parameterised on the basis of six parameters:

- *eM0*: steers the annual mileage of a new vehicle (vehicle of age 0)
- *milPC, milLDV, milHDV, milUB, milMO*: indicate which couple of the *bm* and *Tm* values will be used to calculate the mileage correction factor for vehicle age as mentioned in section 0 by providing the index of the required *bm* and *Tm* pair.

At the first step the annual mileage of the new vehicle is calculated by using the following formula:

$$M0 = (1 + 0.1 \times eM0) \times mN \qquad (3\text{-}10)$$

where *mN* is the mean annual mileage of a new vehicle for each vehicle category and country. This value is then corrected by the mileage correction factor for vehicle age. This factor is calculated by using a Weibull function and the corresponding selection of the *bm* and *Tm* couple as described in section 2.4. The parameters milPC, milLDV, milHDV, milUB, milMO indicate the index of the *bm* and *Tm* pair to be used out of the data pool of 100 different sets.

We evaluated the combination of values for the model parameters *bm* and *Tm* that do not violate the constraints imposed towards an acceptable mileage-model response. This generated the 2-dimensional fitting function surface in the parameter space. A stochastic variable was employed to sample values from the generated response surface, i.e. the permissible values of the joint probability distribution function of *bm* and *Tm*.

3.4.3 Parameterisation of ε_{MODEL}

The variables belonging to this category are all scalar except for the sulphur level in fuel, S_0:

S_0 (GSL DSL) = [40 8]

that is simulated as:

$$S(ifuel) = S_0(ifuel) * (1 + 0.015 * eS) \qquad (3\text{-}11)$$

3.4.4 Parameterisation of the emission factors: ε_{LAB}

The data collected from laboratory measurements are usually processed by regression analysis to provide a set of regression coefficients that are meant to explain the underlying phenomenon through a polynomial curve that fits the observed data. Such regression coefficients are subsequently stored in tables and employed during the execution of the model (COPERT 4). In spite of the fact that the regression curve might perform very poorly (e.g., $R^2 << 1$), the coefficients are considered as fixed numbers in the simulations.

On the basis of the statistical analysis of experimental data available, experimental errors for the coefficients were estimated. Such experimental errors are in the form of stochastic variables that, coupled with the polynomial regression curves ($ef^{COPERTi}$), reproduce the experimental pattern. The probability distribution functions for the stochastic emission factors (ef) are set up utilising the following procedure:

HOT EMISSION FACTORS AND FUEL CONSUMPTION FACTORS

(a) The laboratory measurements have been clustered to 14 equally sized velocity classes (1: 0-10 km/h, 2: 10-20 km/h, …, 14: 130-140 km/h); for each velocity class (v_1, v_2,…, v_K), k=1,2,…,14, we calculate its standard deviation (s_1, s_2,…, s_K). For cycle dependent emission factors (N_2O, CH_4), the maximum value of k equals 4 (urban cycle cold engine, urban cycle hot engine, rural cycle, highway cycle).

(b) We fit a speed dependent log-normal distribution to the laboratory measurements with mean equal to the polynomial regression curve ($ef_{HOT}^{COPERT_i}$) and standard deviation calculated in the previous step (s_1, s_2,…, s_K). The hot emission factor (ef_{HOT}) for the sampled velocity V_j is based on the formula:

$$ef_{HOT}(V_j) = e^{\mu_j + \sigma_j * eEF} \tag{3.12}$$

$$\mu_j = \ln\left(ef_{HOT}^{COPERT}(V_j)\right) - 0.5\ln\left(1 + \left(\frac{s_i}{ef_{HOT}^{COPERT}(V_j)}\right)^2\right) \tag{3.13}$$

$$\sigma_j = \sqrt{\ln\left(1 + \left(\frac{s_i}{ef_{HOT}^{COPERT}(V_j)}\right)^2\right)} \tag{3.14}$$

$$e_{EF} \sim N(0,1) \tag{3.15}$$

This procedure, which reproduces the experimental pattern of the hot emission factors, has been repeated for all Vehicle Categories (PC, LDV, etc), Technologies (Euro 1, Euro 2, etc), Engine Sizes (<1.4lt, >2.0lt, etc) and pollutants.

COLD EMISSION FACTORS

(a) The cold emission factors have been split in fourteen speed classes, similar to hot ones (1: 0-10 km/h, 2: 10-20 km/h, …, 14: 130-140 km/h); for each velocity class (v_1, v_2,…, v_K), k=1,2,…,14, we calculate the standard deviation (s_1, s_2,…, s_K) of $(ef_{COLD}/ef_{HOT}-1)*ef_{HOT}^{COPERT}$, assuming that the ratio of standard deviation over mean of the hot emission factors is equal to the standard deviation over mean for the cold emission factor. For cycle dependent emission factors (N_2O, CH_4), separate cold start emission factors are not calculated, as a cold urban part has already been included in the four categories of the hot emission factors. The highest speed classes are not

relevant for the cold-start emission factor as the COPERT 4 cold-start functions are valid only up to 45 km/h and cold-start is allocated to urban conditions only.

(b) No uncertainty of cold-start emission factors to temperature has been assumed, as no data were available to assess it. Therefore, the uncertainty of cold-start overemission on ambient conditions originates only from the uncertainty in the temperature as such, described in section 3.4.1.

(c) We fit a speed dependent log-normal distribution to the approximated variance of cold-start emission factors with a mean equal to the calculated value for the particular speed ($ef^{COPERT}{}_i$) and a standard deviation calculated in the previous step (s_1, s_2,…, s_K). The cold emission factor (ef_{COLD}) for the sampled velocity V_j is based on the formula:

$$ef_{COLD}(V_j) = (ef_{RATIO}(V_j) - 1) * ef_{HOT}^{COPERT}(V_j) \quad (3.16)$$

$$ef_{RATIO}(V_j) = 1 + e^{\mu_j + \sigma_j * eEFratio} \quad (3.17)$$

$$\mu_j = \ln\left(ef_{RATIO}^{COPERT}(V_j) - 1\right) - 0.5\ln\left(1 + \left(\frac{s_i}{ef_{RATIO}^{COPERT}(V_j) - 1}\right)^2\right) \quad (3.18)$$

$$\sigma_j = \sqrt{\ln\left(1 + \left(\frac{s_i}{ef_{RATIO}^{COPERT} - 1}\right)^2\right)} \quad (3.19)$$

$$e_{EFratio} \sim N(0,1) \quad (3.20)$$

The above procedure, which reproduces the experimental pattern of the cold-start emission factors, has been repeated for all Vehicle Categories (PC, LDV, etc), Technologies (Euro I, Euro II, etc), Engine Sizes (<1.4lt, >2.0lt, etc) and pollutants.

NON-EXHAUST PM

(a) The laboratory measurements have been clustered to 2 source categories (tyre, brake) and we calculate the standard deviation (s_1, s_2) for each vehicle category.

(b) We fit a "wear" dependent normal distribution to the laboratory measurements with mean equal to the polynomial regression curve ($tsp^{COPERT}{}_i$) and standard deviation calculated in the previous step. The total suspended particulates (tsp) for break-wear and tyre-wear are based on the formula:

$$tsp = tsp^{COPERT} + s_j * eEF \quad (3.21)$$

$$e_{EF} \sim N(0,1) \quad (3.22)$$

Based on these considerations, Table 3-1 and Table 3-2 provide a summary of the modelling approach, the mean value and the standard deviation of the variables modelled.

Table 3-1: List of the uncertain input variables, belonging to the traffic, meteorological and laboratory error categories, with their statistical distributions.

			COPERT IV			ITALY		POLAND	
	Error Cat	**Variable**	**Description**	**Units**	**Distribution**	**(μ)**	**(σ)**	**(μ)**	**(σ)**
1	ε-TRAFFIC	PC	population of PC	vehs.	Normal	34,657,123	17,947	12,339,118	204
2	ε-TRAFFIC	LDV	population of LDV	vehs.	Normal	3,445,713	266,137	2,066,645	308,968
3	ε-TRAFFIC	HDV	population of HDV	vehs.	Normal	1,014,354	79,131	662,035	106,017
4	ε-TRAFFIC	UB	population of UB	vehs.	Normal	94,325	195	79,722	241
5	ε-TRAFFIC	MOP	population of MOP	vehs.	Normal	4,942,954	540,295	337,511	0
6	ε-TRAFFIC	MOT	population of MOT	vehs.	Normal	4,936,773	2,748	753,824	249
7	ε-TRAFFIC	τ	FBM technology split	-	Uniform	0	1	0	1
8	ε-TRAFFIC	σ	FBM engine size split	-	Uniform	0	1	0	1
9	ε-TRAFFIC	δ	FBM gsl/dsl split	-	Uniform	0	1	0	1
10	ε-TRAFFIC	milPC	mileage parameter of PC	-	Uniform	0	1	0	1
11	ε-TRAFFIC	milLDV	mileage parameter of LDV	-	Uniform	0	1	0	1
12	ε-TRAFFIC	milHDV	mileage parameter of HDV	-	Uniform	0	1	0	1
13	ε-TRAFFIC	milUB	mileage parameter of UB	-	Uniform	0	1	0	1
14	ε-TRAFFIC	milMO	mileage parameter of MO		Uniform	0	1	0	1
15	ε-TRAFFIC	eM0	M0 parameter		Normal	0	1	0	1
16	ε-METEO	A	Lowest minimum temperature	°C	Normal	3.4	0.35	-16.1	0.47
17	ε-METEO	H	highest minimum - lowest minimum temperature	°C	Normal	14.9	0.51	23.1	0.34
18	ε-METEO	D	highest maximum - (A+H) temperature	°C	Normal	13	0.48	22.1	0.56
19	ε-METEO	eRVP	Fuel reid vapour pressure	kPa	Normal	0	0.02	0	0.02
20	ε-LAB	eEF	amplitude HOT Emission Factor	-	Normal	0	1	0	1
21	ε-LAB	eEFratio	Cold-start emission factor	-	Normal	0	1	0	1

Table 3-2: List of the uncertain input variables, belonging to the *model* error category, with their statistical distributions.

		COPERT IV			ITALY		POLAND	
	Variable	**Description**	**Units**	**Distribution**	**(μ)**	**(σ)**	**(μ)**	**(σ)**
1	UPC	urban share of PC	%	Normal	35	2.33	35	2.33
2	ULDV	urban share of LDV	%	Normal	35	2.33	35	2.33
3	UHDV	urban share of HDV	%	Normal	15	1.00	15	1.00
4	UUB	urban share of COACHES	%	Normal	15	1.00	15	1.00
5	UMO	urban share of MOT	%	Normal	60	4.00	60	4.00
6	HPC	highway share of PC	%	Normal	20	0.67	20	0.67
7	HLDV	highway share of LDV	%	Normal	20	0.67	20	0.67
8	HHDV	highway share of HDV	%	Normal	50	1.67	50	1.67
9	HUB	highway share of COACHES	%	Normal	50	1.67	50	1.67
10	HMO	highway share of MOT	%	Normal	10	0.33	10	0.33
11	VUPC	Urban speed of PC	km/h	Normal	25	1.67	25	1.67
12	VULDV	Urban speed of LDV	km/h	Normal	25	1.67	25	1.67
13	VUHDV	Urban speed of HDV	km/h	Normal	25	1.67	25	1.67
14	VUUB	Urban speed of UB	km/h	Normal	25	1.67	25	1.67
15	VUMO	Urban speed of MO	km/h	Normal	25	1.67	25	1.67
16	VHPC	Highway speed of PC	km/h	Normal	110	3.67	110	3.67
17	VHLDV	Highway speed of LDV	km/h	Normal	100	3.33	100	3.33
18	VHHDV	Highway speed of HDV	km/h	Normal	90	3.00	90	3.00
19	VHUB	Highway speed of UB	km/h	Normal	90	3.00	90	3.00
20	VHMO	Highway speed of MO	km/h	Normal	75	2.50	75	2.50
21	VRPC	Rural speed of PC	km/h	Normal	70	4.67	70	4.67
22	VRLDV	Rural speed of LDV	km/h	Normal	70	4.67	70	4.67
23	VRHDV	Rural speed of HDV	km/h	Normal	65	4.33	65	4.33
24	VRUB	Rural speed of UB	km/h	Normal	65	4.33	65	4.33
25	VRMO	Rural speed of MO	km/h	Normal	65	4.33	65	4.33
26	Ltrip	Mean trip length	km	L-Normal	12.4	2.48	12.4	2.48
27	LF	Load Factor for HDV		Normal	50	3.33	50	3.33
28	H:C	Hydrogen-to-carbon ratio	-	Normal	1.95	0.05	1.95	0.05
29	O:C	Oxygen-to-carbon ratio	-	Normal	0.05	0.015	0.05	0.015
30	eS	Sulfur level in fuel	ppm	Normal	0	1	0	1

4 Software implementation

The uncertainty calculations required an iterative execution of COPERT 4, concerning the import, calculation, and export of a large number of runs. Creating a database where all the input, intermediate and output data of these runs are kept, would result in a very slow software tool. On the other hand new programming functions were added into COPERT in order for the software to be able to import, calculate and export every run, one after the other in the most optimum way.

4.1 Programming Code changes

The integration of uncertainty estimates in COPERT calculations resulted in several programming code changes of the software application COPERT 4. These changes do not interfere with the original calculation of the emission factors since they are applied after the emission factors have been calculated by the original code of the model. Therefore, a regular COPERT 4 run is executed and then the necessary Monte Carlo modifications are brought.

The programming modifications are located in three sections of the calculation process. The first one appears after the hot emission factors have been calculated and equations (4-1), (4-2), (4-3) are applied for each pollutant.

Application	**Equation**	
Hot Emission Factors of VOC, CO, NOx, PM exhaust Log-Normal Distribution	$\mu = \ln\left(ef_{HOT}^{\ COPERT}\right) - 0.5\ln\left(1+\left(\frac{std_{HOT}(V)}{ef_{HOT}^{\ COPERT}}\right)^2\right)$ $\sigma = \sqrt{\ln\left(1+\left(\frac{std_{HOT}(V)}{ef_{HOT}^{\ COPERT}}\right)^2\right)}$ $ef(HOT) = e^{\mu+\sigma*eEF}$	(4-1)
where:	$ef_{HOT}^{\ COPERT}$: The original hot emission factor $std_{HOT}(V)$: The emission factor standard deviation, for the "V" speed class eEF : stochastic error for the hot emission factor $ef(HOT)$: The hot emission factor value used in the particular run	

Application	**Equation**	
Fuel Consumption Normal Distribution	$fc(HOT) = fc_{HOT}^{\ COPERT} + std_{HOT}(V) * eEF$	(4-2)
where:	$fc_{HOT}^{\ COPERT}$: The original calculated hot fuel consumption factor $std_{HOT}(V)$: The standard deviation of the factor, for the "V" speed class eEF : Stochastic error for the hot emission factors fc_{HOT} : Hot fuel consumption factor used in the particular run	

Hot Emission Factors of CH_4, N_2O

$$\mu = \ln\left(ef_{HOT}^{\ COPERT}\right) - 0.5\ln\left(1 + \left(\frac{std_{HOT}(cycle)}{ef_{HOT}^{\ COPERT}}\right)^2\right)$$

Log-Normal Distribution

$$\sigma = \sqrt{\ln\left(1 + \left(\frac{std_{HOT}(cycle)}{ef_{HOT}^{\ COPERT}}\right)^2\right)} \qquad (4\text{-}3)$$

$$ef(HOT) = e^{\mu + \sigma * eEF}$$

where:

$ef_{HOT}^{\ COPERT}$: The original calculated hot emission factor

$std_{HOT}(cycle)$: The standard deviation of the factor, for the corresponding cycle (Urban, Rural or Highway)

eEF : stochastic error for the hot emission factors

$ef(HOT)$: Hot mission factor value for the particular run

The second software modification appears after the cold emission factors have been calculated and equations (4.4), (4.5), (4.6) are applied for each group of pollutants.

Application **Equation**

Cold Emission Factors for VOC, CO, NOx, PM exhaust

$$\mu = \ln\left(ef_{RATIO}^{\ COPERT} - 1\right) - 0.5\ln\left(1 + \left(\frac{std_{HOT}(V)/\ ef_{HOT}^{\ COPERT}}{ef_{RATIO}^{\ COPERT} - 1}\right)^2\right)$$

Shifted Log-Normal Distribution

$$\sigma = \sqrt{\ln\left(1 + \left(\frac{std_{HOT}(V)/\ ef_{HOT}^{\ COPERT}}{ef_{RATIO}^{\ COPERT} - 1}\right)^2\right)} \qquad (4\text{-}4)$$

$$ef(RATIO) = 1 + e^{\mu + \sigma * eEFratio}$$

where:

$ef_{RATIO}^{\ COPERT}$: The original calculated e(cold)/e(hot) ratio

$ef_{HOT}^{\ COPERT}$: The original calculated hot emission factor

$std_{HOT}(V)$: The standard deviation of the factor, for the "V" speed class

$eEFratio$: Stochastic error for the cold ratio

$ef(RATIO)$: The resulted e(cold)/e(hot) ratio for the particular run

Application **Equation**

Cold Fuel Consumption Factors

$$fc(RATIO) = fc_{RATIO}^{\ COPERT} + (std_{HOT}(V)/\ fc_{HOT}^{\ COPERT}) * eEFratio \qquad (4\text{-}5)$$

Normal Distribution

$fc_{RATIO}^{\ COPERT}$: The original calculated Fuel Consumption e(cold)/e(hot) ratio

where:

$fc_{HOT}^{\ COPERT}$: The original calculated hot fuel consumption

$std_{HOT}(V)$: The standard deviation of the factor, for the "V" speed class

$eEFratio$: stochastic error for the cold consumption ratio

$fc(RATIO)$: The resulted Fuel Consumption e(cold)/e(hot) ratio

Cold Emission Factors for CH_4, N_2O

$$\mu = \ln\left(ef_{RATIO}^{\ COPERT} - 1\right) - 0.5\ln\left(1 + \left(\frac{std_{COLD}}{ef_{RATIO}^{\ COPERT} - 1}\right)^2\right)$$

Shifted Log-Normal Distribution

$$\sigma = \sqrt{\ln\left(1 + \left(\frac{std_{COLD}}{ef_{RATIO}^{\ COPERT} - 1}\right)^2\right)} \qquad (4\text{-}6)$$

$$ef(RATIO) = 1 + e^{\mu + \sigma * eEFratio}$$

where:

$ef_{RATIO}^{\ COPERT}$: The original calculated e(cold)/e(hot) ratio

$std_{COLD}(cycle)$: The standard deviation of the ratio

$eEFratio$: stochastic error for the cold ratio

$ef(RATIO)$: The resulted e(cold)/e(hot) ratio

The third modification is applied over the calculation of the PM non-exhaust emissions and equations (4.7), (4.8) are applied for the tyre and break wear respectively.

Application	**Equation**	
TSP (tyre wear) Normal Distribution	$TSP = TSP^{COPERT} + std(tyre) * eEF$	(4-7)
where:	TSP^{COPERT} : The original TSP emission factor for tyre wear $std(tyre)$: The standard deviation of the factor eEF : stochastic error for the TSP emission factors TSP : The resulted TSP emission factor	
TSP (brake wear) Normal Distribution	$TSP = TSP^{COPERT} + std(brake) * eEF$	(4-8)
where:	TSP^{COPERT} : The original TSP emission factor for brake wear $std(brake)$: The standard deviation of the factor eEF : stochastic error for the TSP emission factors TSP : The resulted TSP emission factor	

4.2 Interface (I/O)

Apart from the code changes of the COPERT 4 software, also a new form had to be created (Fig 4.1). This form can be opened under the 'File' > 'Import/Export' > 'Uncertainty Calculation' menu. The form contains 6 buttons, two textboxes, one check-listbox and a text area for the results of the process.
The use of this form is explained in the next section.

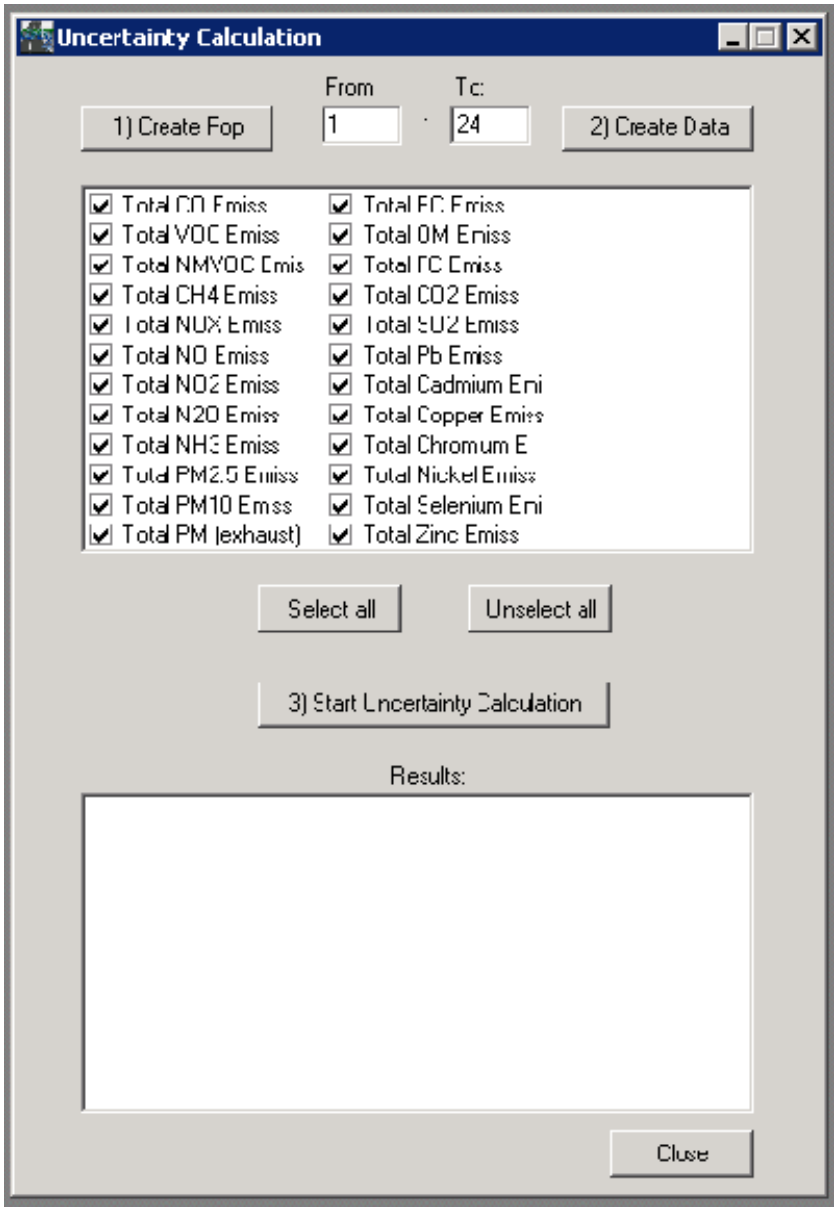


Figure 4-1: The Uncertainty Calculation interface in COPERT 4 software

4.3 Guidance to the use of the software

A large number of data are required to execute a full uncertainty and sensitivity analysis by means of the Monte Carlo approach. About 500 runs are required for the screening tests and ~6000 runs for the full uncertainty/sensitivity analysis. In order to manipulate all these data and execute the simulations, without significant time cost, a dedicated data structure has been produced, splitting the necessary information between an Access database and Excel spreadsheets. The content and approach to perform the simulations is outlined in the following paragraphs.

During the installation of the software a folder named "COPERT 4 MC" (MC = Monte Carlo) is created in the "My Documents" folder. In this folder a database file named "data.mdb" is placed. This database includes all data required to execute the Monte Carlo simulations for Poland. If a different country needs to be simulated, then the content of the tables in this database needs to change. The following sections include information on what each table contains. The tables included in the data.mdb database in alphabetical order are:

- CU_AA
- CU_B_T
- CU_COLD_STD_EF
- CU_FBM
- CU_M0
- CU_SAMPLEMORRIS
- CU_STD_EF
- CU_STD_EF_CH4_N2O
- CU_TEC_PERC
- CU_TSP

The table CU_SAMPLEMORRIS (Table 4-1) contains several columns which need to be filled in by the user. Each row in the table corresponds to a different run; hence for a full uncertainty analysis, this table would include ~6000 rows. The content of the columns is rather self evident. The user needs only to change (or fill in) the content of the columns in non-italic characters in Table 4-1 and in all remaining tables. The rest of the columns contain default values required by the software.

Some other tables need not to be changed by the user. These include tables CU_STD_EF, CU_COLD_STD_EF, CU_STD_EF_CH4_N2O, CU_TSP include the standard deviations for the emission factors. These have been left available to the user to modify if so wished, but as the emission factors of COPERT 4 are given, the recommendation would be not to modify the content of these tables, unless more robust experimental information has become available.

The remaining tables use some ID codes to distinguish for the different pollutants, sectors, subsectors, and technologies. The IDs of the pollutants are given in
Table 4-2, while the IDs for the vehicle category recognition are given in the Annex Table A 12, due to their size.
Each row in table CU_FBM (Table 4-3) contains the population of COPERT 4 vehicle subsectors for each run. All values are in number of vehicles.

Table CU_AA (Table 4-4) contains the average age in years (AA_AA) of vehicles in different technologies. This is country-specific. This parameter needs to be modified to execute a Monte Carlo run for a different country or year of calculation. The τ parameter is internal to the Monte Carlo simulation and should not be modified. This is basically the steering parameter that selects the different values required and appears in several tables.

Table 4-1: CU_SAMPLEMORRIS

Field	Description
ID	*The ID of the run*
PC	*blank*
LDV	*blank*
HDV	*blank*
UB	*blank*
MOP	*blank*
MOT	*blank*
sigma	*blank*
delta	*blank*
tau	*tau*
uPC_MIL	*mileage parameter of PC*
uLDV_MIL	*mileage parameter of LDV*
uHDV_MIL	*mileage parameter of HDV*
uUB_MIL	*mileage parameter of UB*
uMO_MIL	*mileage parameter of MOP*
UPC	urban share of PC (%)
ULDV	urban share of LDV (%)
UHDV	urban share of HDV (%)
UUB	urban share of COACHES (%)
UMO	urban share of MOT (%)
HPC	highway share of PC (%)
HLDV	highway share of LDV (%)
HHDV	highway share of HDV (%)
HUB	highway share of COACHES (%)
HMO	highway share of MOT (%)
VUPC	Urban speed of PC (km/h)
VULDV	Urban speed of LDV (km/h)
VUHDV	Urban speed of HDV (km/h)
VUUB	Urban speed of UB (km/h)
VUMO	Urban speed of MO (km/h)
VHPC	Highway speed of PC (km/h)
VHLDV	Highway speed of LDV (km/h)
VHHDV	Highway speed of HDV (km/h)
VHUB	Highway speed of UB (km/h)
VHMO	Highway speed of MO (km/h)
VRPC	Rural speed of PC (km/h)
VRLDV	Rural speed of LDV (km/h)
VRHDV	Rural speed of HDV (km/h)
VRUB	Rural speed of UB (km/h)
VRMO	Rural speed of MO (km/h)
Ltrip	Mean trip length (km)
LFHDV	Load Factor (%)
A	*Blank*
H	*Blank*
D	*Blank*
eRVP	Parameter of Fuel reid vapour pressure
H:C	Hydrogen-to-carbon ratio (-)
O:C	Oxygen-to-carbon ratio (-)
S	Parameter of Sulfur level in fuel – eS in eq. 3-11
eEF	*stochastic error for the hot and TSP emission factors*
eEFratio	*stochastic error for the cold emission factors*
eM0	*Parameter for the M0 calculation*

Table 4-2: Pollutant IDs used in COPERT 4 database

ID	Pollutant
1	*CO*
2	*NOx*
3	*VOC*
4	*PM (exhaust)*
5	*FC*
6	*CH_4*
8	*N2O*

Table 4-3: CU_FBM: Stock population (no of vehs.) per subsector

Field	Description
FBM_ID	*The ID of the specific run*
FBM_1	Gasoline <1,4 l
FBM_2	Gasoline 1,4 - 2,0 l
FBM_3	Gasoline >2,0 l
FBM_4	Diesel <2,0 l
FBM_5	Diesel >2,0 l
FBM_6	LPG
FBM_26	2-Stroke
FBM_27	Hybrid Gasoline <1,4 l
FBM_28	Hybrid Gasoline 1,4 - 2,0 l
FBM_29	Hybrid Gasoline >2,0 l
FBM_12	Gasoline <3,5t
FBM_13	Diesel <3,5 t
FBM_14	Gasoline >3,5 t
FBM_35	Rigid <=7,5 t
FBM_36	Rigid 7,5 - 12 t
FBM_37	Rigid 12 - 14 t
FBM_38	Rigid 14 - 20 t
FBM_39	Rigid 20 - 26 t
FBM_40	Rigid 26 - 28 t
FBM_41	Rigid 28 - 32 t
FBM_42	Rigid >32 t
FBM_43	Articulated 14 - 20 t
FBM_44	Articulated 20 - 28 t
FBM_45	Articulated 28 - 34 t
FBM_46	Articulated 34 - 40 t
FBM_47	Articulated 40 - 50 t
FBM_48	Articulated 50 - 60 t
FBM_49	Urban CNG Buses
FBM_50	Urban Biodiesel Buses
FBM_30	Urban Buses Midi <=15 t
FBM_31	Urban Buses Standard 15 - 18 t
FBM_32	Urban Buses Articulated >18 t
FBM_33	Coaches Standard <=18 t

FBM_34	Coaches Articulated >18 t
FBM_21	<50 cm³
FBM_22	2-stroke >50 cm³
FBM_23	4-stroke <250 cm³
FBM_24	4-stroke 250 - 750 cm³
FBM_25	4-stroke >750 cm³

Table 4-4: CU_AA containing the mean age of vehicles per technology

Field	Description
AA_SEC_ID	*Sector ID*
AA_SSC_ID	*Subsector ID*
AA_TEC_ID	*Technology ID*
AA_TAU	*τ (steering parameter)*
AA_AA	Average Age of technology (years)

Table CU_B_T (Table 4-5) contains the beta and Tau parameters uncertainty required to estimate the uncertainty of the age profiles of vehicles per subsector.

Table 4-5: CU_B_T, table to calculate vehicle age distribution

Field	Description
BT_SSC_ID	*Subsector ID*
BT_RUN	*τ*
BT_B	B (-)
BT_T	T (-)

Table CU_M0 (Table 4-6) includes the average annual mileage (m0) of new vehicles in each subsector. The user should fill the "M0_mLN" field for every subsector. Columns "M0_sLN", "M0_M0" should be left blank. The value of mileage is in km.

Table 4-6: CU_M0: Average annual mileage (m0 - km) of new vehicles per subsector

Field	Description
M0_SSC_ID	*Subsector ID*
M0_mLN	The average annual mileage
M0_sLN	*blank*
M0_M0	*blank*

Finally, Table CU_TEC_PERC contains the percentage (%) of population distributed in every technology within a subsector for every vehicle type and τ. The user has to fill the "TEC_PERC" field for every vehicle type and τ.

Table 4-7: CU_TEC_PERC: Technology percentage in each subsector

Field	Description
TEC_SEC_ID	*Sector ID*
TEC_SSC_ID	*Subsector ID*
TEC_TEC_ID	*Technology ID*
TEC_TAU	*τ*
TEC_PERC	Percentage (%) of population distributed in every technology within a subsector

After the user has filled these tables, the database data.mdb should be saved and closed. Then using the installed "COPERT 4 MC" software, the user should open the database ('File' > 'Open').

The Import Excel files should then be prepared. These Excel files contain the detailed data required to run the several COPERT 4 runs. These are automatically filled in by the software, using the previous tables. However, in order for the software to fill them in, they need first to be created by the user with a given structure. This structure is explained in the following paragraphs.

At first an empty template (Excel file) should be created using the 'File' > 'Import/Export' > 'Create Import Format Excel File' form in COPERT 4. The name of the Excel file to be created must have this format:
XX_Import_Data.xls

where XX is an index starting from 1. In these Excel files, every column will contain data for one run. Since Excel files have a limited number of columns every Excel file should contain up to 250 runs. So the user should create as many templates (Excel files) as they are necessary for all the required runs. The files should be named according to the right format using numbers instead of XX with ascending order (Figure 4-2). For example, if 6000 runs need to be executed, then 24 empty Excel templates will have to be produced.

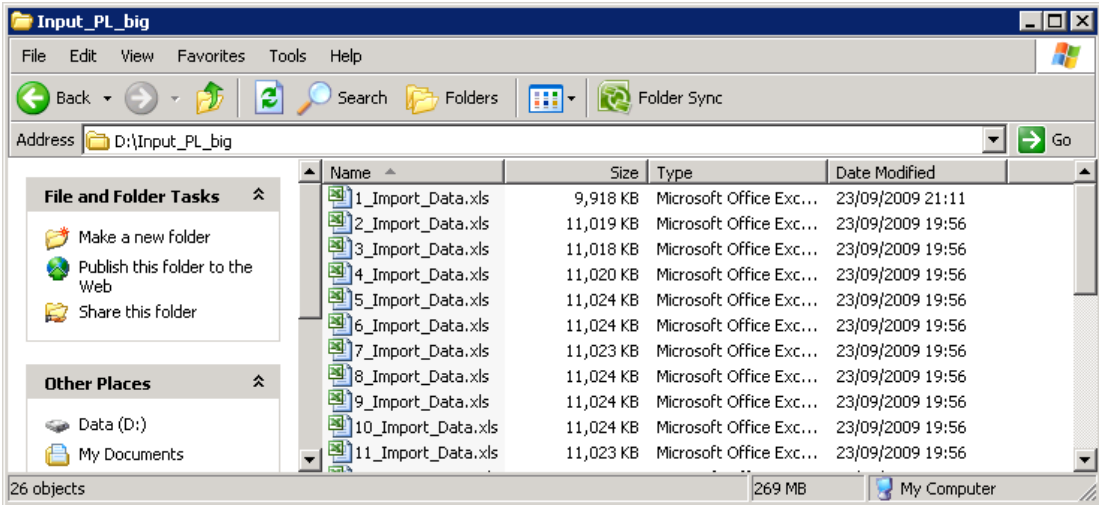


Figure 4-2: The name format of the input Excel files

In every created template the user has to perform three modifications. First, insert a sheet named "Country_Years" that has the structure of Table 4-8. The user should fill the rows for every desired run. For example, if the Excel spreadsheet will include runs 1 to 250, then the column "Year" should be filled in with the values 1 to 250, consecutively in every row. Naming each run as a "Year" is internal to the programme only (COPERT 4 was developed to perform runs for different years). In the framework of this Monte Carlo activity, this is not to be confused: the term "Year" basically means "Run" of the simulation. In these sheets, the l_trip should be left blank since it is automatically filled by the software from the CU_SAMPLEMORRIS table.

The second modification that the user needs to introduce is to include a heading with the run index in each column (first row) of the remaining sheets given in the following list. A screenshot of how an input Excel file looks like is given in Figure 4-3. In this figure, the Excel file is complete with data filled in automatically by COPERT 4 software.

The sheets for which the heading (first row) needs to be completed are:

- Population
- Mileage_km_per_year
- Mean_Fleet_Mileage_km
- U_Speed_km_per_h
- R_Speed_km_per_h
- H_Speed_km_per_h

- U_Share_perc
- R_Share_perc
- H_Share_perc
- Min_Temperature_oC
- Max_Temperature_oC
- RVP_kPa
- Sulphur_Content_perc_wt
- H_C_Ratio
- O_C_Ratio

Table 4-8: "Country_Years" sheet

Country_Name	Year	l_trip	t_trip	fuel_year
Poland	1		0.2	2005
Poland	2		0.2	2005
…..	…		…	…

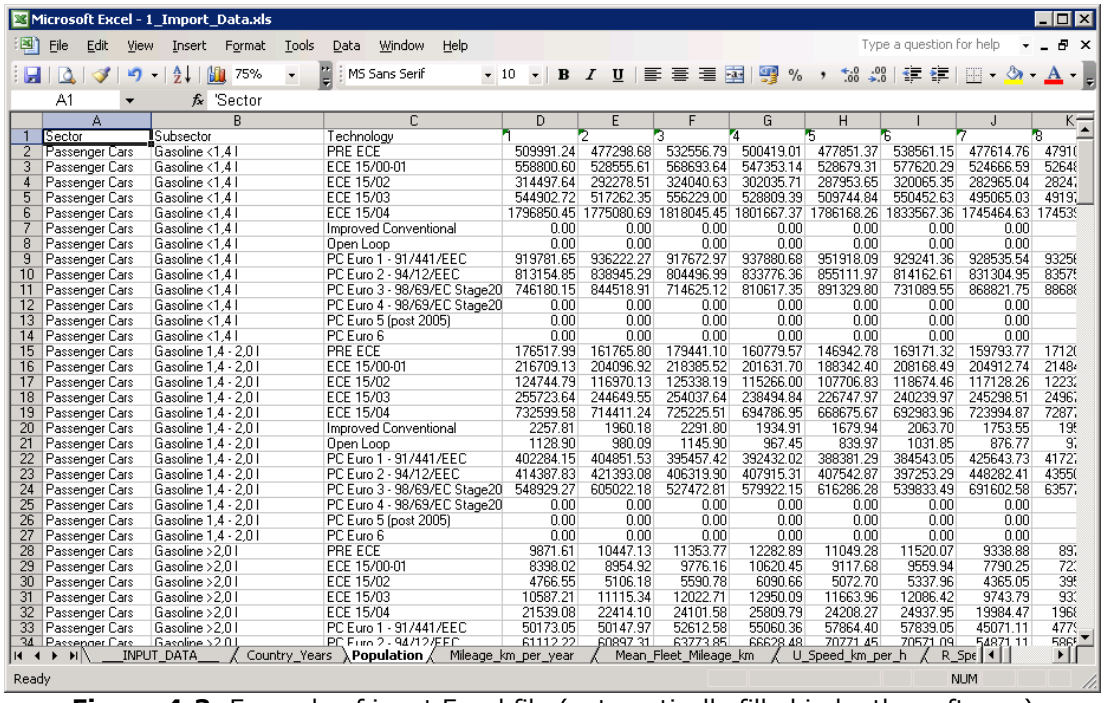


Figure 4-3: Example of input Excel file (automatically filled in by the software)

The third modification is that the user should fill the "Min_Temperature_oC", "Max_Temperature_oC", "RVP_kPa", "Sulphur_Content_perc_wt" sheets. The last sheet only includes the *So* (eq. 3-11) value, which should be the same for each run. I.e. this value should not be changed for different runs, otherwise the simulations will not be correct. The software will modify these values, using parameter eS, included in table CU_SAMPLEMORRIS (Table 4-1).

By performing these steps, the software is ready to execute a full Monte Carlo simulation. In doing so, the user should open the "Copert Uncertainty" form (Figure 4-1). In this, the first step is to press the "1) Create Pop" button. This produces the population for each run. Depending on the number of runs, this may take a few minutes.

The second step is to provide how many Excel files the user wants to fill with Input Data, using the "From – To" textboxes. These numbers correspond to the XX part of the Excel file name. Then the user should press the '2) Create Data' button, select the folder (Figure 4-4) where the Excel files are saved and press OK. Depending on the number of files this should take some time (20 minutes approximately for every Excel file with 250 runs).

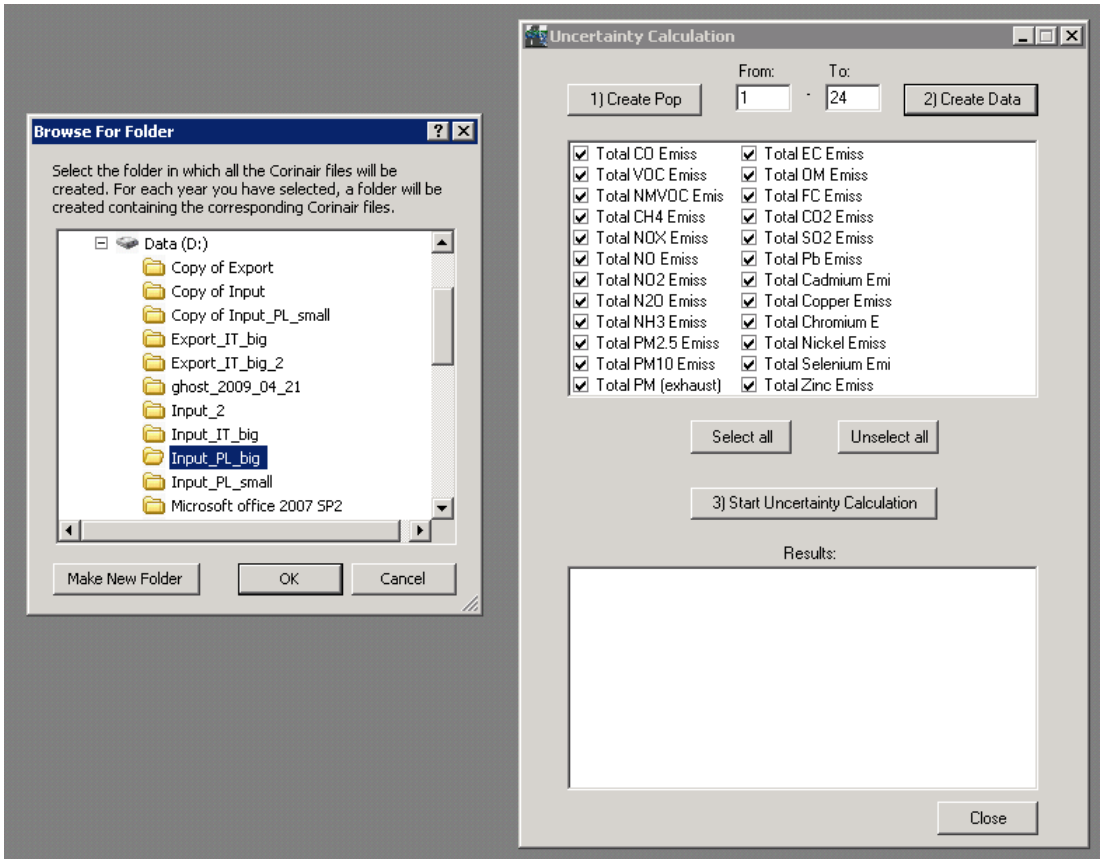
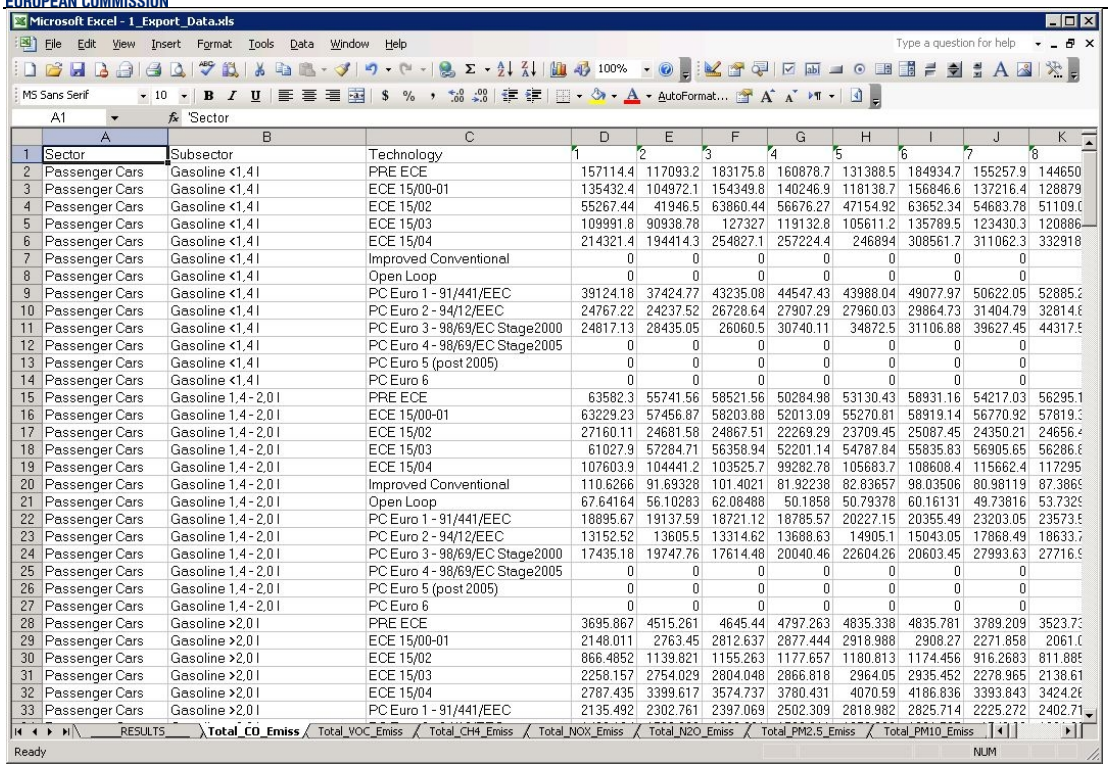


Figure 4-4: Selecting the folder of the input Excel files

After creating all the necessary input data files, the user can select the desired pollutants that will be included in the export files from the listbox area. Then the user should press "3) Start Uncertainty Calculations" and point to the folder where the import Excel files exist. Depending on the number of files this should take some time (8 hours approximately for every Excel file with 250 runs.) During the last process the Input Data files are imported into the software, all the necessary calculations are performed and the emissions are exported in the same folder with their names following this format:

XX_Export_Data.xls
where XX is depending on the number of the Input Data file. An example of such a file is shown in Figure 4-5.



Microsoft Excel - 1_Export_Data.xls

	A	B	C	D	E	F	G	H	I	J	K
1	Sector	Subsector	Technology	1	2	3	4	5	6	7	8
2	Passenger Cars	Gasoline <1,4 l	PRE ECE	157114.4	117093.2	183175.8	160878.7	131388.5	184934.7	155257.9	144650
3	Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	135432.4	104972.1	154349.8	140246.9	118138.7	156846.6	137216.4	128879
4	Passenger Cars	Gasoline <1,4 l	ECE 15/02	55267.44	41946.5	63860.44	56676.27	47154.92	63652.34	54683.78	51109.0
5	Passenger Cars	Gasoline <1,4 l	ECE 15/03	109991.8	90938.78	127327	119132.8	105611.2	135789.5	123430.3	120886
6	Passenger Cars	Gasoline <1,4 l	ECE 15/04	214321.4	194414.3	254827.1	257224.4	246894	308561.7	311062.3	332918
7	Passenger Cars	Gasoline <1,4 l	Improved Conventional	0	0	0	0	0	0	0	
8	Passenger Cars	Gasoline <1,4 l	Open Loop	0	0	0	0	0	0	0	
9	Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	39124.18	37424.77	43235.08	44547.43	43988.04	49077.97	50622.05	52885.2
10	Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	24767.22	24237.52	26728.64	27907.29	27960.03	29864.73	31404.79	32814.8
11	Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	24817.13	28435.05	26060.5	30740.11	34872.5	31106.88	39627.45	44317.5
12	Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	0	0	0	0	0	0	0	
13	Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	0	0	0	0	0	0	0	
14	Passenger Cars	Gasoline <1,4 l	PC Euro 6	0	0	0	0	0	0	0	
15	Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	63582.3	55741.56	58521.56	50284.98	53130.43	58931.16	54217.03	56295.1
16	Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	63229.23	57456.87	58203.88	52013.09	55270.81	58919.14	56770.92	57819.3
17	Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	27160.11	24681.58	24867.51	22269.29	23709.45	25087.45	24350.21	24656.4
18	Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	61027.9	57284.71	56358.94	52201.14	54787.84	55835.83	56905.65	56286.8
19	Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	107603.9	104441.2	103525.7	99282.78	105683.7	108608.4	115662.4	117295
20	Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	110.6266	91.69328	101.4021	81.92238	82.83657	98.03506	80.98119	87.3869
21	Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	67.64164	56.10283	62.08488	50.1858	50.79378	60.16131	49.73816	53.7329
22	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	18895.67	19137.59	18721.12	18785.57	20227.15	20355.49	23203.05	23573.5
23	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	13152.52	13605.5	13314.62	13688.63	14905.1	15043.05	17868.49	18633.7
24	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	17435.18	19747.76	17614.48	20040.46	22604.26	20603.45	27993.63	27716.9
25	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0	0	0	0	0	0	0	
26	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	0	0	0	0	0	0	0	
27	Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	0	0	0	0	0	0	0	
28	Passenger Cars	Gasoline >2,0 l	PRE ECE	3695.867	4515.261	4645.44	4797.263	4835.338	4835.781	3789.209	3523.73
29	Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	2148.011	2763.45	2812.637	2877.444	2918.988	2908.27	2271.858	2061.0
30	Passenger Cars	Gasoline >2,0 l	ECE 15/02	866.4852	1139.821	1155.263	1177.657	1180.813	1174.456	916.2683	811.885
31	Passenger Cars	Gasoline >2,0 l	ECE 15/03	2258.157	2754.029	2804.048	2866.818	2964.05	2935.452	2278.965	2138.61
32	Passenger Cars	Gasoline >2,0 l	ECE 15/04	2787.435	3399.617	3574.737	3780.431	4070.59	4186.836	3393.843	3424.26
33	Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	2135.492	2302.761	2397.069	2502.309	2818.982	2825.714	2225.272	2402.71

RESULTS | Total_CO_Emiss | Total_VOC_Emiss | Total_CH4_Emiss | Total_NOX_Emiss | Total_N2O_Emiss | Total_PM2.5_Emiss | Total_PM10_Emiss

Ready NUM

Figure 4-5: Example of an output Excel file

5 Results

In this section two test cases at the country level are presented. The selected countries, namely Italy and Poland, demonstrate different levels of input uncertainty. The adopted methodological procedure was the same for both countries. At the first stage, the rather large number of uncertain input variables (51) has been filtered out from its non-influential inputs through a screening sensitivity analysis (Morris, 1991). At the second stage, the set of influential inputs is explored thoroughly by means of a quantitative sensitivity analysis (Cukier et al., 1978; Saltelli et al., 1999) to provide uncertainty and sensitivity estimates of total atmospheric emissions for the year 2005. Then, we evaluate the uncertainty of the COPERT prediction with reference to the statistical fuel consumption reported in each country, which is generally known with good confidence. Based on the fuel consumption comparison, the sample data set is corrected and the quantitative sensitivity analysis is repeated. This provides the corrected uncertainty and sensitivity analysis.

The sensitivity analysis for both countries has been performed through the following steps:

1. Prepare the Monte Carlo sample for the screening experiment using the Morris design.
2. Execute the Monte Carlo simulations and collect the results.
3. Compute the sensitivity measures corresponding to the elementary effects in order to isolate the non-influential inputs.
4. Prepare the Monte Carlo sample for the variance-based sensitivity analysis, for the influential variables identified important in the previous step.
5. Execute the Monte Carlo simulations and collect the results
6. Quantify the importance of the uncertain inputs, taken singularly as well as their interactions.
7. Determine the input factors that are most responsible for producing model outputs within the targeted bounds of fuel consumption.

5.1 Case Study 1: Uncertainty and sensitivity for Italy

5.1.1 Initial data sample

The relative importance of the 51 uncertain input factors is initially explored with the screening design of Morris. A sample of 510 simulations was generated containing 8 percentiles for each input factor. The estimated mean and standard deviation of each elementary effects distribution are displayed in Figure 5-1. A general order of importance for the examined factors can be established considering the Euclidean distance from the origin in the (MU, SIGMA) space. According to this distance, the most influential input set, for all the output variables considered, contains 16 entries:

- the total population of passenger cars, light duty vehicles, heavy duty vehicles and mopeds (PC, LDV, HDV, MOP)
- the annual mileage of passenger cars, light duty vehicles, heavy duty vehicles and two-wheel vehicles (milPC, milLDV, milHDV, milMO)
- the urban share of the passenger cars (UPC)
- the velocity of the passenger cars under all driving modes (VUPC, VRPC, VHPC)
- the average trip length (ltrip)
- the oxygen to carbon ratio in the fuel (O2C)
- the hot and cold emission factors (eEF, eEFratio)

The 16 most influential parameters identified from the screening analysis were used next in a quantitative sensitivity analysis. For this purpose, a sample was built by selecting 5904 design points over a particular space-filling curve in the 16th dimensional input space so as to explore each factor with a different frequency (Cukier et al., 1978). The uncertainty of the annual emissions of CO, VOC, CH_4, NO_x, N_2O, $PM_{2.5}$, PM_{10}, non-exhaust PM and CO_2 is presented in Figure 5-2 while their descriptive statistics are given in Table 5-1. The red line in the histogram of CO_2 corresponds to the cumulative uncertainty of the greenhouse gases (N_2O, CH_4, CO_2) and is presented as equivalent CO_2. This is calculated taking into account the 100-year GHG equivalent contribution of the three species (CO_2: 1, N_2O: 310, CH_4: 21). Apart from CO_2 and FC (Figure 5-3a) that are best fit by a normal distribution, uncertainty for all other pollutants is better represented by a log-normal distribution. Among them, the most skewed are N_2O followed by CO and CH_4. The coefficient of variation is 10% for CO_2, in the order of 20-30% for NO_x, VOC, $PM_{2.5}$, PM_{10} and non-exhaust PM, on the order of 50-60% for CO and CH_4 and over 100% for N_2O.

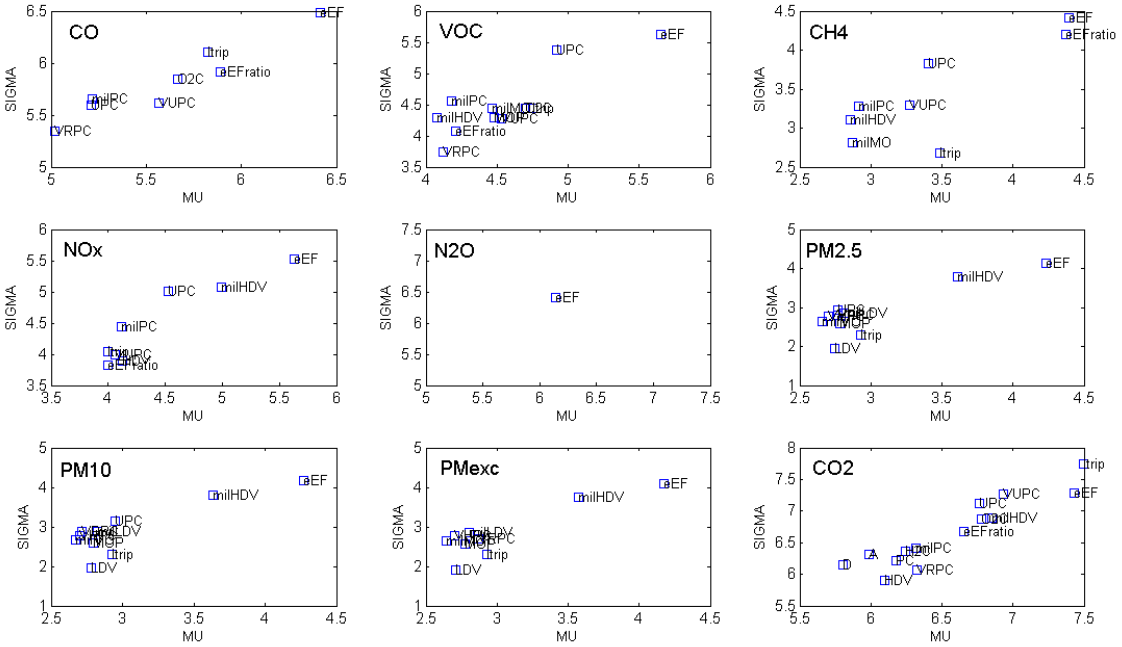


Figure 5-1: Morris results for Italy (year 2005). The influence of each variable for each pollutant increases with distance from the axes origin.

The first and total order sensitivity indices (*extended-FAST*) are presented in Table 5.2. The first order index represents the fractional contribution of the uncertain input (i.e. its main effect) to the output variability, while the sum of all the S_i's represents the cumulative contribution of all the variables (main effects) to the output variance. The difference between the total effect and the first order index for an input variable indicates the fraction of the output variance that is accounted for by interactions in which the specific input variable is involved. This means that the input variable interacts with other input parameters but it does not indicate with which parameters this interaction occurs.

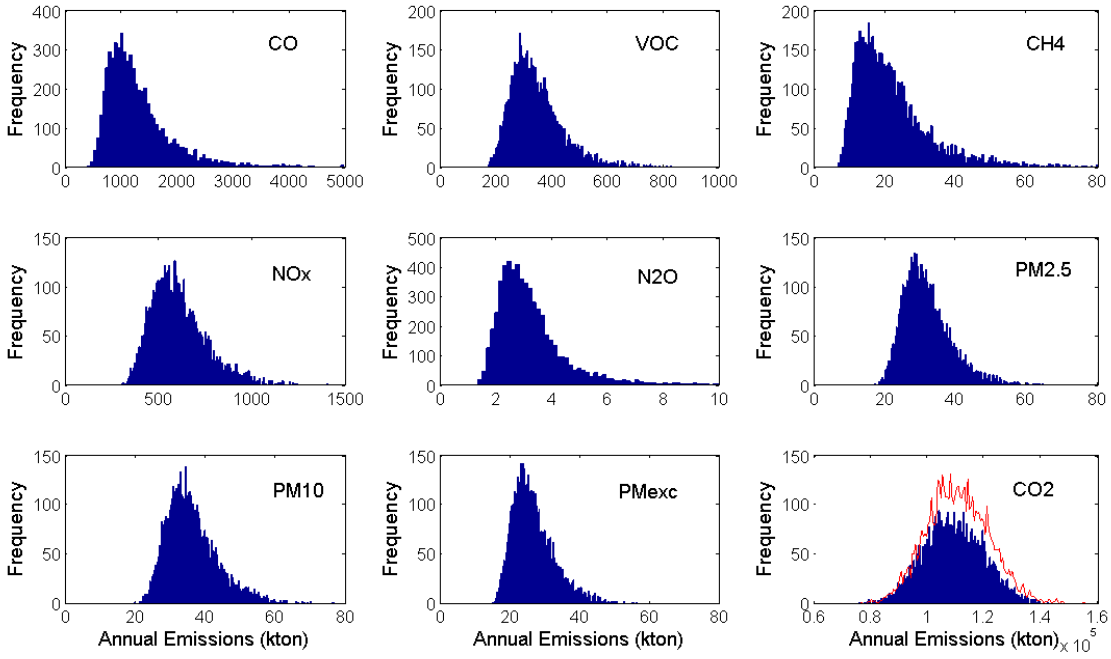


Figure 5-2: Uncertainty analysis of the annual emissions from road transport in Italy (year 2005). Red line stands for cumulative uncertainty of greenhouse gases (CO_2, CH_4, N_2O).

Table 5-1: Descriptive statistics of the histograms presented in Figure 5-2. Values are in ktonnes. CO_{2e} stands for total uncertainty of GHG equivalent.

	CO	**VOC**	**CH_4**	**NO_X**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**	**CO_{2e}**
Mean	1,363	347	22	611	3.7	32	36	27	36,386	109,081	110,694
Median	1,162	328	19	586	3.0	31	34	26	36,311	108,859	110,236
St. Dev.	776	98	11	155	4	7	7	6	3,538	10,668	11,459
Coef. Var. (%)	57	28	50	25	108	22	19	22	10	10	10

The hot emission factors influence most the variability of the emissions; this characteristic is common for all the outputs. Specifically, 78-83% of the emissions variance of VOC, NO_X, $PM_{2.5}$, PM_{10} and $PM_{exhaust}$ is explained by the single contribution of the hot emission factors. The fraction of explained variance from hot emission factors for CO, CO_2 and FC is ~64% and drops down to 19% for N_2O. For CH_4, hot and cold emission factors explain equal portions of the variance (36% each). Analytically:

Table 5-2: First and Total Order Sensitivity Indices (extended-FAST) for VOC, NO_X, $PM_{2.5}$, PM_{10}, $PM_{exhaust}$, CO, N_2O, CH_4, CO_2 and FC (2005).

VOC	**S_I**	**S_{TI}**	**NO_X**	**S_I**	**S_{TI}**	**PM2.5**	**S_I**	**S_{TI}**	**PM10**	**S_I**	**S_{TI}**	**PMexh**	**S_I**	**S_{TI}**
eEF	0.78	0.92	eEF	0.83	0.92	eEF	0.81	0.92	eEF	0.81	0.91	eEF	0.81	0.92
ltrip	0.03	0.14	milHDV	0.08	0.17	milHDV	0.07	0.17	milHDV	0.07	0.17	milHDV	0.07	0.19
eEFratio	0.02	0.14	HDV	0.01	0.10	HDV	0.01	0.12	HDV	0.01	0.11	VHPC	0.01	0.14
milMO	0.02	0.13	VHPC	0.01	0.11	VHPC	0.01	0.13	milPC	0.01	0.11	HDV	0.01	0.13
O2C	0.01	0.11	eEFratio	0.00	0.11	milPC	0.01	0.11	VHPC	0.01	0.12	milPC	0.01	0.12
HDV	0.01	0.12	VRPC	0.00	0.12	ltrip	0.00	0.09	ltrip	0.00	0.09	ltrip	0.01	0.10
MOP	0.01	0.16	LDV	0.00	0.08	milMO	0.00	0.09	LDV	0.00	0.10	milMO	0.00	0.10
milHDV	0.01	0.12	MOP	0.00	0.11	MOP	0.00	0.11	milMO	0.00	0.09	MOP	0.00	0.13
VUPC	0.01	0.12	milPC	0.00	0.08	LDV	0.00	0.10	MOP	0.00	0.11	eEFratio	0.00	0.13
LDV	0.00	0.10	UPC	0.00	0.09	VUPC	0.00	0.09	VUPC	0.00	0.08	LDV	0.00	0.12
PC	0.00	0.15	ltrip	0.00	0.07	eEFratio	0.00	0.12	eEFratio	0.00	0.12	VUPC	0.00	0.09
VHPC	0.00	0.12	PC	0.00	0.08	UPC	0.00	0.11	UPC	0.00	0.11	VRPC	0.00	0.15
VRPC	0.00	0.15	milLDV	0.00	0.09	VRPC	0.00	0.13	milLDV	0.00	0.11	UPC	0.00	0.13
UPC	0.00	0.13	milMO	0.00	0.07	milLDV	0.00	0.12	VRPC	0.00	0.12	milLDV	0.00	0.13
milPC	0.00	0.12	VUPC	0.00	0.07	O2C	0.00	0.09	PC	0.00	0.09	O2C	0.00	0.10
milLDV	0.00	0.11	O2C	0.00	0.07	PC	0.00	0.09	O2C	0.00	0.08	PC	0.00	0.10
ΣS_i	**0.91**	**2.86**		**0.95**	**2.35**		**0.93**	**2.62**		**0.93**	**2.52**		**0.93**	**2.79**
CO	**S_I**	**S_{TI}**	**N2O**	**S_I**	**S_{TI}**	**CH4**	**S_I**	**S_{TI}**	**CO2**	**S_I**	**S_{TI}**	**FC**	**S_I**	**S_{TI}**
eEF	0.64	0.87	eEF	0.19	0.83	eEF	0.36	0.53	eEF	0.63	0.71	eEF	0.64	0.73
eEFratio	0.05	0.31	eEFratio	0.04	0.81	eEFratio	0.36	0.54	milHDV	0.08	0.16	milHDV	0.08	0.16
HDV	0.01	0.27	ltrip	0.02	0.70	ltrip	0.02	0.22	eEFratio	0.05	0.16	eEFratio	0.05	0.16
LDV	0.01	0.20	MOP	0.02	0.82	VUPC	0.00	0.19	milPC	0.03	0.13	milPC	0.03	0.12
ltrip	0.01	0.22	VHPC	0.02	0.79	VHPC	0.00	0.21	O2C	0.02	0.09	ltrip	0.02	0.10
milHDV	0.00	0.23	HDV	0.02	0.76	PC	0.00	0.22	ltrip	0.02	0.10	HDV	0.01	0.10
milLDV	0.00	0.19	VRPC	0.02	0.82	HDV	0.00	0.16	HDV	0.01	0.10	LDV	0.01	0.08
milMO	0.01	0.21	milHDV	0.02	0.73	MOP	0.00	0.20	LDV	0.01	0.08	VUPC	0.01	0.07
milPC	0.00	0.23	milLDV	0.02	0.70	VRPC	0.00	0.21	VUPC	0.01	0.07	VHPC	0.01	0.09
MOP	0.01	0.35	milPC	0.02	0.74	milHDV	0.00	0.18	VHPC	0.00	0.09	PC	0.00	0.08
O2C	0.01	0.21	UPC	0.02	0.71	LDV	0.00	0.16	PC	0.00	0.07	UPC	0.00	0.09
PC	0.01	0.30	PC	0.02	0.80	UPC	0.00	0.18	UPC	0.00	0.09	MOP	0.00	0.09
UPC	0.01	0.24	LDV	0.02	0.73	milMO	0.00	0.15	MOP	0.00	0.09	milMO	0.00	0.09
VHPC	0.01	0.24	milMO	0.02	0.69	milLDV	0.00	0.14	milMO	0.00	0.09	VRPC	0.00	0.09
VRPC	0.01	0.31	O2C	0.02	0.66	milPC	0.00	0.16	VRPC	0.00	0.09	milLDV	0.00	0.09
VUPC	0.01	0.23	VUPC	0.01	0.77	O2C	0.00	0.18	milLDV	0.00	0.09	O2C	0.00	0.07
ΣS_i	**0.78**	**4.61**		**0.50**	**12.0**		**0.78**	**3.63**		**0.88**	**2.21**		**0.87**	**2.20**

- VOC: 91% of the VOC emissions variance is explained by single contributions of the 16 variables; 78% of the VOC emissions variance is explained by the single

contribution of the eEF. The sum of all the S_i's is very close to 1 indicating that the model behaves almost additively (with respect to the input parameters).

- NO_x: the eEF (83%) and the milHDV (8%) are influencing more the uncertainty of the NO_x emissions. The single contributions of the 16 variables explain the 95% of the NO_x emissions. Like VOC, the model behaves almost additively (with respect to the input parameters).
- PM: the results are similar with those of NO_x. 93% of the PM emissions variance is explained by single contributions of the 16 variables. Likewise, 88% of the PM emissions variance is explained by single contributions of only 2 variables, the eEF (81%) and the milHDV (7%). The model behaves almost additively (with respect to the input parameters).
- CO: 78% of the CO emissions variance is explained by single contributions of the 16 variables. A big fraction of the variance (specifically, 69%) is explained by single contributions of the hot (64%) and cold (5%) emission factors. The CO emissions are influenced by some high-order interactions, as seen by the sum of S_{TI}, which is quite greater than 1.
- N_2O: only half (i.e. 50%) of the N_2O emissions variance is explained by single contributions of the 16 variables. The eEF explains 19% of the N_2O emissions variance followed by eEFratio (4%) while all the other variables contribute equally by 2%. The interaction effects of second and higher-order in the N_2O emissions are as high as the contributions of the 16 uncertain input variables taken singularly. The low explanation of variance by the 16 variables and the high uncertainty of the N_2O calculation is rather an artefact of the method, based on the selection of the range of the input variables. This is corrected in the subsequent sections.
- CH_4: uncertainty in the CH_4 emissions is mostly influenced by the emission factors, which taken singularly explain 72% of the variance (36% by the eEF and 36% by the eEFratio). The single contribution of all the uncertain inputs explains 78% of the CH_4 emissions variance.
- CO_2: 88% of the CO_2 emissions variance is explained by single contributions of the 16 variables. The single contribution of four variables [eEF (63%), milHDV (8%), eEFratio (5%) and milPC (3%)], explain 81% of the CO_2 emissions variance.
- FC: 87% of the FC variance is explained by single contributions of the 16 variables. Similarly, 82% of the FC variance is explained by single contributions of only 4 variables, namely eEF (64%), milHDV (8%), eEFratio (5%) and milPC (3%).

We now restrict the analysis to the subset of the simulations with predicted fuel consumption within a range of one standard deviation (i.e. 10%). This is done as a run that would lead to fuel consumption much beyond this range, would not be accepted by the inventory developer, as total fuel consumption in Italy is known with good confidence. Therefore, it is interesting to limit the analysis of uncertainty to these runs only that come with realistic fuel consumption figures. The annual fuel consumption for Italy (2005) according to EC4MACS (PRIMES) is 14,203,743 tonnes for gasoline and 22,860,081 tonnes for diesel. Therefore, we summed up the predicted by COPERT 4 fuel consumption of gasoline and diesel cars at each Monte Carlo simulation and kept only the runs for which both predicted values were within 10% of the reported value.

The statistical distribution of the filtered fuel consumption is presented in Figure 5-3b while for all other output variables it is shown in Figure 5-4. The corresponding descriptive statistics are given in Table 5-3. The normal distribution represents quite well the emissions of CO_2, VOC, NO_x and PM. Apart from CH_4, all distributions exhibit lower skewness. The coefficient of variation has been reduced by a factor of 5 for N_2O, by a factor of 1.6 for CH_4 and approximately by a factor of 2.5 for all the others. The new coefficient of variation is 4% for CO_2, on the order of 10-13% for NO_x, VOC, $PM_{2.5}$, PM_{10} and non-exhaust PM, on the order of 21-25% for CO and N_2O and 32% for CH_4.

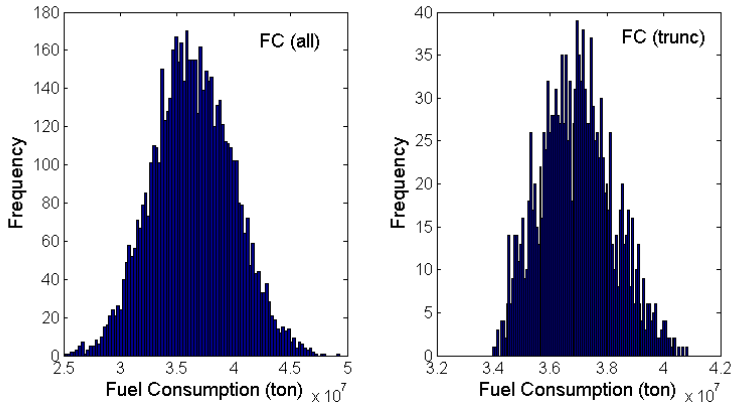


Figure 5-3: Uncertainty Analysis of the annual fuel consumption from road transport for Italy resulted from: (a) all simulations (left), (b) simulations within 10% of the officially reported fuel consumption.

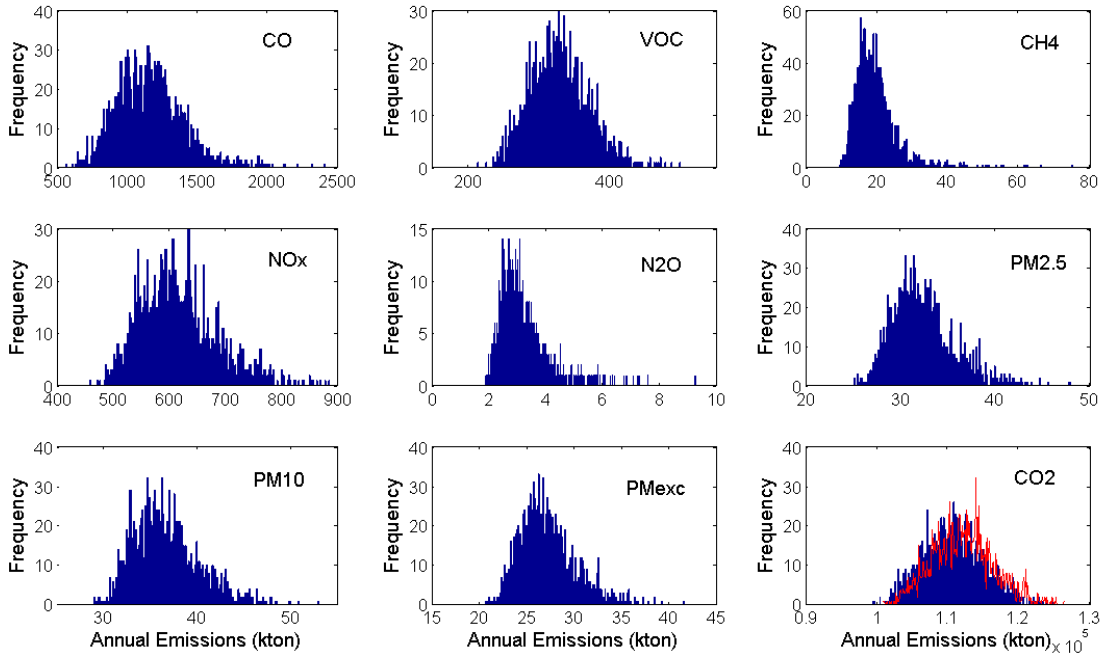


Figure 5-4: Uncertainty Analysis of the annual emissions from road transport for Italy (year 2005) for the simulations with predicted fuel consumption within a small range of the official value.

Table 5-3: Descriptive statistics of the histograms presented in Figure 5-4. Values are in ktonnes.

	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Mean	1,161	329	20	617	3	32	37	27	36,929	110,689	112,061
Median	1,140	327	19	607	3	32	36	27	36,924	110,600	111,957
St. Dev.	245	41	6	69	1	3	4	3	1,285	4,194	4,310
Coef. Var. (%)	21	13	32	11	25	10	10	11	3	4	4

Table 5-4: The Pearson Correlation Coefficient for the full Monte Carlo set (top) and the filtered set (bottom), for CO, VOC, CH_4, NO_x, N_2O, $PM_{2.5}$, PM_{10}, non-exhaust PM, FC and CO_2 (2005).

Full MC	**CO**	**VOC**	**CH_4**	**NO_x**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**
PC	-	-	0.02	0.04	-	0.04	0.04	0.04	0.05	0.04
LDV	-	-	-	-	-	0.02	0.02	0.02	-	-
HDV	0.03	0.05	0.02	0.05	-	0.05	0.05	0.05	0.06	0.08
MOP	-	-	-	-	-	-	-	-	-	-
milPC	0.08	0.09	0.10	0.11	0.04	0.11	0.12	0.10	0.25	0.24
milLDV	-	-	-	-	-	-	-	-	-	0.02
milHDV	0.03	0.07	0.04	0.25	0.02	0.22	0.22	0.23	0.29	0.28
milMO	-	-	-	-	-	-	-	-	-	-
UPC	0.07	0.08	0.04	0.05	0.02	0.06	0.06	0.05	0.09	0.12
VUPC	-	-	0.04	0.02	-	-	-	-	-	-
VHPC	0.06	0.04	0.13	0.03	0.03	0.03	0.03	0.03	0.09	0.08
VRPC	-	-	-	-	-	-	-	-	-	-
Ltrip	-	-	-	-	-	-	-	-	-	-
O2C	-	-	-	-	-	-	-	-	-	-
eEF	0.74	0.85	0.58	0.90	0.33	0.89	0.90	0.88	0.85	0.84
eEFratio	0.22	0.16	0.57	0.07	0.17	0.06	0.06	0.06	0.23	0.23
Filtered	**CO**	**VOC**	**CH_4**	**NO_x**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**
PC	-	-	-	-	-	-	-	-	-	-
LDV	0.06	0.08	-	-	-	0.04	0.04	0.04	-	0.05
HDV	-	-	-	-	-	-	-	-	-	-
MOP	-	-	-	-	-	-	-	-	0.04	-
milPC	-	-	-	-	-	-	-	-	0.09	0.09
milLDV	-	-	-	-	-	-	-	-	-	-
milHDV	-	-	-	0.15	0.05	-	-	-	0.22	0.20
milMO	-	-	-	0.06	-	-	-	-	-	-
UPC	-	-	-	-	-	-	-	-	0.04	0.12
VUPC	-	0.07	0.11	0.16	-	0.13	0.13	0.13	-	-
VHPC	-	-	0.17	-	0.21	-	-	-	-	-
VRPC	-	-	0.06	0.06	-	-	-	0.06	-	-
ltrip	-	-	-	0.24	-	0.15	0.16	0.14	0.06	-
O2C	-	-	-	-	-	-	-	-	-	-

eEF	0.52	0.65	0.05	0.84	-	0.86	0.86	0.84	0.53	0.46
eEFratio	0.25	-	0.67	-	0.67	-	-	-	0.06	0.10

The Pearson correlation coefficient (CC) between the uncertain inputs and the annual emissions is presented in Table 5-4 for the complete as well as for the filtered Monte Carlo sample. Only the values that are significant at the 95% level of significance are shown. Similarly, the standardised regression coefficients (SRC) are given in

Table 5-5. The SRCs are calculated from a least square regression analysis applied to the output of a Monte Carlo output simulation. The effectiveness of the linear regression model is verified by means of R, the model coefficient of determination, which gives the percentage of data variance explained by the regression model. Both the CC and the SRC revealed the principal importance of the hot emission factors between the two samples for all output emissions except for CH_4 and N_2O. For those greenhouse gases, the cold emission factors are the most important input in the filtered sample. However, we should note here that the coefficient of model determination for CH_4 and N_2O was 0.55 and 0.52 respectively and corresponds to the least effective regression models among the ten outputs. The R was 0.86 for NOx, 0.81 for PM, 0.72 for VOC, 0.69 for CO_2 and 0.63 for CO. All Rs were reduced in the filtered dataset except for N_2O.

The cumulative distribution functions of the uncertain inputs for the full and the filtered Monte Carlo sample are shown in Figure 5-5. In principle these graphs are used to demonstrate whether the full dataset and the dataset referring to samples within two standard deviations of the official fuel consumption are equivalent. Divergence of the two lines in Figure 5-5 corresponds to a situation where the filtered sample is not equivalent to the full one. A Kolmogorov-Smirnov was also performed to determine the situations where the samples are drawn from the same distribution. At the 95% level of significance, most of the inputs passed the test, which means that the two datasets are equivalent. The inputs that correspond to different distributions, sorted for their significance are: eEF, milHDV, milLDV. We may conclude that, for eEF, a distribution with smaller variance is more realistic, as the filtered dataset clearly shows that the variance cannot range between two standard deviations. Most probably this means that the contribution of outliers in the emission factors is larger than in real-world conditions. In addition, the high values of the milHDV are more likely to produce behavioural model realizations. The opposite is true for the milLDV parameter.

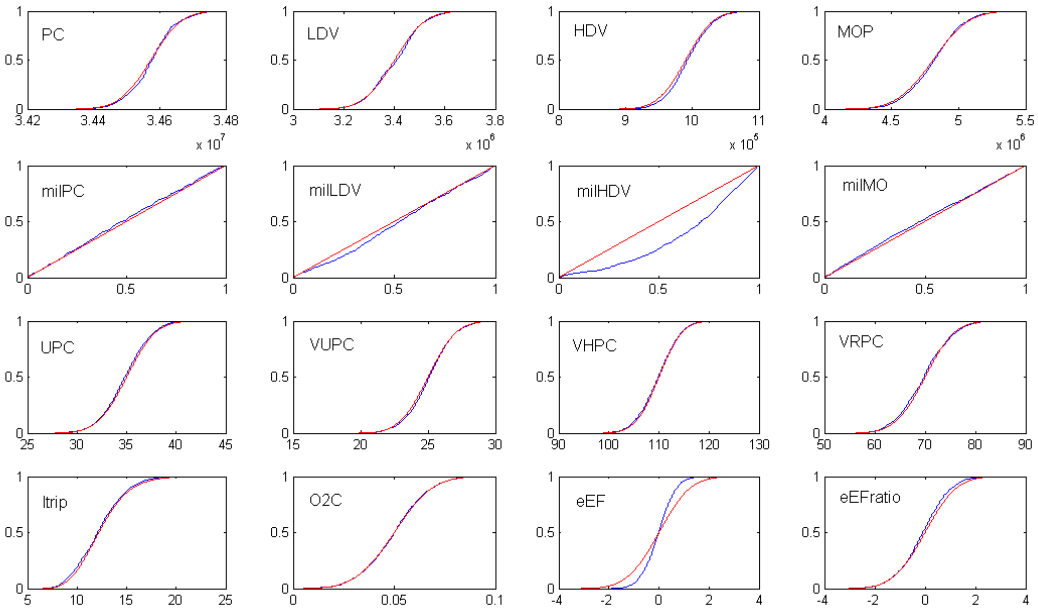


Figure 5-5: Cumulative distribution function of the uncertain inputs for the full (red) and the filtered (blue) Monte Carlo sample.

Table 5-5: The Standardised Regression Coefficients for the full Monte Carlo set (top) and the filtered set (bottom), for CO, VOC, CH_4, NO_x, N_2O, $PM_{2.5}$, PM_{10}, non-exhaust PM, FC and CO_2 (2005).

Full MC	**CO**	**VOC**	**CH_4**	**NO_x**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**
PC	-	-	-	-	-	-	-	-	-	-
LDV	-	-	-	-	-	-	-	-	-	-
HDV	-	-	-	-	-	-	-	-	0.06	-
MOP	-	0.04	-	-	-	-	-	-	-	-
milPC	-	-	-	-	-	-	-	-	0.15	0.15
milLDV	-	-	-	-	-	-	-	-	-	-
milHDV	-	0.04	-	0.25	-	0.22	0.21	0.22	0.27	0.27
milMO	-	-	-	-	-	-	-	-	-	-
UPC	-	0.02	-	-	-	-	-	-	0.06	-
VUPC	-	-	-	-	-	-	-	-	-	-
VHPC	-	-	-	-	-	-	-	-	-	-
VRPC	-	-	-	-	-	-	-	-	-	-
ltrip	-	-	-	-	-	-	-	-	-	-
O2C	-	-	-	-	-	-	-	-	-	-
eEF	0.75	0.86	0.58	0.90	0.33	0.89	0.90	0.88	0.84	0.83
eEFratio	0.22	0.16	0.57	-	0.17	-	-	-	0.22	0.21
R	0.63	0.82	0.68	0.88	0.14	0.86	0.87	0.83	0.91	0.91
Filtered	**CO**	**VOC**	**CH_4**	**NO_x**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**
PC	-	-	-	-	-	-	-	-	-	-
LDV	-	-	-	-	-	-	-	-	-	-
HDV	-	-	-	-	-	-	-	-	-	-
MOP	-	-	-	-	-	-	-	-	-	-
milPC	-	-	-	-	0.06	-	-	-	-	-
milLDV	-	-	-	-	-	-	-	-	-	-
milHDV	-	-	-	0.41	0.12	0.27	0.27	0.28	0.49	0.45
milMO	-	-	-	-	-	-	-	-	-	-
UPC	-	-	-	-	-	-	-	-	-	-
VUPC	-	-	-	-	-	-	-	-	-	-
VHPC	-	-	-	-	0.06	-	-	-	-	-
VRPC	-	-	-	-	-	-	-	-	-	-
ltrip	-	-	-	-	-	-	-	-	-	-
O2C	-	-	-	-	-	-	-	-	-	-
eEF	0.75	0.82	0.33	0.95	0.18	0.97	0.98	0.96	0.92	0.83
eEFratio	0.47	-	0.78	-	0.75	-	-	-	-	-
R	0.63	0.72	0.55	0.86	0.52	0.81	0.82	0.79	0.64	0.69

The input uncertainty imposed on the emission factors was built from a laborious work applied to the experimental data and reproduced the observational variance in a stochastic manner. Therefore, it was not the result of assumptions or modelling but their probability distribution was built based on actual data. In the case of Italy, we have shown that their "real uncertainty" is smaller than the "observational (laboratory)

uncertainty". In other words, many of the observations lead to non-behavioural model realizations. In fact, we have used a lognormal distribution to describe the variance of emission factors. The reason was that all values are above zero but some outliers sometimes shift the distributions to very high emission levels. The uncertainty analysis performed showed that in order to retain a realistic fuel consumption, the variance of the emission and consumption factors in real-world cannot be as high as the variance of the dataset. This had to be corrected. However, even in this case, the emission factors still remain the dominant factor that drives the uncertainty of the emissions.

Therefore, following the results of the "calibration process" with reference to the compliance to the official fuel consumption, we have modified the distribution of eEF and the joint distribution of milHDV and milLDV and we have repeated all the uncertainty and sensitivity analysis. The results are given in section 5.1.2.

5.1.2 Corrected Data Sample

The updated scheme for the emission factors and the mileage, in order to respect the limitation of the fuel consumption resulted to a significant reduction of the output uncertainty. The uncertainty of the annual emissions of CO, VOC, CH_4, NOx, N_2O, PM2.5, PM10, non-exhaust PM and CO_2 is presented in Figure 5-6 while their descriptive statistics are given in Table 5-6. Apart from CO, CH_4 and N_2O that are best fit by a log-normal distribution, all the others are better represented by a normal distribution. Among them, the most skewed are CH_4 and N_2O followed by CO. The coefficient of variation is 7% for FC and CO_2, 13% for PM2.5, PM10 and non-exhaust PM, 15% for NOx, 18% for VOC, on the order of 30-33% for CO and N_2O and 44% for CH_4. The reduction of the output uncertainty compared with the previous setting ranged from 17% (CH_4) to 70% (N_2O) and resulted in a normally distributed output uncertainty for most of the emissions.

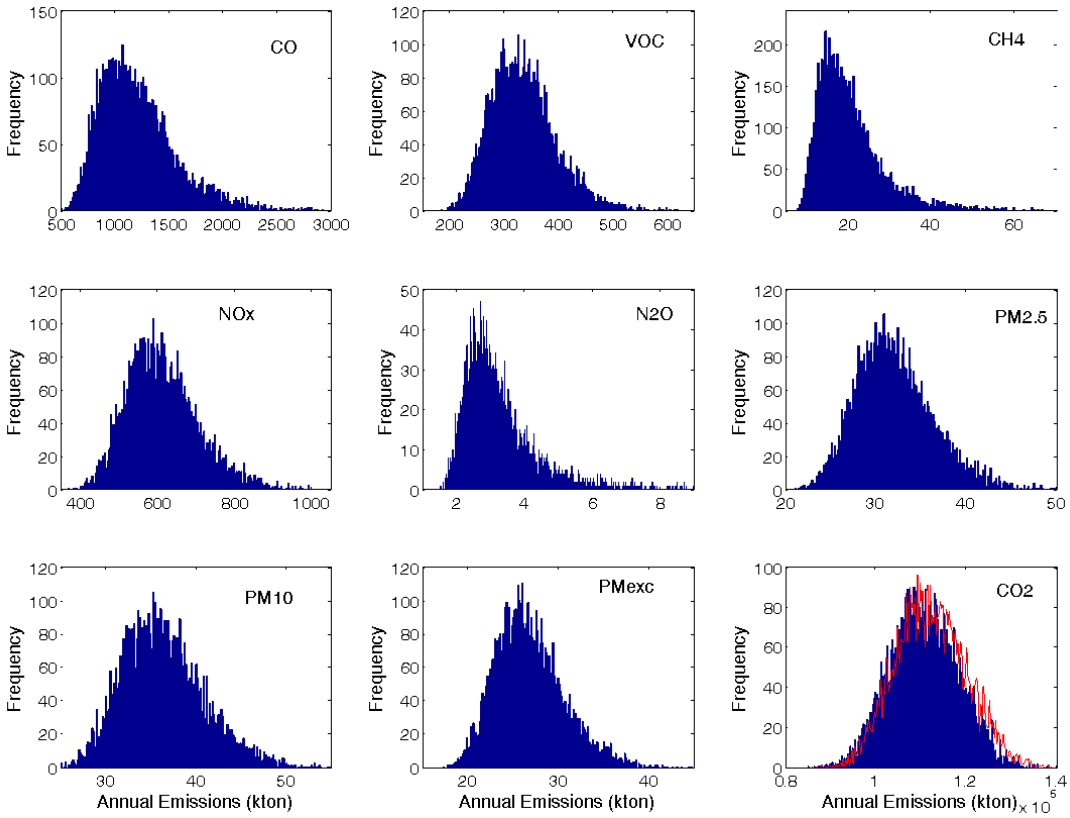


Figure 5-6: Uncertainty analysis of the annual emissions from road transport for Italy (year 2005).

Table 5-6: Descriptive statistics of the histograms presented in Figure 5.6. Values are in ktonnes. CO_{2e} stands for total uncertainty of GHG equivalent.

	CO	VOC	CH_4	NO_X	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Mean	1,215	335	21	613	3.2	32	36	27	36,885	110,570	111,999
Median	1,150	329	19	603	2.9	32	36	26	36,828	110,357	111,751
St. Dev.	371	60	9	92	1.1	4	5	4	2,484	7,596	7,902
Coef. Var. (%)	30	18	44	15	33	13	13	14	7	7	7

Table 5-7: First and Total Order Sensitivity Indices (extended-FAST) for VOC, NO_X, $PM_{2.5}$, PM_{10}, PMexhaust, CO, N_2O, CH_4, CO_2 and FC (2005).

VOC	**S_I**	**S_{TI}**	**NO_X**	**S_I**	**S_{TI}**	**PM2.5**	**S_I**	**S_{TI}**	**PM_{10}**	**S_I**	**S_{TI}**	**PMexh**	**S_I**	**S_{TI}**
eEF	0.63	0.78	eEF	0.76	0.85	eEF	0.72	0.86	eEF	0.72	0.84	eEF	0.72	0.86
ltrip	0.08	0.22	milHDV	0.12	0.22	milHDV	0.08	0.22	milHDV	0.08	0.21	milHDV	0.09	0.23
eEFrati	0.05	0.15	HDV	0.01	0.08	ltrip	0.01	0.13	ltrip	0.01	0.13	ltrip	0.01	0.14
milMO	0.05	0.17	PC	0	0.08	HDV	0.01	0.12	HDV	0.01	0.11	HDV	0.01	0.14
VUPC	0.02	0.16	ltrip	0	0.08	eEFrati	0.01	0.13	milPC	0.01	0.12	eEFrati	0.01	0.14
O2C	0.02	0.15	LDV	0	0.08	LDV	0.01	0.12	LDV	0.01	0.11	LDV	0.01	0.12
HDV	0.01	0.13	VHPC	0	0.1	milPC	0.01	0.13	eEFrati	0.01	0.13	milPC	0.01	0.14
MOP	0.01	0.14	VUPC	0	0.08	PC	0	0.13	PC	0.01	0.13	milMO	0.01	0.12
milHDV	0.01	0.14	O2C	0	0.08	milMO	0	0.11	milMO	0.00	0.10	PC	0.00	0.14
LDV	0.01	0.12	milPC	0	0.08	milLDV	0	0.12	milLDV	0.00	0.12	milLDV	0.00	0.13
PC	0	0.15	UPC	0	0.08	VHPC	0	0.13	VHPC	0.00	0.12	VHPC	0.00	0.14
VRPC	0	0.15	MOP	0	0.09	MOP	0.00	0.13	MOP	0.00	0.12	MOP	0.00	0.15
milPC	0	0.14	eEFrati	0	0.1	O2C	0	0.11	O2C	0	0.1	O2C	0	0.12
VHPC	0	0.13	milMO	0	0.07	UPC	0	0.12	UPC	0	0.11	UPC	0	0.13
milLDV	0	0.14	VRPC	0	0.1	VUPC	0	0.12	VRPC	0	0.12	VRPC	0	0.13
UPC	0	0.14	milLDV	0	0.08	VRPC	0	0.12	VUPC	0	0.11	VUPC	0	0.13
ΣS_i	**0.91**	**3.03**		**0.91**	**2.27**		**0.87**	**2.78**		**0.87**	**2.69**		**0.88**	**2.96**

CO	**S_I**	**S_{TI}**	**N_2O**	**S_I**	**S_{TI}**	**CH_4**	**S_I**	**S_{TI}**	**CO_2**	**S_I**	**S_{TI}**	**FC**	**S_I**	**S_{TI}**
eEF	0.44	0.56	eEFrati	0.59	0.76	eEFrati	0.61	0.76	eEF	0.40	0.51	eEF	0.43	0.54
eEFrati	0.19	0.29	ltrip	0.06	0.37	eEF	0.13	0.29	eEFrati	0.10	0.22	eEFrati	0.11	0.24
ltrip	0.05	0.21	VUPC	0.06	0.23	ltrip	0.03	0.26	milHDV	0.09	0.2	milHDV	0.09	0.21
O2C	0.03	0.16	eEF	0.04	0.16	VUPC	0.01	0.19	milPC	0.05	0.17	milPC	0.05	0.17
VUPC	0.03	0.17	milHDV	0.01	0.14	HDV	0	0.16	ltrip	0.04	0.21	ltrip	0.04	0.21
milMO	0.01	0.13	milPC	0.01	0.13	milMO	0	0.13	O2C	0.04	0.16	HDV	0.02	0.13
HDV	0.01	0.15	HDV	0	0.13	LDV	0	0.16	HDV	0.02	0.13	VUPC	0.01	0.11
LDV	0	0.12	MOP	0	0.18	MOP	0	0.18	VUPC	0.01	0.11	PC	0.01	0.12
VHPC	0	0.15	LDV	0	0.13	VHPC	0	0.21	PC	0.01	0.12	LDV	0.01	0.13
VRPC	0	0.17	milLDV	0	0.11	milHDV	0	0.16	LDV	0.01	0.12	UPC	0.01	0.14
MOP	0	0.17	milMO	0	0.11	VRPC	0	0.2	UPC	0.01	0.14	MOP	0.00	0.12
UPC	0	0.15	VRPC	0.00	0.18	UPC	0	0.16	MOP	0.00	0.12	milLDV	0.00	0.12
PC	0	0.14	UPC	0	0.13	PC	0	0.2	milLDV	0	0.12	VHPC	0	0.12
milHDV	0	0.12	VHPC	0	0.25	milLDV	0	0.13	VHPC	0	0.11	O2C	0	0.12
milPC	0	0.15	O2C	0	0.24	milPC	0	0.16	milMO	0	0.14	milMO	0	0.14
milLDV	0	0.1	PC	0	0.17	O2C	0	0.21	VRPC	0	0.12	VRPC	0	0.12
ΣS_i	**0.79**	**2.94**		**0.79**	**3.44**		**0.80**	**3.58**		**0.78**	**2.68**		**0.79**	**2.72**

The first and total order sensitivity indices (*extended-FAST*) are presented in Table 5-7. The emission factors influences most the variability of the emissions; this characteristic is common for all the outputs. The hot emission factors are driving the uncertainty of all the emissions except for N_2O and CH_4 that are influenced primarily from the cold emission factors. Specifically, 72-76% of the emissions variance of NO_X, $PM_{2.5}$, PM_{10} and $PM_{exhaust}$ is explained by the single contribution of the hot emission factors. The fraction of explained variance from hot emission factors for VOC is 63% and drops down to ~40-44% for CO, CO_2 and FC. On the other hand, for CH_4 and N_2O, the cold emission factors explain 59-61% of the output variance. Analytically:

- VOC: 91% of the VOC emissions variance is explained by single contributions of the 16 variables; 81% of the VOC emissions variance is explained by the single contribution of only four variables, namely eEF (63%), ltrip (8%), eEFratio (5%) and milMO(5%). The sum of all the S_i's is very close to 1 indicating that the model behaves almost additively (with respect to the input parameters).
- NO_x: two variables, the eEF (76%) and the milHDV (12%), are influencing more the uncertainty of the NO_x emissions. The single contributions of the 16 variables explain the 91% of the NO_x emissions. Like VOC, the model behaves almost additively (with respect to the input parameters).
- PM: the results are similar with those of NO_x. 87% of the PM emissions variance is explained by single contributions of the 16 variables. Likewise, 80% of the PM emissions variance is explained by single contributions of only 2 variables, the eEF (72%) and the milHDV (8%). The model behaves almost additively (with respect to the input parameters).
- CO: 79% of the CO emissions variance is explained by single contributions of the 16 variables. A big fraction of the variance (specifically, 63%) is explained by single contributions of the hot (44%) and cold (19%) emission factors.
- N_2O: 79% of the N_2O emissions variance is explained by single contributions of the 16 variables. The eEFratio explains most of the N_2O emissions variance (59%) followed by ltrip and VUPC (6% each) and eEF (4%). The interaction effects of second and higher-order in the N_2O emissions are quite high as can be seen from the sum of the total indices. However, N_2O variance has been greatly reduced compared to the initial sample used and most of the uncertainty is now explained.
- CH_4: uncertainty in the CH_4 emissions is mostly influenced by the emission factors, which taken singularly explain 74% of the variance (61% by the eEFratio and 13% by the eEF). The single contribution of all the uncertain inputs explains the 80% of the CH_4 emissions variance.
- CO_2: 78% of the CO_2 emissions variance is explained by single contributions of the 16 variables. The single contribution of six variables [eEF (40%), eEFratio (10%), milHDV (9%), milPC (5%), ltrip (4%), O2C (4%)], explain 72% of the CO_2 emissions variance.
- FC: 79% of the FC variance is explained by single contributions of the 16 variables. Similarly, 72% of the FC variance is explained by single contributions of only five variables, namely eEF (43%), eEFratio (11%), milHDV (9%), milPC (5%) and ltrip (4%).

Furthermore, the parameter that contributes most to the output uncertainty by means of higher order interactions is *ltrip*. In addition, N_2O and CH_4 demonstrate significant interactions of second and higher order while for NO_X, the higher order interactions are of minor importance.

Like the previous section, we performed also an analysis for the subset of the simulations with predicted fuel consumption within a range of one standard deviation (i.e. 7%). In this way we would like to demonstrate that the statistical distribution of output uncertainty is correct. The statistical distribution of the filtered fuel consumption is presented in Figure 5-7b while for all other output variables it is shown in Figure 5-8. The corresponding descriptive statistics are given in Table 5-8. We clearly observe a homogeneous reduction in the output uncertainty of all emissions by ~30%. Furthermore,

the cumulative distribution function of the uncertain inputs for the full and the filtered Monte Carlo sample is shown in Figure 5-9. The new distributions of eEF, milHDV, milLDV are more realistic and produce behavioural model realizations. We must admit that the joint probability distribution of (beta, tau) that drive the uncertainty of milHDV can still be further optimized. However, the gradient of change of the first and total sensitivity indices suggest that one should expect another 1-2% (maximum) of explained variance by the milHDV and therefore it does not worth to repeat the analysis.

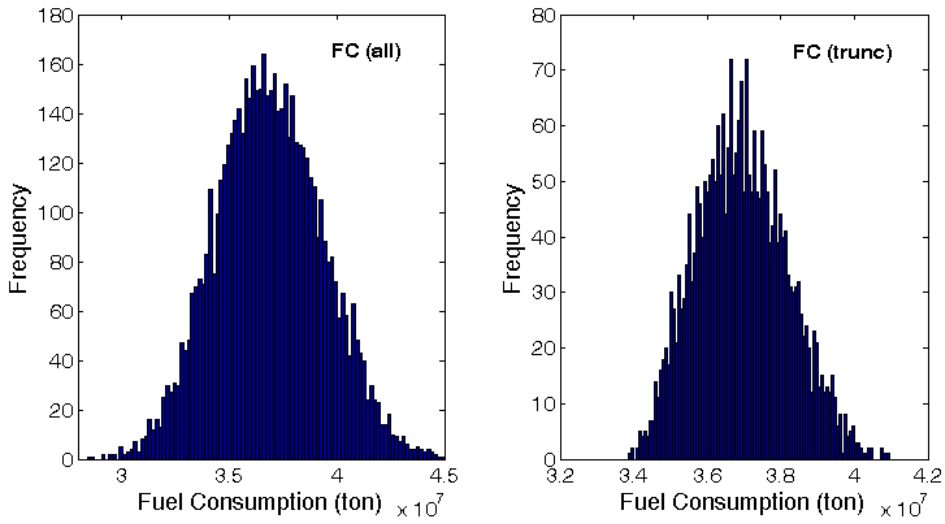


Figure 5-7: Uncertainty Analysis of the annual fuel consumption from road transport for Italy resulted from: (a) all simulations (left), (b) simulations within 10% of the officially reported fuel consumption.

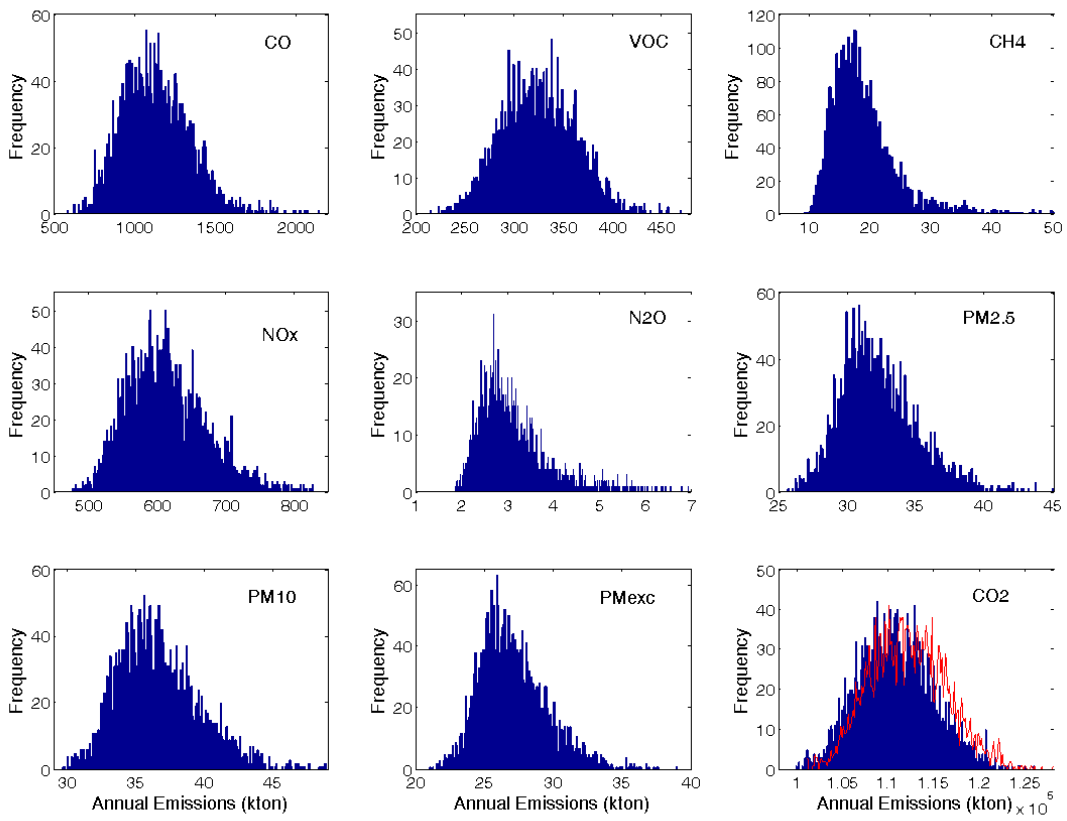


Figure 5-8: Uncertainty Analysis of the annual emissions from road transport for Italy (year 2005) for the simulations with predicted fuel consumption within a small range of the official value.

Table 5-8: Descriptive statistics of the histograms presented in Figure 5-4. Values are in ktonnes.

	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Mean	1,134	325	19	614	3.1	32	37	27	36,945	110,735	112,094
Median	1,118	324	18	608	2.9	32	36	27	36,901	110,622	111,941
St. Dev.	218	38	7	59	0.8	3	3	3	1,241	4,079	4,203
Variation (%)	19	12	34	10	26	9	8	9	3	4	4

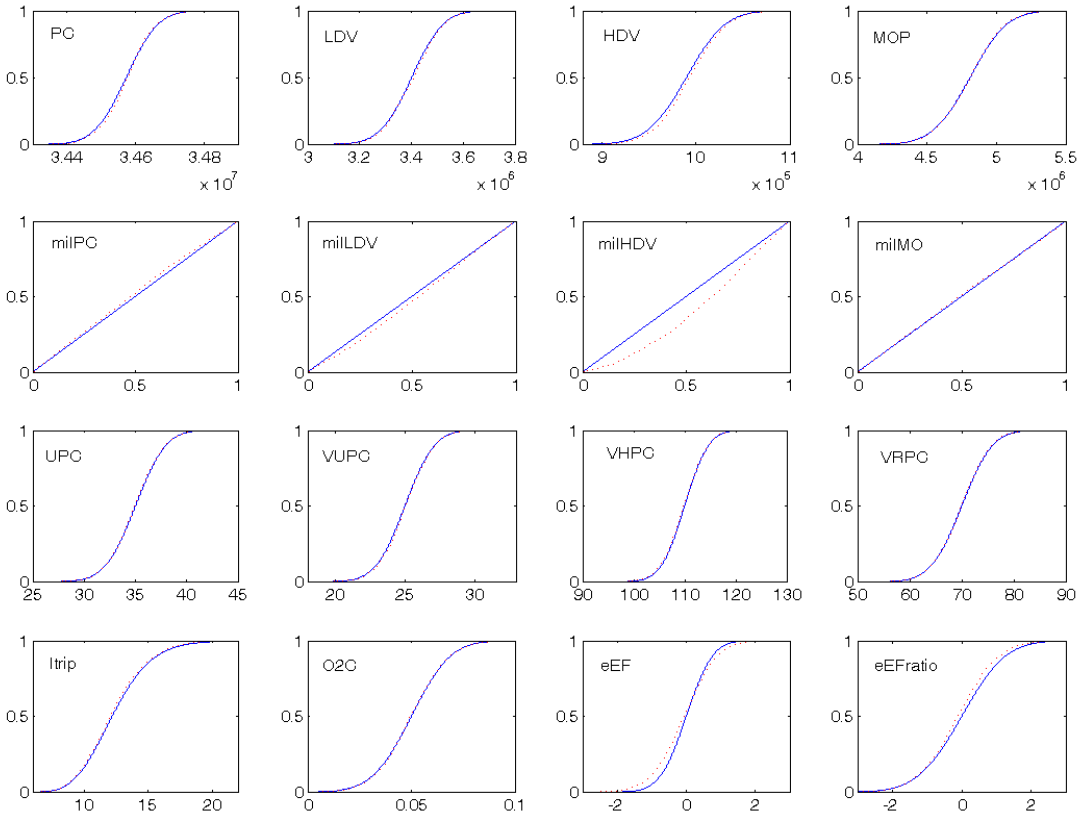


Figure 5-9: Cumulative distribution function of the uncertain inputs for the full (blue) and the filtered (red) Monte Carlo sample.

5.2 Case study 2: Uncertainty & sensitivity for Poland

5.2.1 Initial Data Sample

The methodological procedure adopted for Italy is repeated hereafter for Poland. The differences in the statistical distributions of the uncertain inputs with the run conducted for Italy were mostly in the vehicle populations and in the temperature time series. In addition, a slightly modified module in the fleet breakdown model, from total population down to the sub-sector level, has been implemented due to the different type of available information (i.e. the stochastic fleet breakdown model was conditional on different restrictions).

The screening analysis with the method of Morris (Figure 5-10) identified the following influential variables:

- the total population of light duty vehicles and heavy duty vehicles (LDV, HDV)
- the parameters of the fleet breakdown model (delta, sigma, tau)
- the annual mileage of passenger cars, light duty vehicles, heavy duty vehicles and urban buses-coaches (milPC, milLDV, milHDV, milUB, eM0)
- the urban driving cycle velocity of the passenger cars, the light duty vehicles and the urban buses (VUPC, VULDV, VUUB)
- the average trip length (ltrip)
- the oxygen to carbon ratio in the fuel (O2C)
- the hot and cold emission factors (eEF, eEFratio)

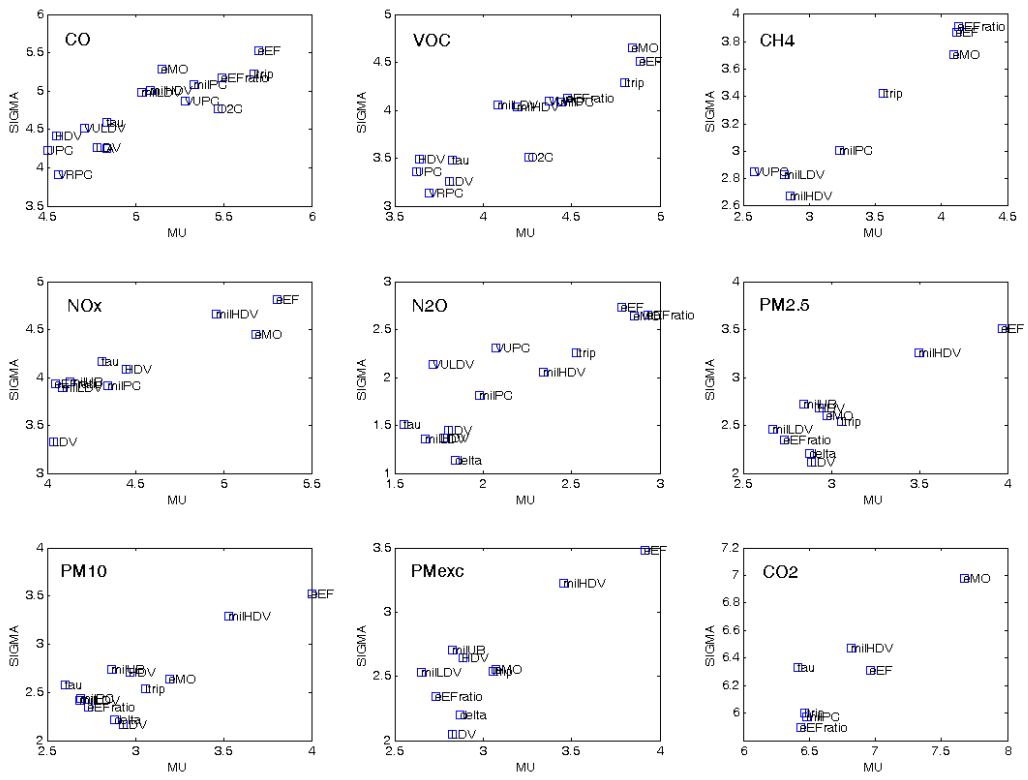


Figure 5-10: Morris results for Poland (year 2005)

The 17 most influential parameters identified from the screening analysis were used next in a quantitative sensitivity analysis. The sample was created with FAST sampling and required 6273 Monte Carlo simulations. The uncertainty of the annual emissions of CO, VOC, CH_4, NOx, N_2O, PM2.5, PM10, non-exhaust PM and CO_2 is presented in Figure 5-11 while their descriptive statistics are given in Table 5-9. The red line in the histogram of CO_2 corresponds to the cumulative uncertainty of the greenhouse gases (N_2O, CH_4, CO_2) and is presented as equivalent CO_2. Apart from CO_2 and FC (Figure 5-12a) that are best fit by a normal distribution, all the others are better represented by a log-normal distribution. Among them, the most skewed are N_2O followed by CO and CH_4. The coefficient of variation is 13% for CO_2, on the order of 20-30% for NOx, VOC, PM2.5, PM10, non-exhaust PM and CO, 66% for CH_4 and almost 200% for N_2O.

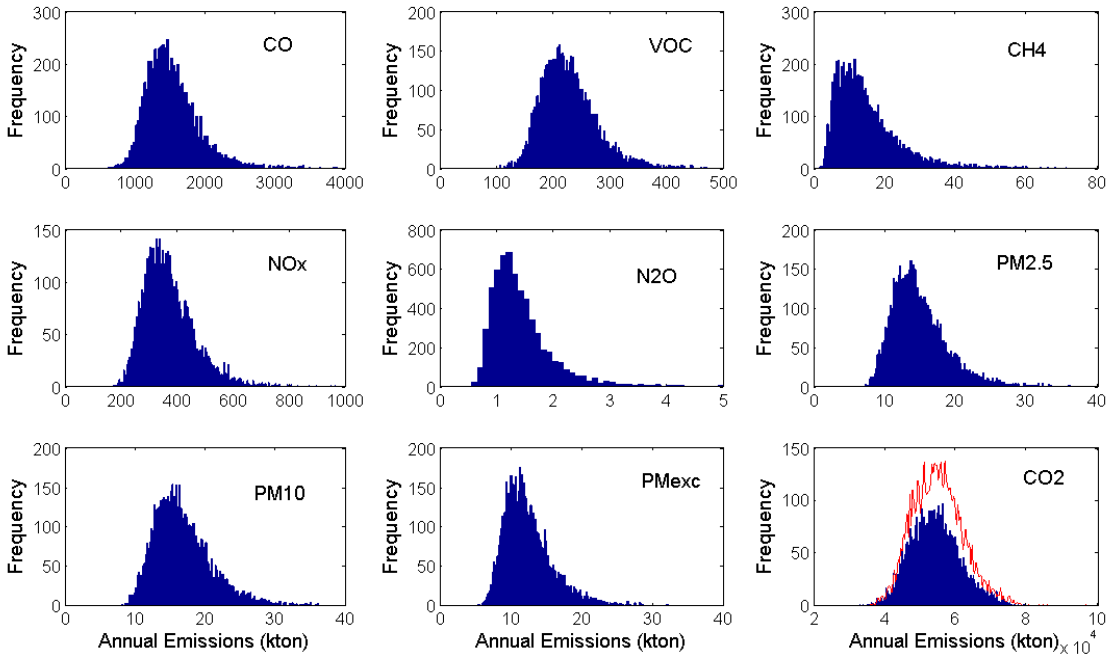


Figure 5-11: Uncertainty Analysis of the annual emissions from road transport for Poland (year 2005).

Table 5-9: Descriptive statistics of the histograms presented in Figure 5-11. Values are in ktonnes.

	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Mean	1,553	228	15	369	1.75	15	17	13	17,865	54,029	54,891
Median	1,470	220	13	354	1.31	14	16	12	17,762	53,763	54,509
St. Dev.	459	52	10	91	3.48	4	4	4	2,273	6,889	7,324
Coef. Var.(%)	30	23	66	25	199	27	26	29	13	13	13

The first and total order sensitivity indices (*extended-FAST*) are presented in Table 5-10. The hot emission factors influences most the variability of the emissions; they are ranked first in all the outputs except for FC and CO_2 where the mileage parameter M0 is dominant. Specifically, 73-75% of the emissions variance of NO_x, $PM_{2.5}$, PM_{10} and non-exhaust PM is explained by the single contribution of the hot emission factors. The fraction of explained variance from hot emission factors for VOC and CO is 51% and 44% respectively and drops down to 8% for N_2O. For CH_4, hot and cold emission factors explain equal portions of the variance (36% each). Finally, for CO_2 and FC, although the emission factors were ranked in the second place, they explain ~25% of the variance. Analytically:

- VOC: 95% of the VOC emissions variance is explained by single contributions of the 17 variables. Similarly, 91% of the VOC emissions variance is explained by single contributions of only 4 variables, namely eEF (51%), eM0 (20%), ltrip (13%) and eEFratio (7%). The sum of all the S_i's is very close to 1 indicating that the model behaves almost additively (with respect to the input parameters).

- NO_x: 96% of the NO_x emissions variance is explained by single contributions of the 17 variables. Likewise, 89% of the NO_x emissions variance is explained by single contributions of only 2 variables, namely eEF (73%) and eM0 (16%). Like VOC, the model behaves almost additively (with respect to the input parameters).

- PM: the results are similar with those of NO_x. 95% of the PM emissions variance is explained by single contributions of all the uncertain inputs while 87% of the PM emissions variance is explained by single contributions of only 2 variables, namely eEF (74%) and eM0 (13%). The model behaves almost additively (with respect to the input parameters).

- CO: 86% of the CO emissions variance is explained by single contributions of the 17 variables. Most of the explained variance (~75%) arises from single contributions of only 4 variables, namely eEF (44%), eM0 (12%), eEFratio (10%) and ltrip (9%). The CO emissions are influenced by some high-order interactions, as seen by the sum of S_{TI}, which is quite greater than 1.

- N_2O: less than half (44%) of the N_2O emissions variance is explained by single contributions of the 17 variables. The eEF explains 8% of the N_2O emissions variance followed by eEFratio (3%) while all the other variables contribute equally by 2%. The interaction effects of second and higher-order in the N_2O emissions are higher than the contributions of the 17 uncertain input variables taken singularly. The same problem of the N_2O variance with the Italy case is also shown here.

- CH_4: 82% of the CH_4 emissions variance is explained by single contributions of the 17 variables. The emission factors taken singularly explain 75% of the CH_4 emissions variance (37% by the eEF and 38% by the eEFratio).

- CO_2: 94% of the CO_2 emissions variance is explained by single contributions of the 17 variables. The single contribution of two variables [eEF (25%), eM0 (56%)], explain 81% of the CO_2 emissions variance. CO_2 emissions seem to behave almost additively (with respect to the input parameters).

- FC: 94% of the FC variance is explained by single contributions of the 17 variables. Similarly, 82% of the FC variance is explained by single contributions of only 4 variables, namely eM0 (56%) and eEF (26%). FC emissions seem to behave almost additively (with respect to the input parameters).

Table 5-10: First and Total Order Sensitivity Indices (extended-FAST) for VOC, NO_x, $PM_{2.5}$, PM_{10}, non-exhaust, CO, N_2O, CH_4, CO_2 and FC (2005).

VOC	S_I	S_{TI}	***NO_x***	S_I	S_{TI}	***PM2.5***	S_I	S_{TI}	***PM10***	S_I	S_{TI}	***PMexh***	S_I	S_{TI}
eEF	0.51	0.65	eEF	0.73	0.80	eEF	0.74	0.81	eEF	0.73	0.79	eEF	0.75	0.82
eM0	0.20	0.33	eM0	0.16	0.26	eM0	0.13	0.24	eM0	0.15	0.25	eM0	0.11	0.23
ltrip	0.13	0.23	milHDV	0.04	0.12	milHDV	0.04	0.13	milHDV	0.04	0.12	milHDV	0.04	0.14
eEFratio	0.07	0.19	eEFratio	0.01	0.09	ltrip	0.01	0.07	ltrip	0.01	0.07	Ltrip	0.01	0.08
VUPC	0.02	0.15	HDV	0.01	0.06	HDV	0.01	0.07	HDV	0.01	0.06	HDV	0.01	0.07
O2C	0.01	0.11	delta	0.00	0.06	delta	0.01	0.07	delta	0.00	0.07	delta	0.01	0.08
milPC	0.00	0.12	tau	0.00	0.07	LDV	0.00	0.08	LDV	0.00	0.07	eEFratio	0.00	0.10
VULDV	0.00	0.10	VUUB	0.00	0.06	eEFratio	0.00	0.09	milLDV	0.00	0.07	LDV	0.00	0.09
VUUB	0.00	0.11	milPC	0.00	0.07	milLDV	0.00	0.08	eEFratio	0.00	0.09	milLDV	0.00	0.09
milHDV	0.00	0.12	ltrip	0.00	0.06	VUUB	0.00	0.07	VUUB	0.00	0.07	milUB	0.00	0.09
milUB	0.00	0.12	LDV	0.00	0.07	milUB	0.00	0.08	milUB	0.00	0.08	VUUB	0.00	0.08
LDV	0.00	0.12	sigma	0.00	0.06	milPC	0.00	0.06	milPC	0.00	0.06	O2C	0.00	0.06
HDV	0.00	0.07	milLDV	0.00	0.06	O2C	0.00	0.06	O2C	0.00	0.06	sigma	0.00	0.07
delta	0.00	0.08	milUB	0.00	0.08	sigma	0.00	0.06	sigma	0.00	0.06	milPC	0.00	0.07
sigma	0.00	0.12	O2C	0.00	0.06	tau	0.00	0.06	tau	0.00	0.06	VUPC	0.00	0.07
milLDV	0.00	0.10	VUPC	0.00	0.06	VUPC	0.00	0.07	VUPC	0.00	0.06	tau	0.00	0.07
tau	0.00	0.11	VULDV	0.00	0.05	VULDV	0.00	0.06	VULDV	0.00	0.05	VULDV	0.00	0.07
ΣS_i	**0.95**	**3.84**		**0.96**	**3.10**		**0.95**	**3.15**		**0.95**	**3.09**		**0.95**	**3.27**
CO	S_I	S_{TI}	***N2O***	S_I	S_{TI}	***CH4***	S_I	S_{TI}	***CO2***	S_I	S_{TI}	***FC***	S_I	S_{TI}
eEF	0.44	0.72	eEF	0.08	0.88	eEFratio	0.38	0.61	eM0	0.56	0.63	eM0	0.56	0.63
eM0	0.12	0.39	eEFratio	0.03	0.80	eEF	0.37	0.58	eEF	0.25	0.30	eEF	0.26	0.30
eEFratio	0.10	0.33	VULDV	0.02	0.75	eM0	0.03	0.18	milHDV	0.04	0.07	milHDV	0.04	0.07
ltrip	0.09	0.26	milUB	0.02	0.82	ltrip	0.02	0.18	eEFratio	0.02	0.09	eEFratio	0.02	0.09
O2C	0.04	0.24	eMO	0.02	0.85	VUPC	0.00	0.17	ltrip	0.02	0.06	ltrip	0.02	0.06
VUPC	0.02	0.31	VUUB	0.02	0.81	tau	0.00	0.17	tau	0.01	0.05	tau	0.01	0.05
VULDV	0.01	0.18	tau	0.02	0.82	VUUB	0.00	0.19	milPC	0.01	0.04	milPC	0.01	0.04
milUB	0.01	0.25	LDV	0.02	0.81	LDV	0.00	0.22	O2C	0.01	0.06	LDV	0.01	0.05
LDV	0.00	0.25	milLDV	0.02	0.78	milPC	0.00	0.16	LDV	0.01	0.05	HDV	0.01	0.05
VUUB	0.00	0.21	O2C	0.02	0.72	milUB	0.00	0.16	HDV	0.01	0.05	VUPC	0.01	0.05
milPC	0.00	0.23	milPC	0.02	0.79	VULDV	0.00	0.16	VUPC	0.01	0.05	sigma	0.00	0.04
milHDV	0.00	0.24	delta	0.02	0.76	HDV	0.00	0.14	sigma	0.00	0.05	milLDV	0.00	0.05
milLDV	0.00	0.21	VUPC	0.02	0.83	O2C	0.00	0.15	milLDV	0.00	0.05	delta	0.00	0.04
tau	0.00	0.25	milHDV	0.02	0.79	milHDV	0.00	0.15	delta	0.00	0.04	VUUB	0.00	0.04
delta	0.00	0.15	HDV	0.02	0.70	delta	0.00	0.13	VUUB	0.00	0.03	O2C	0.00	0.05
sigma	0.00	0.21	sigma	0.02	0.72	milLDV	0.00	0.15	VULDV	0.00	0.03	VULDV	0.00	0.03
HDV	0.00	0.14	ltrip	0.02	0.70	sigma	0.00	0.17	milUB	0.00	0.05	milUB	0.00	0.05
ΣS_i	**0.86**	**5.59**		**0.40**	**14.3**		**0.82**	**4.68**		**0.94**	**2.69**		**0.94**	**2.68**

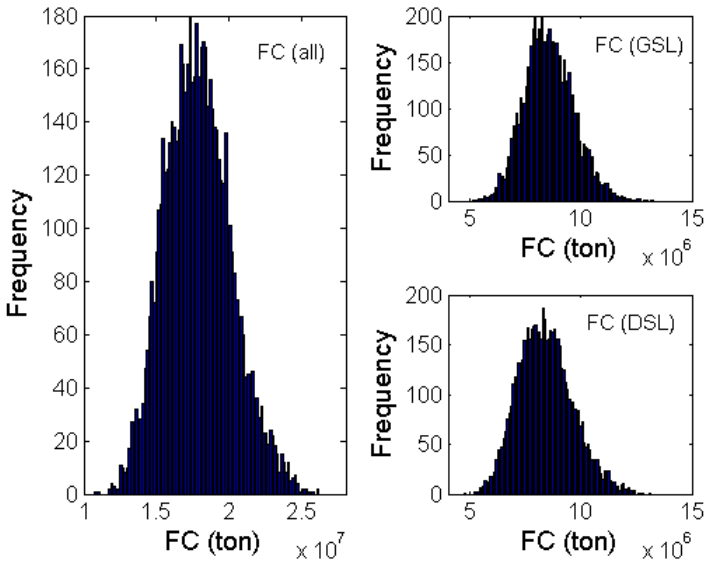


Figure 5-12: Uncertainty Analysis of the annual fuel consumption from road transport for Poland: (a) Cumulative fuel consumption (left), (b) Gasoline fuel consumption (right, top row), (c) Diesel fuel consumption (right, bottom row).

We now restrict the analysis to the subset of the simulations with predicted fuel consumption within a range of one standard deviation (i.e. 13%) from the known fuel consumption. The annual fuel consumption for Poland (2005) according to EC4MACS (PRIMES) is 4,140,256 tonnes for gasoline and 5,445,725 tonnes for diesel. Therefore, we summed up the predicted by COPERT 4 fuel consumption of gasoline and diesel cars at each Monte Carlo simulation and kept only the runs for which both predicted values were within 13% of the reported value.

The statistical distribution of the gasoline and diesel fuel consumption is presented in Figure 5-12b,c). We clearly observe that the simulated fuel consumption is much above the official values and hence no further analysis is possible. The big difference between calculated and statistical fuel consumption may be derived either from a large black market or from an erroneous M0 value, which was based on data of other countries. In any case, the significant difference between the two does not allow focussing the discussion only around values of the statistical fuel consumption. We will perform next another set of Monte Carlo simulations with the updated scheme for the emission factors and the mileage identified for Italy that will remove the outliers arising from an imperfect statistical distribution. In addition, we will use a modified M0 that is expected to shift the whole output distribution. The corrected M0 was 56% of the original value for gasoline and 74% of the original value for diesel.

5.2.2 Corrected Data Sample

In this case, the uncertainty analysis was performed by introducing the sample corrections, also introduced in the case of Italy. In addition, the initial mileage value was corrected to bring the fuel consumption closer to the official value. This correction does not affect the uncertainty of the calculation, it only shifts the distribution to a more realistic range for Poland. As it was explained in section 2.4, the initial mileage value for Poland was assessed on the basis of the average mileage of eight member states and no national data. Therefore, the correction is absolutely justified.

The uncertainty of the annual emissions of CO, VOC, CH_4, NOx, N_2O, PM2.5, PM10, non-exhaust PM and CO_2 is presented in Figure 5-13 while their descriptive statistics are given in Table 5-11. CH_4 and N_2O are best fit by a log-normal distribution, FC and CO_2 are better represented by a normal distribution while the others are log-normally distributed

with small sigma though (quasi normal). Among them, the most skewed are CH_4 and N_2O followed by CO. The coefficient of variation is 11% for FC and CO_2, 17-20% for PM2.5, PM10, non-exhaust PM, NOx, VOC and CO, 28% for N_2O and 57% for CH_4. The reduction in the output uncertainty compared with the previous setting ranged from 14% (CH_4, FC, CO_2) to 86% (N_2O).

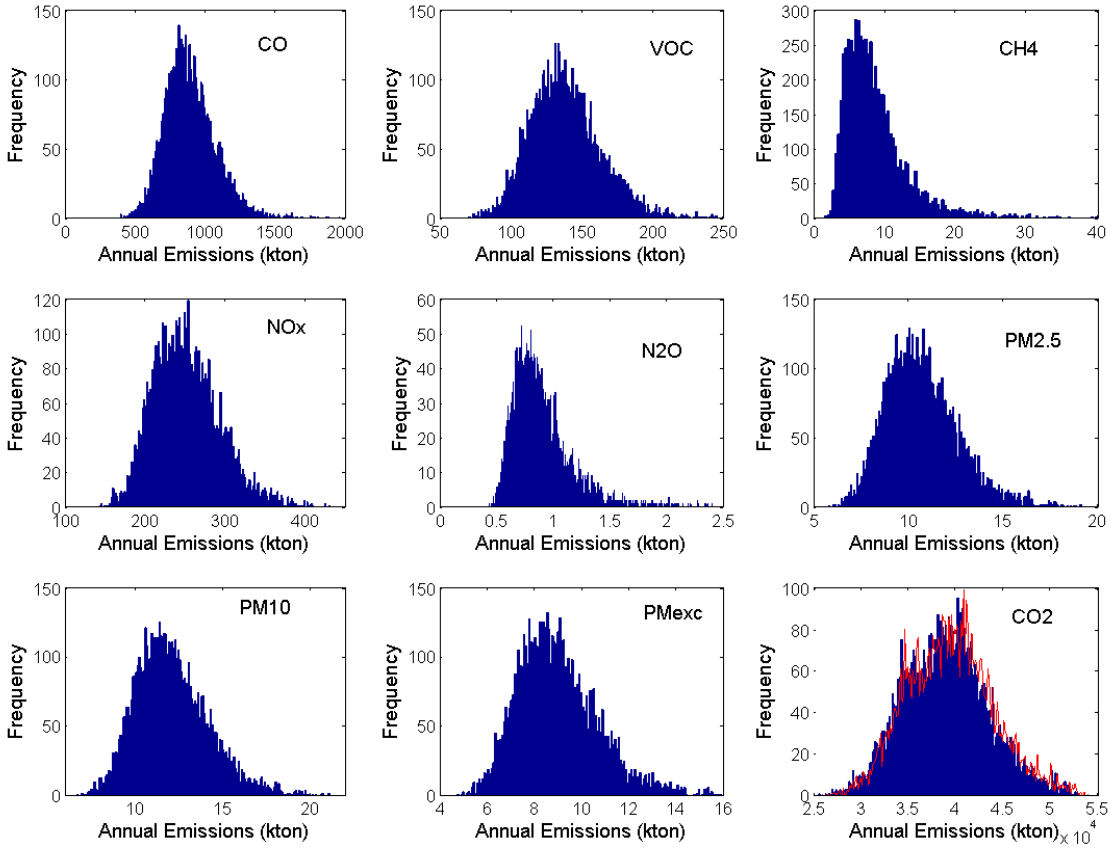


Figure 5-13: Uncertainty analysis of the annual emissions from road transport for Poland (year 2005).

Table 5-11: Descriptive statistics of the histograms presented in Figure 5-13. Values are in ktonnes. CO_{2e} stands for total uncertainty of GHG equivalent.

	CO	**VOC**	**CH_4**	**NO_X**	**N_2O**	**$PM_{2.5}$**	**PM_{10}**	**PM_{exh}**	**FC**	**CO_2**	**CO_{2e}**
Mean	892	139	8.8	251	0.9	11	12	9.0	12,895	38,912	39,370
Median	873	136	7.7	247	0.8	10	12	8.8	12,846	38,839	39,277
St. Dev.	183	25	5.0	42	0.2	1.9	2.1	1.7	1,465	4,447	4,531
Poland	20	18	57	17	28	18	17	19	11	11	12

Table 5-12: First and Total Order Sensitivity Indices (extended-FAST) for VOC, NO_X, $PM_{2.5}$, PM10, PMexhaust, CO, N_2O, CH_4, CO_2 and FC (2005).

VOC	**S_I**	**S_{TI}**	**NO_X**	**S_I**	**S_{TI}**	**PM2.5**	**S_I**	**S_{TI}**	**PM10**	**S_I**	**S_{TI}**	**PMexc**	**S_I**	**S_{TI}**
eM0	0.27	0.40	eEF	0.49	0.56	eEF	0.54	0.60	eEF	0.52	0.58	eEF	0.55	0.61
ltrip	0.23	0.37	eMO	0.35	0.43	eMO	0.28	0.37	eMO	0.31	0.39	eMO	0.25	0.34
eEF	0.20	0.34	milHDV	0.07	0.12	milHDV	0.05	0.12	milHDV	0.05	0.11	milHDV	0.06	0.14
VUPC	0.10	0.23	HDV	0.02	0.08	ltrip	0.02	0.07	ltrip	0.02	0.07	ltrip	0.02	0.08
eEFratio	0.08	0.18	eEFratio	0.01	0.08	HDV	0.02	0.07	HDV	0.01	0.07	HDV	0.02	0.08
delta	0.01	0.09	LDV	0.00	0.07	LDV	0.01	0.07	LDV	0.01	0.07	LDV	0.01	0.08
O2C	0.01	0.14	ltrip	0.00	0.07	eEFratio	0.01	0.08	eEFratio	0.01	0.08	delta	0.01	0.06
tau	0.01	0.10	VUPC	0.00	0.06	milLDV	0.01	0.07	milLDV	0.01	0.06	eEFratio	0.01	0.09
LDV	0.00	0.12	VUUB	0.00	0.05	delta	0.01	0.05	delta	0.00	0.05	milLDV	0.01	0.08
milPC	0.00	0.11	O2C	0.00	0.06	tau	0.00	0.05	tau	0.00	0.04	tau	0.00	0.05
HDV	0.00	0.07	tau	0.00	0.05	milUB	0.00	0.07	milUB	0.00	0.06	milUB	0.00	0.08
milUB	0.00	0.09	milPC	0.00	0.06	VUUB	0.00	0.05	VUUB	0.00	0.05	VUUB	0.00	0.06
VULDV	0.00	0.10	milLDV	0.00	0.06	O2C	0.00	0.05	O2C	0.00	0.05	O2C	0.00	0.05
sigma	0.00	0.13	milUB	0.00	0.07	VULDV	0.00	0.05	milPC	0.00	0.04	VUPC	0.00	0.06
milHDV	0.00	0.10	VULDV	0.00	0.05	sigma	0.00	0.06	VULDV	0.00	0.05	sigma	0.00	0.07
VUUB	0.00	0.11	sigma	0.00	0.06	VUPC	0.00	0.06	sigma	0.00	0.06	VULDV	0.00	0.06
milLDV	0.00	0.10	delta	0.00	0.05	milPC	0.00	0.05	VUPC	0.00	0.06	milPC	0.00	0.05
ΣS_i	**0.93**	**2.80**		**0.96**	**1.97**		**0.95**	**1.94**		**0.95**	**1.89**		**0.95**	**2.04**
CO	**S_I**	**S_{TI}**	**N2O**	**S_I**	**S_{TI}**	**CH4**	**S_I**	**S_{TI}**	**CO2**	**S_I**	**S_{TI}**	**FC**	**S_I**	**S_{TI}**
eM0	0.22	0.35	eEFratio	0.48	0.70	eEFratio	0.56	0.80	eMO	0.67	0.74	eMO	0.68	0.74
ltrip	0.20	0.36	eMO	0.14	0.28	eEF	0.12	0.35	eEF	0.09	0.13	eEF	0.10	0.14
eEFratio	0.15	0.28	eEF	0.11	0.39	eMO	0.03	0.11	delta	0.03	0.06	delta	0.03	0.06
eEF	0.15	0.31	VUPC	0.06	0.25	ltrip	0.03	0.25	milHDV	0.03	0.05	milHDV	0.03	0.05
O2C	0.08	0.24	ltrip	0.04	0.27	VUPC	0.01	0.16	ltrip	0.02	0.06	ltrip	0.02	0.06
VUPC	0.08	0.23	milHDV	0.02	0.20	delta	0.00	0.12	eEFratio	0.02	0.06	eEFratio	0.02	0.07
delta	0.01	0.10	VULDV	0.01	0.18	HDV	0.00	0.18	LDV	0.01	0.06	LDV	0.01	0.05
VULDV	0.01	0.11	HDV	0.01	0.17	milUB	0.00	0.16	O2C	0.01	0.06	HDV	0.01	0.05
LDV	0.01	0.15	delta	0.00	0.11	milPC	0.00	0.14	HDV	0.01	0.05	milPC	0.01	0.04
tau	0.01	0.13	tau	0.00	0.18	LDV	0.00	0.22	milPC	0.01	0.04	VUPC	0.01	0.05
milUB	0.00	0.11	LDV	0.00	0.20	VUUB	0.00	0.18	VUPC	0.01	0.05	milLDV	0.00	0.04
HDV	0.00	0.09	milPC	0.00	0.14	O2C	0.00	0.13	milLDV	0.00	0.04	sigma	0.00	0.04
sigma	0.00	0.16	milLDV	0.00	0.16	tau	0.00	0.15	sigma	0.00	0.04	tau	0.00	0.04
milPC	0.00	0.13	milUB	0.00	0.20	milLDV	0.00	0.15	tau	0.00	0.04	VUUB	0.00	0.04
VUUB	0.00	0.12	O2C	0.00	0.20	VULDV	0.00	0.14	VUUB	0.00	0.04	VULDV	0.00	0.03
milLDV	0.00	0.12	VUUB	0.00	0.16	milHDV	0.00	0.13	VULDV	0.00	0.03	milUB	0.00	0.03
milHDV	0.00	0.12	sigma	0.00	0.14	sigma	0.00	0.15	milUB	0.00	0.04	O2C	0.00	0.05
ΣS_i	**0.92**	**3.11**		**0.89**	**3.96**		**0.77**	**3.55**		**0.91**	**1.58**		**0.92**	**1.58**

The first and total order sensitivity indices (*extended-FAST*) are presented in Table 5-12. The emission factors, the mileage parameter M0 and the average trip length influences mostly the variability of the emissions. The hot emission factors are driving the uncertainty of NO_X and PM, the cold emission factors influence primarily the emissions of N_2O and CH_4 and the mileage parameter M0 is the key uncertainty factor for FC and CO_2. For VOC and CO, all the above mentioned factors contribute to the output uncertainty. The fraction of explained variance from the single contributions of the emission factors and the mileage parameter M0 ranges between 52% and 85%. Analytically:

- VOC: 93% of the VOC emissions variance is explained by single contributions of the 17 variables; 88% of the VOC emissions variance is explained by the single contribution of only five variables, namely eM0 (27%), ltrip (23%), eEF (20%), VUPC (10%) and eEFratio (8%). The sum of all the S_i's is very close to 1 indicating that the model behaves almost additively (with respect to the input parameters).
- NO_x: two variables, the eEF (49%) and the eM0 (35%), are influencing more the uncertainty of the NO_x emissions. The single contributions of the 17 variables explain the 96% of the NO_x emissions. Like VOC, the model behaves almost additively (with respect to the input parameters)
- PM: the results are similar with those of NO_x. 95% of the PM emissions variance is explained by single contributions of the 17 variables. Likewise, 81-84% of the PM emissions variance is explained by single contributions of only 2 variables, the eEF (52-55%) and the eM0 (25-31%). The model behaves almost additively (with respect to the input parameters).
- CO: 92% of the CO emissions variance is explained by single contributions of the 17 variables. The biggest fraction of the variance (specifically, 88%) is explained by single contributions of only six variables, namely eM0 (22%), ltrip (20%), eEFratio (15%), eEF (15%), O2C (8%) and VUPC (8%).
- N_2O: 89% of the N_2O emissions variance is explained by single contributions of the 17 variables. The eEFratio explains most of the N_2O emissions variance (48%) followed by eM0 (14%) and eEF (11%). The interaction effects of second and higher-order in the N_2O emissions are quite high as can be seen from the sum of the total indices.
- CH_4: uncertainty in the CH_4 emissions is mostly influenced by the emission factors, which taken singularly explain 68% of the variance (56% by the eEFratio and 12% by the eEF). The single contribution of all the uncertain inputs explains the 77% of the CH_4 emissions variance.
- CO_2: 91% of the CO_2 emissions variance is explained by single contributions of the 17 variables. The single contribution of two variables [eM0 (67%), eEF (9%)], explain 78% of the CO_2 emissions variance.
- FC: 92% of the FC variance is explained by single contributions of the 17 variables. Similarly, 80% of the FC variance is explained by single contributions of only two variables, namely eM0 (68%) and eEF (10).

Furthermore, the parameter that contributes more to the output uncertainty by means of higher order interactions is *ltrip*. In addition, N_2O and CH_4 demonstrate significant interactions of second and higher order while for CO_2 and FC, the higher order interactions are of minor importance.

Like the previous section, we performed also an analysis for the subset of the simulations with predicted fuel consumption within a range of one standard deviation (i.e. 11%). In this way we would like to demonstrate that the statistical distribution of output uncertainty is correct. The statistical distribution of the filtered fuel consumption is presented in Figure 5-14b while for all other output variables it is shown in Figure 5-15. The corresponding descriptive statistics are given in Table 5-13. We clearly observe a homogeneous reduction in the output uncertainty of most emissions by ~40% (~20% for CO, VOC and N_2O; only 5% for CH_4). Furthermore, the cumulative distribution function of

the uncertain inputs for the full and the filtered Monte Carlo sample is shown in Figure 5-16. All distributions are similar between the full and the filtered dataset except for eM0, indicating that even lower values are more realistic. Hence, the estimated sensitivity indices for eM0 are lower in reality, provided that there does not exist any black market.

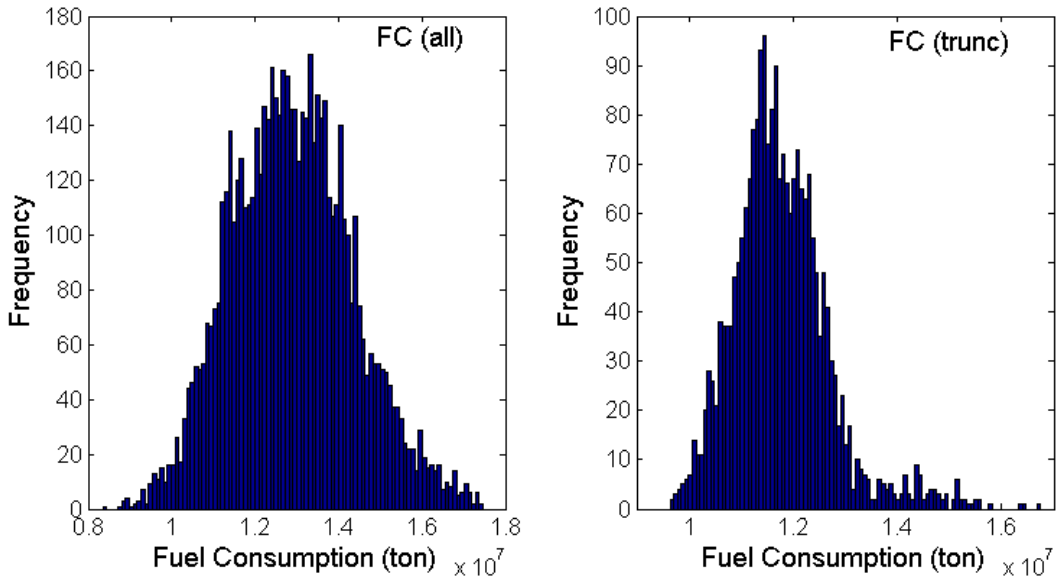


Figure 5-14: Uncertainty Analysis of the annual fuel consumption from road transport for Poland resulted from: (a) all simulations (left), (b) simulations within 11% of the officially reported fuel consumption.

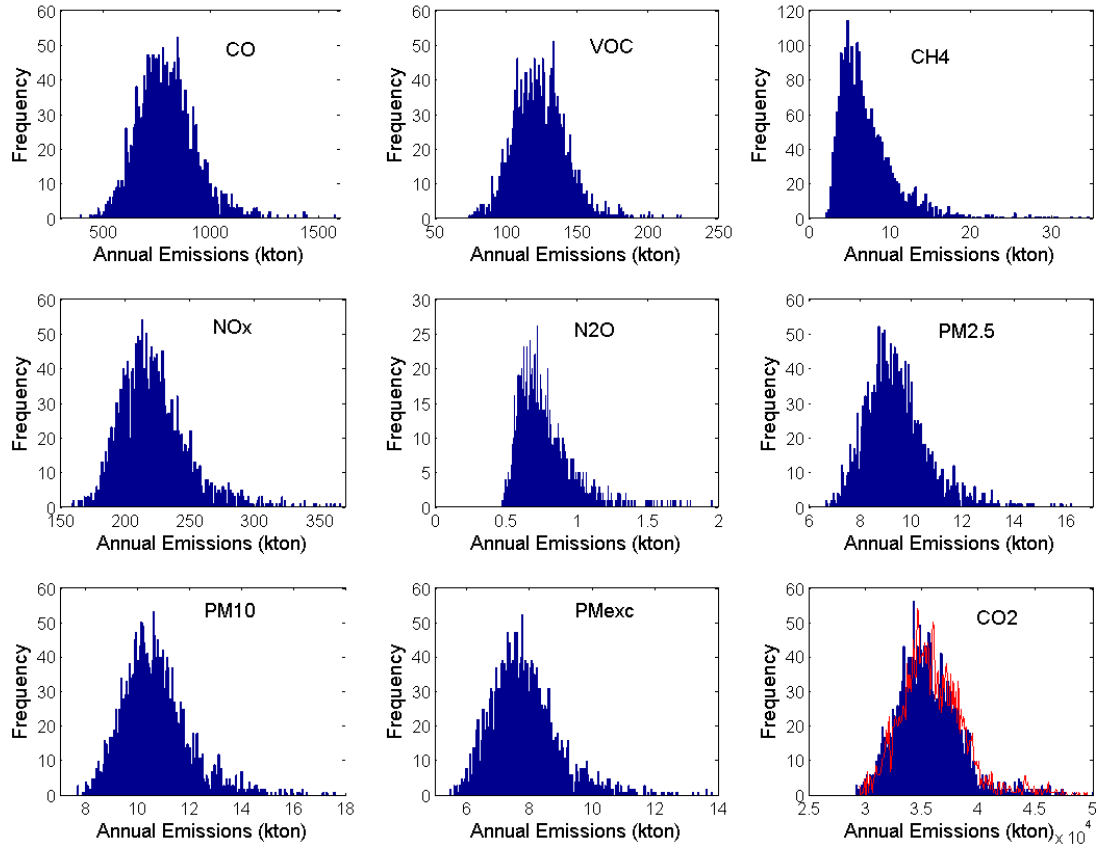


Figure 5-15: Uncertainty Analysis of the annual emissions from road transport for Poland (year 2005) for the simulations with predicted fuel consumption within a small range of the official value.

Table 5-13: Descriptive statistics of the histograms presented in Figure 5-15. Values are in ktonnes.

	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Mean	793	124	7.2	222	0.8	9.4	10.7	7.9	11,772	35,520	35,907
Median	783	123	6.3	218	0.7	9.2	10.5	7.7	11,666	35,199	35,569
St. Dev.	134	18	3.9	26	0.2	1.2	1.3	1.1	934	2,891	2,933
Variation (%)	17	15	54	12	24	13	12	14	8	8	8

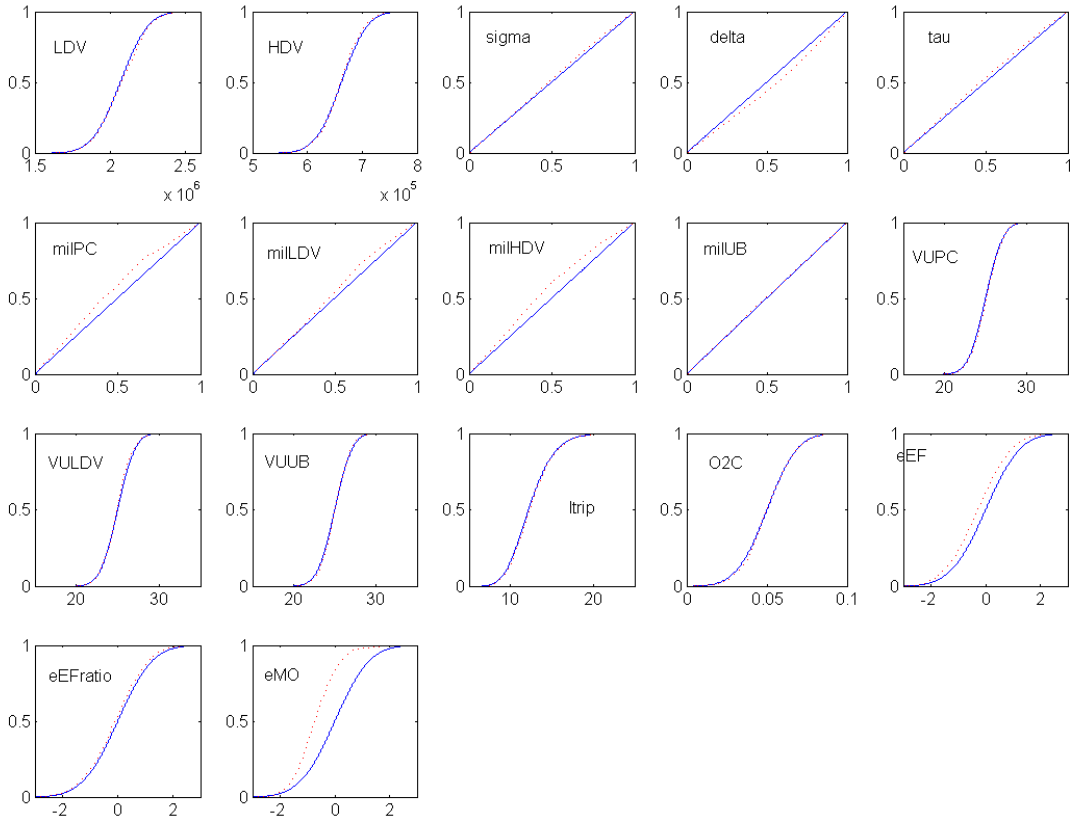


Figure 5-16: Cumulative distribution function of the uncertain inputs for the full (blue) and the filtered (red) Monte Carlo sample.

5.3 Comparison with an earlier study, discussion, recommendations

5.3.1 Italy

The improvements of the current study, in comparison to the previous one (Kioutsioukis et al., 2004) for Italy, include:

1. use of the updated version of the COPERT model (version 4)
2. incorporation of emission factors uncertainty for all sectors (not only PC & LDV) and all vehicle technologies through Euro 4 (Euro V for trucks)
3. application of a more realistic fleet breakdown model due to the detailed fleet inventory available
4. application of a detailed and more realistic mileage module based on the age distribution of the fleet (decomposition down to the technology level)
5. inclusion of more uncertain inputs: cold emission factors, hydrogen-to-carbon ratio, oxygen-to-carbon ratio, sulphur level in fuel, RVP.
6. validation of the output and input uncertainty

The previous study identified the emission factors, the fleet breakdown model and the mileage as the parameters that are influencing mostly the uncertainty of the emissions. In the current study, the use of updated information for the fleet breakdown model and the mileage resulted in a significant reduction of their uncertainty, lumping most of the emissions variability to the emission factors. The parameters ltrip and milHDV were also found important but explained only a small fraction of the output variance. The upper ceiling of explained variance for eEF, eEFratio, milHDV and ltrip is 76%, 61%, 12% and 8% respectively. Furthermore, the parameter that contributes most to the output uncertainty by means of higher order interactions is *ltrip*. In addition, N_2O and CH_4 demonstrate significant interactions of second and higher order while for NO_X, the higher order interactions are of minor importance.

To summarize, the contribution of the most influential variables to the emissions uncertainty (Italy) is (only values higher than 5% are presented):

a. hot emission factors [eEF]: NOx (76%), PM (72%), VOC (63%), CO (44%), FC (43%), CO_2 (40%), CH_4 (13%).
b. cold emission factors [eEFratio]: CH_4 (61%), N_2O (59%), CO (19%), FC (11%), CO_2 (10%), VOC (5%).
c. mileage of HDV [milHDV]: NOx (12%), PM (8-9%), FC (9%), CO_2 (9%).
d. mean trip length [ltrip]: VOC (8%), N_2O (6%), CO (5%).

5.3.2 Poland

For the case of Poland, the emission factors, the mileage parameter M0 and the average trip length influence mostly the variability of the emissions. The importance of the input factors was the same with Italy except for CO_2 and FC (eM0 dominant) and VOC and CO (four-five important factors). The upper ceiling of explained variance for eM0, eEFratio, eEF, and ltrip is 68%, 56%, 55% and 23% respectively. Furthermore, the parameter that contributes most to the output uncertainty by means of higher order interactions is *ltrip*. In addition, N_2O and CH_4 demonstrate significant interactions of second and higher order while for CO_2 and FC in particular, the higher order interactions are of minor importance.

To summarize, the contribution of the most influential variables to the emissions uncertainty (Poland) is (only values higher than 5% are presented):

a. mileage parameter [eM0]: FC (68%), CO_2 (67%), NOx (35%), VOC (27%), PM (25-31%), CO (22%), N_2O (14%).
b. cold emission factors [eEFratio]: CH_4 (56%), N_2O (48%), CO (15%), VOC (8%).
c. hot emission factors [eEF]: PM (52-55%), NOx (49%), VOC (20%), CO (15%), CH_4 (12%), N_2O(11%), FC (10%), CO_2 (9%).
d. mean trip length [ltrip]: VOC (23%), CO (20%).
e. Urban velocity of passenger cars [VUPC]: VOC (10%), CO (8%), N_2O (6%).
f. Oxygen to carbon ratio in fuel [O2C]: CO (8%)

5.3.3 Comparison between the two countries

Table 5-14 attempts a comparison between the coefficients of variation of Italy and Poland, after correcting the dataset for fuel consumption. A number of observations can be made on the basis of the comparison.

Table 5-14: Summary of coefficients of variation for Poland and Italy. Two cases are shown, one w/o correction for fuel consumption, and one with correction for fuel consumption

Case	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.5}$	PM_{10}	PM_{exh}	FC	CO_2	CO_{2e}
Italy w/o FC	30	18	44	15	33	13	13	14	7	7	7
Italy w. FC	19	12	34	10	26	9	8	9	3	4	4
Poland w/o FC	20	18	57	17	28	18	17	19	11	11	12
Poland w. FC	17	15	54	12	24	13	12	14	8	8	8

1. The most uncertain emissions calculations are for CH_4 and N_2O followed by CO. For CH_4 and N_2O it is either the hot or the cold emission factor variance which explains most of the uncertainty. However, in all cases, the initial mileage value considered for each technology class is a significant user-defined parameter, that explains much of the variance. Definition of mileage functions of age is therefore significant to reduce the uncertainty of those pollutants.
2. CO_2 is calculated with the least uncertainty, as it directly depends on fuel consumption. It is followed by NOx and PM2.5 which are calculated with a coefficient of variance of less than 15%. The reason is that these pollutants are dominated by diesel vehicles, with emission factors which are less variable than gasoline ones.
3. The correction for fuel consumption within plus/minus one standard deviation of the official value is very critical as it significantly reduces the uncertainty of the calculation in all pollutants. Therefore, good knowledge of the statistical fuel consumption (per fuel type) and comparison with the calculated fuel consumption is necessary to improve the quality of the inventories. Particular attention should be given when dealing with the black market of fuel and road transport fuel used for other uses (e.g. off-road applications). Both these can affect the actual fuel quantity used for road transportation. For example, in the case of Poland we had to reduce mileage significantly from our initial calculations to match the statistical fuel consumption. Part of this correction might have to do with a significant extent of not reported fuel quantities.

The relative level of variance in Poland appears lower than Italy in some pollutants (CO, N_2O), despite the allocation to vehicle technologies in Poland is not well known compared to Italy. This is for three reasons, (a) the stock of Poland is older than the Italian one and the variance of the emission factors of older technologies was smaller than new technologies, (b) the colder conditions in Poland make the cold-start of older technologies to be dominant, (c) partially this is an artefact of the method as the uncertainty was not possible to be quantified for the emission factors of some older vehicle technologies (e.g. see Table A.4). As a result, the uncertainty of the Polish calculation which is shifted to older technologies may have been

artificially reduced. This is also evident from the fact that the uncertainty in the emission factors explains 44% of the CO variance for Italy (Table 5-10) and only 15% of the variance in Poland (Table 5-12). Despite the relatively larger uncertainty in CH_4 and N_2O emissions, the uncertainty in total Greenhouse Gas emissions (CO_{2e}) is dominated by CO_2 emissions in both countries. Therefore, improving the emission factors of N_2O and CH_4 would not offer an improved calculation of total GHG emissions. This may change in the future as CO_2 emissions from road transportation decrease.

6 Updated Guidebook Chapter

Based on the work of this project, the relevant Guidebook chapter (section 4.5) is updated as follows.

6.1 Uncertainty assessment

6.1.1 Uncertainty of emission factors

The Tier 1 and Tier 2 emission factors have been calculated from detailed emission factors and activity data using the Tier 3 method. The Tier 1 and Tier 2 emission factors will therefore have a higher level of uncertainty than those for Tier 3.

The Tier 1 emission factors have been derived from the Tier 3 methodology using 1995 fleet data for the EU-15. The upper limits of the stated ranges in the emission factors correspond to a typical uncontrolled (pre-Euro) technology fleet, and the lower limit of the range corresponds to an average EU-15 fleet in 2005. The suitability of these emission factors for a particular country and year depends on the similarity between the national fleet and the assumptions used to derive the Tier 1 emission factors.

The Tier 2 emission factors have been calculated based on average driving and temperature conditions for the EU-15 in 2005. These emission factors assume average urban, rural and highway driving mileage shares and speeds for the EU-15. Again, the suitability of these emission factors depends on the similarity between the national driving conditions and the average of EU-15.

The Tier 3 emission factors have been derived from experimental (measured) data collected in a range of scientific programmes. The emission factors for old-technology passenger cars and light-duty vehicles were taken from earlier Copert/Corinair activities (Eggleston et al., 1989), whilst the emissions from more recent vehicles are calculated on the basis of data from the Artemis project. (Boulter and Barlow, 2005; Boulter and McCrae, 2007). The emission factors for mopeds and motorcycles are derived from a study on impact assessment of two-wheel emissions (Ntziachristos et al., 2004). Also, the emission factors of Euro 4 diesel passenger cars originate from an ad-hoc analysis of the Artemis dataset, enriched with more measurements (Ntziachristos et al., 2007).

Emission factors proposed for the Tier 3 methodology are functions of the vehicle type (emission standard, fuel, capacity or weight) and travelling speed. These have been deduced on the basis of a large number of experimental data, i.e. individual vehicles which have been measured over different laboratories in Europe and their emission performance has been summarized in a database. Emission factors per speed class are average emission levels of the individual vehicles. As a result, the uncertainty of the emission factor depends on the variability of the individual vehicle measurements for the particular speed class. This uncertainty has been characterized in the report of Kouridis et al. (2009) for each type of vehicle, pollutant, and speed classes. The tables are not repeated in this report due to their size. In general, the variability of the emission factors depends on the pollutant, the vehicle type, and the speed class considered. The standard deviations range from a few percentage units of the mean value to more than two times the emission factor value for some speed classes with limited emission information.

The distribution of individual values around the mean emission factor for a particular speed class is considered to follow a log-normal size distribution. This is because negative emission factor values are not possible and the log-normal distribution can only lead to positive values. Also, the lognormal distribution is highly skewed with a much higher probability allocated to values lower than the mean and a long tail that reaches high emission values. This very well represents the contribution of high and ultra emitters.

It follows that because of the large range of data utilised, and the processing involved, different limitations/restrictions are associated with the emission factors for different vehicle classes. However, a number of general rules should be followed when applying the methodology, and these are described below.

- The emission factors should only applied within the speed ranges given in the respective Tables. These ranges have been defined according to the availability of the experimental data. Extrapolation of the proposed formulae to lower or higher speeds is therefore not advisable.
- The proposed formulae should only be used with average travelling speed, and by no means can be they considered to be accurate when only 'spot' or constant speed values are available.
- The emission factors can be considered representative of emission performance with constant speed only at high velocities (> 100 km/h) when, in general, speed fluctuation is relatively low.
- The emission factors should not be applied in situations where the driving pattern differs substantially from the 'norm' (e.g. in areas with traffic calming).

6.1.2 Uncertainty of the emission inventory

In all cases of the application of the estimation methodologies, the results obtained are subject to uncertainties. Since the true emissions are unknown, it is impossible to calculate the accuracy of the estimates. However, one can obtain an estimate of their precision. This estimate also provides an impression of the accuracy, as long as the methodology used for estimating road traffic emissions represents a reliable image of reality. Errors when compiling an inventory may originate from two major sources:

- Systematic errors of the emission calculation methodology. These may include errors in the determination of the emission factors and other emission-related elements (e.g. cold start modelling, default values of metals, etc.)
- Errors in the input data provided by the inventory compiler. These refer to the activity data (vehicle parc, annual mileage, …), fuel properties, and environmental conditions.

The uncertainty of the emission factors has been discussed in section 6.1.1. This has been mathematically determined based on the available experimental data. The most significant data input errors include:

- Erroneous assumptions of vehicle usage. In many countries the actual vehicle usage is not known. In others, data from only a few statistical investigations are available. Most important are errors in total kilometres travelled, the decrease of mileage with age, and the average trip length.
- Erroneous estimates of the vehicle parc. The Tier 3 methodology proposes emission factors for 241 individual vehicle types. Detailed statistics for all the vehicle types are not available in all countries and sometimes they have to be assessed. For example, assessing the number of gasoline and diesel vehicles > 2.5 t which belong to the category 'light-duty vehicles' and those which belong to the category 'heavy-duty vehicles' involves much uncertainty, since the exact numbers are not available. The same may hold true for splitting a certain category into different age and technology groups, as the real numbers are again not always known.

Table 6-1 provides qualitative indications of the 'precision' which can be allocated to the calculation of the different pollutants

Table 6-1: Precision indicators of the emission estimate for the different vehicle categories and pollutants

Vehicle Category	**Pollutant**							
	NO$_x$	**CO**	**NMVOC**	**CH_4**	**PM**	**N_2O**	**NH_3**	**CO_2**
Gasoline passenger cars								
Without catalyst	A	A	A	A	-	C	C	A
With catalyst	A	A	A	A	-	A	A	A
Diesel passenger cars								
All technologies	A	A	A	A	A	B	B	A
LPG passenger cars	A	A	A	-	-	--	-	A
Without catalyst	A	A	A	A	D	C	C	A
With catalyst	D	D	D	D	D	D	D	A
2-stroke passenger cars	B	B	B	D	-	D	D	B
Light-duty vehicles								
Gasoline	B	B	B	C	-	B	B	A
Diesel	B	B	B	C	A	B	B	A
Heavy-duty vehicles								
Gasoline	D	D	D	D	-	D	D	D
Diesel	A	A	A	B	A	B	B	A
Two-wheel vehicles								
< 50 cm³	A	A	A	B	-	B	B	A
> 50 cm³ 2-stroke	A	A	A	B	-	B	B	A
> 50 cm³ 4-stroke	A	A	A	B	-	B	B	A
Cold-start emissions								
Pass. Cars conventional	B	B	B	-	-	-	-	B
Pass. Cars Euro 1 and later	B	B	B	A	-	-	-	A
Pass. Cars diesel Conv.	C	C	C	-	C	-	-	B
Pass. Cars diesel Euro I	A	A	A	A	A	-	-	A
Pass. Cars LPG	C	C	C	-	-	-	-	B
Gas. Light-duty vehicles	D	D	D	-	-	-	-	D
Diesel light-duty vehicles	D	D	D	-	D	-	-	D

Note:
A: Statistically significant emission factors based on sufficiently large set of measured and evaluated data; B: Emission factors non statistically significant based on a small set of measured re-evaluated data; C: Emission factors estimated on the basis of available literature; D: Emission factors estimated applying similarity considerations and/or extrapolation.

In order to assess the uncertainty of a complete emission inventory, Kouridis et al. (2009) performed an uncertainty characterisation study of the Tier 3 emission methodology, using the COPERT 4 emission model, which encompasses the methodology. Global sensitivity and uncertainty analysis was performed by characterising the uncertainty of the emission factors and the input data and by performing Monte Carlo simulations. The report of Kouridis et al. (2009) presents in detail the steps followed in this process. It is not the intention to repeat the methodology followed in that study. However, some key points and recommendations may prove useful in quantifying and, more significantly, reducing the uncertainty of road transport inventories.

The study quantified the uncertainty of the 2005 road transport inventory in two countries. These two countries were selected as examples of a country in the southern Europe with good knowledge of the stock and activity data and one country in northern Europe with poor statistics on the stock description. The difference in the territories selected (north vs south) affects the environmental conditions considered in each case.

For the compilation of the uncertainty and sensitivity analysis, the uncertainty of the input data was assessed based on available information and justified assumptions in case of no data. The uncertainty in the effect of vehicle age on the annual mileage driven and was assessed by collecting information from different countries. The variability in other input data (fuel properties, temperatures, trip distance distributions, etc.) was quantified based on justified assumptions. In total, the variability of 51 individual variables and parameters was assessed. Some of these parameters were multidimensional.

As a first step of the uncertainty characterisation methodology, a screening test was performed. This screened the significant variables and parameters and separated them from the non significant ones. 'Significant' in this case means that the expected variance of the particular variable affects the variance of the result by a significant amount. The significant variables in the case of the two countries are given in Table 6-2. It is evident from the table that there is a certain overlap of variables which are significant in both cases (hot emission factors, mean trip distance, …) but there are also other variables which are important only to each of the countries. For example, the country with good stock statistics has a very large number of two wheelers. As a result, even a small uncertainty in their mileage or total stock will significantly add to the uncertainty of the final result. This is not the case in the country with the weak stock statistics where two wheelers are relatively less. On the other hand, that country has a rough knowledge of the allocation of vehicles to different technologies and this shows up as a significant variable.

The 16 variables in the case of the country with good statistics can explain from 78% (CO_2) to 91% (VOC) of the total uncertainty. This means that the remaining 35 variables can only explain ~10% of the remaining uncertainty of the result. In the country with poor statistics, the 17 variables can explain from 77% (CH_4) to 96% (NOx) of the total uncertainty. This means that even by zeroing the uncertainty of the remaining 34 variables, the uncertainty in the case of that country would be reduced by less than 15% of its current value. Evidently, an effort should be made to reduce the uncertainty of the variables shown in Table 6-2. Reducing the uncertainty of other variables would have limited effect on the end result.

Some examples can be given to identify differences between the two countries examined:

In the country with good statistics, the uncertainty in NOx emissions is dominated by the uncertainty in the emission factor, which explains 76% of the total model uncertainty. This means that even if that country had perfect input data of zero uncertainty, the NOx calculation would not be more than 24% less uncertain that the current calculation. As a matter of fact, the variable that individually explains most of the uncertainty of the inventory is the hot emission factor, followed by either the heavy duty vehicles mileage or the cold-start overemission. Other variables that are affected by the user (motorcycle and moped mileage, ltrip, speeds, etc.) affect the total uncertainty by 10-25%. This means that this country is an example where the uncertainty in the calculation of total emissions depends mostly on the inherent uncertainty of the model (emission factors) rather than on the uncertainty of the data provided by the inventory compiler.

Table 6-2: Variables significant for the quantification of the total emission inventory uncertainty (not by order of significance)

Variable	**Significant for country with good stock statistics**	**Significant for country with weak stock statistics**
Hot emission factor	☑	☑
Cold overemission	☑	☑
Mean trip distance	☑	☑
Oxygen to carbon ratio in the fuel	☑	☑
Population of passenger cars	☑	-
Population of light duty vehicles	☑	☑
Population of heavy duty vehicles	☑	☑
Population of mopeds	☑	-
Annual mileage of passenger cars	☑	☑
Annual mileage of light duty vehicles	☑	☑
Annual mileage of heavy duty vehicles	☑	☑
Annual mileage of urban busses	-	☑
Annual mileage of mopeds/motorcycles	☑	-
Urban passenger car speed	☑	☑
Highway passenger car speed	☑	-
Rural passenger car speed	☑	-
Urban speed of light duty vehicles	☑	-
Urban share of passenger cars	☑	-
Urban speed of light duty vehicles	-	☑
Urban speed of busses	-	☑
Annual mileage of vehicles at the year of their registration	-	☑
The split between diesel and gasoline cars	-	☑
The split of vehicles to capacity and weight classes	-	☑
The allocation of vehicles to different technology classes	-	☑

In the case of the country with poor stock statistics, the situation is quite different. In this case, the uncertainty was estimated using all available information and building submodels to estimate the distribution of vehicles to classes and technologies. This is because the allocation of vehicles to different fuels and technology classes is hardly known in this case. The uncertainty of the emission factors still remains as one of the most important variables in estimating the total uncertainty. However, other variables, such as the initial vehicle mileage and the distribution of vehicles to different types are equally important. For example, the hot and cold-start emission factor uncertainty explains only ~30% of the total VOC and CO uncertainty. The rest is determined by values introduced by the inventory compiler. This is also true to a lesser extent also for the other pollutants. As a result, the quality of the inventory can significantly improve by collecting more detailed input data and by reducing their uncertainty.

The uncertainty analysis conducted in the study of Kouridis et al. (2009) also made possible to quantify the total uncertainty of the calculation. Table 6-3 shows the coefficient of variation (standard deviation over mean) for the different pollutants, for the two countries. Pollutant CO_{2e} is the equivalent CO_2 emission, when summing up all greenhouse gases (CO_2, CH_4, and N_2O) with their corresponding 100-year GHG equivalent. In fact, two different uncertainty ranges are given per country. The first one (w/o FC) is the uncertainty calculated without trying to respect the statistical fuel consumption. This means that the calculated fuel consumption can obtain any value, regardless of the statistical one. The second calculation is by filtering the calculation to keep only these runs that provide fuel consumption values which are within plus minus one standard deviation (7% for the country with good statistics, 11% for the country of poor statistics) of the statistical fuel consumption. This is a reasonable filtering, as an

inventory calculation which would lead to a very high or very low fuel consumption value would have been rejected as non valid.

Table 6-3: Summary of coefficients of variation Two cases are shown, one w/o correction for fuel consumption, and one with correction for fuel consumption.

Case	CO	VOC	CH_4	NO_x	N_2O	$PM_{2.}$	PM_{10}	PM_{ex}	FC	CO_2	CO_{2e}
Good statistics w/o FC	30	18	44	15	33	13	13	14	7	7	7
Good statistics w. FC	19	12	34	10	26	9	8	9	3	4	4
Poor statistics w/o FC	20	18	57	17	28	18	17	19	11	11	12
Poor statistics w. FC	17	15	54	12	24	13	12	14	8	8	8

The following remarks can be made by comparing the values in Table 6-3:

1. The most uncertain emissions calculations are for CH_4 and N_2O followed by CO. For CH_4 and N_2O it is either the hot or the cold emission factor variance which explains most of the uncertainty. However, in all cases, the initial mileage value considered for each technology class is a significant user-defined parameter, that explains much of the variance. Definition of mileage functions of age is therefore significant to reduce the uncertainty in the calculation of those pollutants.
2. CO_2 is calculated with the least uncertainty, as it directly depends on fuel consumption. It is followed by NO_x and $PM_{2.5}$ which are calculated with a coefficient of variance of less than 15%. The reason is that these pollutants are dominated by diesel vehicles, with emission factors which are less variable than gasoline ones.
3. The correction for fuel consumption within plus/minus one standard deviation of the official value is very critical as it significantly reduces the uncertainty of the calculation in all pollutants. Therefore, good knowledge of the statistical fuel consumption (per fuel type) and comparison with the calculated fuel consumption is necessary to improve the quality of the inventories. Particular attention should be given when dealing with the black market of fuel and road transport fuel used for other uses (e.g. off-road applications).
4. The relative level of variance in the country with poor stock statistics appears lower than the country with good stock statistics in some pollutants (CO, N_2O), despite the allocation to vehicle technologies in the former is not well known. This is for three reasons, (a) the stock in the country with poor statistics is older and the variance of the emission factors of older technologies was smaller than new technologies, (b) the colder conditions in the former country make the cold-start of older technologies to be dominant, (c) partially this is an artefact of the method as the variance of some emission factors of old technologies was not possible to quantify. As a result, the uncertainty of the old fleet calculation may have been artificially reduced.
5. Despite the relatively larger uncertainty in CH_4 and N_2O emissions, the uncertainty in total Greenhouse Gas emissions (CO_{2e}) is dominated by CO_2 emissions in both countries. Therefore, improving the emission

factors of N_2O and CH_4 would not offer an improved calculation of total GHG emissions. This may change in the future as CO_2 emissions from road transportation decrease.

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Annex I: Detailed tables of uncertainty parameters

Table A 1: Technology implementation matrix for Poland, Passenger Cars <1,4l.

Sector	Subsector	Technology	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Passenger Cars	Gasoline <1,4 l	PRE ECE	1	1																			0,73
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01			1	1	1	1	1	1													0,27
Passenger Cars	Gasoline <1,4 l	ECE 15/02									1	1	1										
Passenger Cars	Gasoline <1,4 l	ECE 15/03												1	1	1	1						
Passenger Cars	Gasoline <1,4 l	ECE 15/04																1	1	1	1	1	
Passenger Cars	Gasoline <1,4 l	Improved Conventional																					
Passenger Cars	Gasoline <1,4 l	Open Loop																					
Passenger Cars	Gasoline <1,4 l	PC Euro I - 91/441/EEC																					
Passenger Cars	Gasoline <1,4 l	PC Euro II - 94/12/EEC																					
Passenger Cars	Gasoline <1,4 l	PC Euro III - 98/69/EC Stage2000																					
Passenger Cars	Gasoline <1,4 l	PC Euro IV - 98/69/EC Stage2005																					
Passenger Cars	Gasoline <1,4 l	PC Euro V (post 2005)																					

Sector	Subsector	Technology	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Passenger Cars	Gasoline <1,4 l	PRE ECE	0,73	0,56																			
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	0,27	0,22	0,5	0,25	0,26																
Passenger Cars	Gasoline <1,4 l	ECE 15/02		0,13	0,3	0,15	0,15																
Passenger Cars	Gasoline <1,4 l	ECE 15/03		0,9	0,2	0,1	0,1	0,17	0,1	0,7	0,7	0,7	0,7	0,6									
Passenger Cars	Gasoline <1,4 l	ECE 15/04				0,5	0,49	0,83	0,49	0,36	0,33	0,36	0,32	0,31									
Passenger Cars	Gasoline <1,4 l	Improved Conventional																					
Passenger Cars	Gasoline <1,4 l	Open Loop																					
Passenger Cars	Gasoline <1,4 l	PC Euro I - 91/441/EEC							0,41	0,29	0,3	0,29	0,3	0,12	0,3								
Passenger Cars	Gasoline <1,4 l	PC Euro II - 94/12/EEC								0,28	0,3	0,28	0,31	0,51	0,33								
Passenger Cars	Gasoline <1,4 l	PC Euro III - 98/69/EC Stage2000													0,37	1	1	1					
Passenger Cars	Gasoline <1,4 l	PC Euro IV - 98/69/EC Stage2005																	1	1	1	1	
Passenger Cars	Gasoline <1,4 l	PC Euro V (post 2005)																					1

Table A 2: Pairs of Beta and Tau used for the parameterization of the stock in Poland

Index	Passenger Cars													
	Gasoline <1,4 l		Gasoline 1,4 - 2,0 l		Gasoline >2,0 l		Diesel <1,4 l		Diesel 1.4-2.0l		Diesel >2,0 l		car - LPG	
	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau
1	1,2	27,4	1,4	21,7	1,0	11,3	1,0	11,3	1,0	11,3	3,6	14,6	1,0	5,3
2	1,2	28,4	1,5	20,1	1,0	11,5	1,0	11,5	1,0	11,5	3,8	14,8	1,1	4,8
3	1,2	29,4	1,5	20,7	1,0	11,7	1,0	11,7	1,0	11,7	4,0	14,3	1,1	5,5
4	1,3	24,5	1,5	21,3	1,0	11,9	1,0	11,9	1,0	11,9	4,1	15,0	1,2	5,1
5	1,3	25,5	1,6	19,0	1,0	12,1	1,0	12,1	1,0	12,1	4,2	15,6	1,2	5,8
6	1,3	26,5	1,6	19,6	1,0	12,3	1,0	12,3	1,0	12,3	4,4	14,0	1,3	5,4
7	1,3	27,5	1,6	20,2	1,0	12,5	1,0	12,5	1,0	12,5	4,5	14,1	1,3	6,1
8	1,3	28,5	1,6	20,8	1,0	12,7	1,0	12,7	1,0	12,7	4,6	14,1	1,4	5,8
9	1,3	29,5	1,7	17,9	1,0	12,9	1,0	12,9	1,0	12,9	4,7	14,0	1,5	5,5
10	1,4	22,8	1,7	18,5	1,0	13,1	1,0	13,1	1,0	13,1	4,7	16,3	1,5	6,2
11	1,4	23,8	1,7	19,1	1,0	13,3	1,0	13,3	1,0	13,3	4,8	16,1	1,6	6,0
12	1,4	24,8	1,7	19,7	1,0	13,5	1,0	13,5	1,0	13,5	4,9	15,8	1,7	5,8
13	1,4	25,8	1,7	20,3	1,0	13,7	1,0	13,7	1,0	13,7	5,0	15,4	1,7	6,5
14	1,4	26,8	1,7	20,9	1,0	13,9	1,0	13,9	1,0	13,9	5,1	14,9	1,8	6,4
15	1,4	27,8	1,8	17,4	1,0	14,1	1,0	14,1	1,0	14,1	5,2	14,3	1,9	6,3
16	1,4	28,8	1,8	18,0	1,0	14,3	1,0	14,3	1,0	14,3	5,2	16,6	2,0	6,2
17	1,4	29,8	1,8	18,6	1,0	14,5	1,0	14,5	1,0	14,5	5,3	16,0	2,0	6,9
18	1,5	21,6	1,8	19,2	1,0	14,7	1,0	14,7	1,0	14,7	5,4	15,4	2,1	6,9
19	1,5	22,6	1,8	19,8	1,0	14,9	1,0	14,9	1,0	14,9	5,5	14,9	2,2	6,9
20	1,5	23,6	1,8	20,4	1,0	15,1	1,0	15,1	1,0	15,1	5,6	14,4	2,3	6,9
21	1,5	24,6	1,8	21,0	1,0	15,3	1,0	15,3	1,0	15,3	5,6	16,7	2,4	6,9
22	1,5	25,6	1,9	17,1	1,0	15,5	1,0	15,5	1,0	15,5	5,7	16,3	2,5	7,0
23	1,5	26,6	1,9	17,7	1,1	10,8	1,1	10,8	1,1	10,8	5,8	16,0	2,6	7,1
24	1,5	27,6	1,9	18,3	1,1	11,0	1,1	11,0	1,1	11,0	5,9	15,7	2,7	7,2
25	1,5	28,6	1,9	18,9	1,1	11,2	1,1	11,2	1,1	11,2	6,0	15,5	2,8	7,3
26	1,6	20,2	1,9	19,5	1,1	11,4	1,1	11,4	1,1	11,4	6,1	15,2	2,9	7,4
27	1,6	21,2	1,9	20,1	1,1	11,6	1,1	11,6	1,1	11,6	6,2	15,0	3,0	7,5
28	1,6	22,2	1,9	20,7	1,1	11,8	1,1	11,8	1,1	11,8	6,3	14,9	3,1	7,7
29	1,6	23,2	2,0	16,5	1,1	12,0	1,1	12,0	1,1	12,0	6,3	17,2	3,2	7,9
30	1,6	24,2	2,0	17,1	1,1	12,2	1,1	12,2	1,1	12,2	6,4	17,0	3,3	8,1
31	1,6	25,2	2,0	17,7	1,1	12,4	1,1	12,4	1,1	12,4	6,5	16,9	3,4	8,3
32	1,6	26,2	2,0	18,3	1,1	12,6	1,1	12,6	1,1	12,6	6,6	16,9	3,6	8,0
33	1,6	27,2	2,0	18,9	1,1	12,8	1,1	12,8	1,1	12,8	6,7	16,9	3,7	8,2
34	1,7	19,1	2,0	19,5	1,1	13,0	1,1	13,0	1,1	13,0	6,8	16,9	3,8	8,4
35	1,7	20,1	2,0	20,1	1,1	13,2	1,1	13,2	1,1	13,2	6,9	16,9	3,9	8,6
36	1,7	21,1	2,0	20,7	1,1	13,4	1,1	13,4	1,1	13,4	7,0	17,0	4,0	8,8
37	1,7	22,1	2,1	16,4	1,1	13,6	1,1	13,6	1,1	13,6	7,1	17,0	4,1	9,0
38	1,7	23,1	2,1	17,0	1,1	13,8	1,1	13,8	1,1	13,8	7,2	17,1	4,3	8,9
39	1,7	24,1	2,1	17,6	1,1	14,0	1,1	14,0	1,1	14,0	7,3	17,2	4,4	9,2
40	1,7	25,1	2,1	18,2	1,1	14,2	1,1	14,2	1,1	14,2	7,4	17,4	4,6	9,1
41	1,7	26,1	2,1	18,8	1,1	14,4	1,1	14,4	1,1	14,4	7,5	17,5	4,7	9,4
42	1,7	27,1	2,1	19,4	1,2	10,7	1,2	10,7	1,2	10,7	7,6	17,7	4,8	9,7
43	1,8	19,7	2,1	20,0	1,2	10,9	1,2	10,9	1,2	10,9	7,7	17,9	5,0	9,6
44	1,8	20,7	2,1	20,6	1,2	11,1	1,2	11,1	1,2	11,1	7,9	16,1	5,1	9,9
45	1,8	21,7	2,2	16,5	1,2	11,3	1,2	11,3	1,2	11,3	8,0	16,3	5,3	9,8
46	1,8	22,7	2,2	17,1	1,2	11,5	1,2	11,5	1,2	11,5	8,1	16,6	5,4	10,1
47	1,8	23,7	2,2	17,7	1,2	11,7	1,2	11,7	1,2	11,7	8,2	16,9	5,5	10,4
48	1,8	24,7	2,2	18,3	1,2	11,9	1,2	11,9	1,2	11,9	8,3	17,2	5,7	10,3
49	1,8	25,7	2,2	18,9	1,2	12,1	1,2	12,1	1,2	12,1	8,4	17,6	5,8	10,6
50	1,8	26,7	2,2	19,5	1,2	12,3	1,2	12,3	1,2	12,3	8,5	18,0	6,0	10,5
51	1,9	19,9	2,2	20,1	1,2	12,5	1,2	12,5	1,2	12,5	8,6	18,3	6,1	10,9
52	1,9	20,4	2,3	18,5	1,1	11,7	1,1	11,7	1,1	11,7	8,6	17,2	5,7	10,6
53	1,9	21,4	2,3	19,1	1,1	11,9	1,1	11,9	1,1	11,9	8,7	17,6	5,9	10,5
54	1,9	22,4	2,3	19,7	1,1	12,1	1,1	12,1	1,1	12,1	8,8	18,0	6,0	10,8
55	1,9	23,4	2,3	20,3	1,1	12,3	1,1	12,3	1,1	12,3	8,9	18,4	6,2	10,9
56	1,9	24,4	2,4	16,6	1,1	12,5	1,1	12,5	1,1	12,5	9,0	18,8	6,4	11,0
57	1,9	25,4	2,4	17,2	1,1	12,7	1,1	12,7	1,1	12,7	9,2	17,4	6,5	11,4
58	2,0	19,1	2,4	17,8	1,1	12,9	1,1	12,9	1,1	12,9	9,3	17,8	6,7	11,5
59	2,0	20,1	2,4	18,4	1,1	13,1	1,1	13,1	1,1	13,1	9,4	18,3	6,9	11,6
60	2,0	21,1	2,4	19,0	1,1	13,3	1,1	13,3	1,1	13,3	9,5	18,8	7,1	11,7
61	2,0	22,1	2,4	19,6	1,1	13,5	1,1	13,5	1,1	13,5	9,6	19,3	7,2	12,1
62	2,0	23,1	2,4	20,2	1,1	13,7	1,1	13,7	1,1	13,7	9,8	18,1	7,4	12,2
63	2,0	24,1	2,5	16,6	1,1	13,9	1,1	13,9	1,1	13,9	9,9	18,7	7,6	12,3
64	2,0	25,1	2,5	17,2	1,1	14,1	1,1	14,1	1,1	14,1	10,0	19,2	7,8	12,4
65	2,1	19,2	2,5	17,8	1,1	14,3	1,1	14,3	1,1	14,3	10,1	19,7	7,9	12,8
66	2,1	20,2	2,5	18,4	1,1	14,5	1,1	14,5	1,1	14,5	10,3	18,5	8,1	12,9
67	2,1	21,2	2,5	19,0	1,2	10,8	1,2	10,8	1,2	10,8	10,4	19,1	8,3	13,0
68	2,1	22,2	2,5	19,6	1,2	11,0	1,2	11,0	1,2	11,0	10,5	19,7	8,5	13,1
69	2,1	23,2	2,5	20,2	1,2	11,2	1,2	11,2	1,2	11,2	10,7	18,6	8,6	13,5
70	2,1	24,2	2,6	16,9	1,2	11,4	1,2	11,4	1,2	11,4	10,8	19,3	8,8	13,6
71	2,1	25,2	2,6	17,5	1,2	11,6	1,2	11,6	1,2	11,6	10,9	19,9	9,0	13,7
72	2,2	19,7	2,6	18,1	1,2	11,8	1,2	11,8	1,2	11,8	11,1	18,8	9,2	13,8
73	2,2	20,7	2,6	18,7	1,2	12,0	1,2	12,0	1,2	12,0	11,2	19,4	9,3	14,2
74	2,2	21,7	2,6	19,3	1,2	12,2	1,2	12,2	1,2	12,2	11,3	20,1	9,5	14,3
75	2,2	22,7	2,6	19,9	1,2	12,4	1,2	12,4	1,2	12,4	11,5	19,2	9,7	14,4
76	2,2	23,7	2,6	20,5	1,2	12,6	1,2	12,6	1,2	12,6	11,6	19,9	9,9	14,5
77	2,2	24,7	2,7	17,3	1,2	12,8	1,2	12,8	1,2	12,8	11,7	20,6	10,0	14,9
78	2,3	19,6	2,7	17,9	1,2	13,0	1,2	13,0	1,2	13,0	11,9	19,7	10,2	15,0
79	2,3	20,6	2,7	18,5	1,2	13,2	1,2	13,2	1,2	13,2	12,0	20,5	10,4	15,1
80	2,3	21,6	2,7	19,1	1,2	13,4	1,2	13,4	1,2	13,4	12,1	21,2	10,6	15,2
81	2,3	22,6	2,7	19,7	1,2	13,6	1,2	13,6	1,2	13,6	12,3	20,3	10,7	15,6
82	2,3	23,6	2,8	17,0	1,3	11,1	1,3	11,1	1,3	11,1	12,4	21,0	10,9	15,7
83	2,4	19,3	2,8	17,6	1,3	11,3	1,3	11,3	1,3	11,3	12,5	21,7	11,1	15,8
84	2,4	20,3	2,8	18,2	1,3	11,5	1,3	11,5	1,3	11,5	12,7	20,9	11,3	16,1
85	2,4	21,3	2,8	18,8	1,3	11,7	1,3	11,7	1,3	11,7	12,8	21,7	11,5	16,4
86	2,4	22,3	2,8	19,4	1,3	11,9	1,3	11,9	1,3	11,9	13,0	21,0	11,8	16,5
87	2,4	23,3	2,9	17,3	1,3	12,1	1,3	12,1	1,3	12,1	13,1	21,8	12,0	16,8
88	2,5	19,9	2,9	17,9	1,3	12,3	1,3	12,3	1,3	12,3	13,3	21,1	12,2	17,1
89	2,5	20,9	2,9	18,5	1,3	12,5	1,3	12,5	1,3	12,5	13,4	21,9	12,5	17,2
90	2,5	21,9	2,9	19,1	1,3	12,7	1,3	12,7	1,3	12,7	13,6	21,2	12,7	17,5
91	2,6	19,4	3,0	17,5	1,3	12,9	1,3	12,9	1,3	12,9	13,7	22,0	12,9	17,8
92	2,6	20,4	3,0	18,1	1,3	13,1	1,3	13,1	1,3	13,1	13,8	22,8	13,2	17,9
93	2,6	21,4	3,0	18,7	1,4	11,6	1,4	11,6	1,4	11,6	14,0	22,1	13,4	18,2
94	2,7	19,5	3,1	17,5	1,4	11,8	1,4	11,8	1,4	11,8	14,1	22,9	13,6	18,5
95	2,7	20,5	3,1	18,1	1,4	12,0	1,4	12,0	1,4	12,0	14,3	22,2	13,9	18,6
96	2,7	21,5	3,1	18,7	1,4	12,2	1,4	12,2	1,4	12,2	14,4	23,1	14,1	18,9
97	2,8	20,3	3,2	17,9	1,4	12,4	1,4	12,4	1,4	12,4	14,6	22,6	14,3	19,2
98	2,9	19,6	3,3	17,5	1,4	12,6	1,4	12,6	1,4	12,6	14,7	23,5	14,6	19,3
99	3,0	19,5	3,3	18,1	1,5	12,0	1,5	12,0	1,5	12,0	14,9	23,0	14,8	19,6
100	3,1	19,8	3,5	17,8	1,5	12,2	1,5	12,2	1,5	12,2	15,0	23,9	15,0	19,9

Table A 2: Pairs of Beta and Tau used for the parameterization of the stock in Poland (cont.)

Index	Light Duty Vehicles							
	LDV - Gasoline		LDV - Diesel		Van - Gasoline		Van - Diesel	
	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau
1	1,7	20,6	1,7	17,0	1,7	20,6	1,7	17,0
2	1,7	21,4	1,7	17,5	1,7	21,4	1,7	17,5
3	1,8	20,0	1,7	18,0	1,8	20,0	1,7	18,0
4	1,8	20,8	1,8	16,7	1,8	20,8	1,8	16,7
5	1,9	18,8	1,8	17,2	1,9	18,8	1,8	17,2
6	1,9	19,6	1,8	17,7	1,9	19,6	1,8	17,7
7	1,9	20,4	1,9	15,9	1,9	20,4	1,9	15,9
8	2,0	17,9	1,9	16,4	2,0	17,9	1,9	16,4
9	2,0	18,7	1,9	16,9	2,0	18,7	1,9	16,9
10	2,0	19,5	1,9	17,4	2,0	19,5	1,9	17,4
11	2,0	20,3	1,9	17,9	2,0	20,3	1,9	17,9
12	2,1	17,3	2,0	15,6	2,1	17,3	2,0	15,6
13	2,1	18,1	2,0	16,1	2,1	18,1	2,0	16,1
14	2,1	18,9	2,0	16,6	2,1	18,9	2,0	16,6
15	2,1	19,7	2,0	17,1	2,1	19,7	2,0	17,1
16	2,1	20,5	2,0	17,6	2,1	20,5	2,0	17,6
17	2,2	17,2	2,0	18,1	2,2	17,2	2,0	18,1
18	2,2	18,0	2,1	15,5	2,2	18,0	2,1	15,5
19	2,2	18,8	2,1	16,0	2,2	18,8	2,1	16,0
20	2,2	19,6	2,1	16,5	2,2	19,6	2,1	16,5
21	2,2	20,4	2,1	17,0	2,2	20,4	2,1	17,0
22	2,3	16,8	2,1	17,5	2,3	16,8	2,1	17,5
23	2,3	17,6	2,1	18,0	2,3	17,6	2,1	18,0
24	2,3	18,4	2,2	15,1	2,3	18,4	2,2	15,1
25	2,3	19,2	2,2	15,6	2,3	19,2	2,2	15,6
26	2,3	20,0	2,2	16,1	2,3	20,0	2,2	16,1
27	2,3	20,8	2,2	16,6	2,3	20,8	2,2	16,6
28	2,4	17,2	2,2	17,1	2,4	17,2	2,2	17,1
29	2,4	18,0	2,2	17,6	2,4	18,0	2,2	17,6
30	2,4	18,8	2,2	18,1	2,4	18,8	2,2	18,1
31	2,4	19,6	2,3	14,8	2,4	19,6	2,3	14,8
32	2,4	20,4	2,3	15,3	2,4	20,4	2,3	15,3
33	2,5	17,1	2,3	15,8	2,5	17,1	2,3	15,8
34	2,5	17,9	2,3	16,3	2,5	17,9	2,3	16,3
35	2,5	18,7	2,3	16,8	2,5	18,7	2,3	16,8
36	2,5	19,5	2,3	17,3	2,5	19,5	2,3	17,3
37	2,5	20,3	2,3	17,8	2,5	20,3	2,3	17,8
38	2,6	17,1	2,3	18,3	2,6	17,1	2,3	18,3
39	2,6	17,9	2,4	15,0	2,6	17,9	2,4	15,0
40	2,6	18,7	2,4	15,5	2,6	18,7	2,4	15,5
41	2,6	19,5	2,4	16,0	2,6	19,5	2,4	16,0
42	2,6	20,3	2,4	16,5	2,6	20,3	2,4	16,5
43	2,7	17,2	2,4	17,0	2,7	17,2	2,4	17,0
44	2,7	18,0	2,4	17,5	2,7	18,0	2,4	17,5
45	2,7	18,8	2,4	18,0	2,7	18,8	2,4	18,0
46	2,7	19,6	2,5	14,9	2,7	19,6	2,5	14,9
47	2,7	20,4	2,5	15,4	2,7	20,4	2,5	15,4
48	2,8	17,4	2,5	15,9	2,8	17,4	2,5	15,9
49	2,8	18,2	2,5	16,4	2,8	18,2	2,5	16,4
50	2,8	19,0	2,5	16,9	2,8	19,0	2,5	16,9
51	2,8	19,8	2,5	17,4	2,8	19,8	2,5	17,4
52	2,8	17,5	2,4	18,3	2,8	17,5	2,4	18,3
53	2,8	18,3	2,5	15,2	2,8	18,3	2,5	15,2
54	2,8	19,1	2,5	15,7	2,8	19,1	2,5	15,7
55	2,8	19,9	2,5	16,2	2,8	19,9	2,5	16,2
56	2,8	20,7	2,5	16,7	2,8	20,7	2,5	16,7
57	2,9	17,9	2,5	17,2	2,9	17,9	2,5	17,2
58	2,9	18,7	2,5	17,7	2,9	18,7	2,5	17,7
59	2,9	19,5	2,5	18,2	2,9	19,5	2,5	18,2
60	2,9	20,3	2,6	15,2	2,9	20,3	2,6	15,2
61	3,0	17,6	2,6	15,7	3,0	17,6	2,6	15,7
62	3,0	18,4	2,6	16,2	3,0	18,4	2,6	16,2
63	3,0	19,2	2,6	16,7	3,0	19,2	2,6	16,7
64	3,0	20,0	2,6	17,2	3,0	20,0	2,6	17,2
65	3,1	17,4	2,6	17,7	3,1	17,4	2,6	17,7
66	3,1	18,2	2,6	18,2	3,1	18,2	2,6	18,2
67	3,1	19,0	2,7	15,3	3,1	19,0	2,7	15,3
68	3,1	19,8	2,7	15,8	3,1	19,8	2,7	15,8
69	3,1	20,6	2,7	16,3	3,1	20,6	2,7	16,3
70	3,2	18,1	2,7	16,8	3,2	18,1	2,7	16,8
71	3,2	18,9	2,7	17,3	3,2	18,9	2,7	17,3
72	3,2	19,7	2,7	17,8	3,2	19,7	2,7	17,8
73	3,2	20,5	2,7	18,3	3,2	20,5	2,7	18,3
74	3,3	18,1	2,8	15,5	3,3	18,1	2,8	15,5
75	3,3	18,9	2,8	16,0	3,3	18,9	2,8	16,0
76	3,3	19,7	2,8	16,5	3,3	19,7	2,8	16,5
77	3,3	20,5	2,8	17,0	3,3	20,5	2,8	17,0
78	3,4	18,2	2,8	17,5	3,4	18,2	2,8	17,5
79	3,4	19,0	2,8	18,0	3,4	19,0	2,8	18,0
80	3,4	19,8	2,9	15,6	3,4	19,8	2,9	15,6
81	3,4	20,6	2,9	16,1	3,4	20,6	2,9	16,1
82	3,5	18,4	2,9	16,6	3,5	18,4	2,9	16,6
83	3,5	19,2	2,9	17,1	3,5	19,2	2,9	17,1
84	3,5	20,0	2,9	17,6	3,5	20,0	2,9	17,6
85	3,6	18,0	3,0	15,7	3,6	18,0	3,0	15,7
86	3,6	18,8	3,0	16,2	3,6	18,8	3,0	16,2
87	3,6	19,6	3,0	16,7	3,6	19,6	3,0	16,7
88	3,6	20,4	3,0	17,2	3,6	20,4	3,0	17,2
89	3,7	18,8	3,0	17,7	3,7	18,8	3,0	17,7
90	3,7	19,6	3,1	16,2	3,7	19,6	3,1	16,2
91	3,8	18,3	3,1	16,7	3,8	18,3	3,1	16,7
92	3,8	19,1	3,1	17,2	3,8	19,1	3,1	17,2
93	3,8	19,9	3,2	16,1	3,8	19,9	3,2	16,1
94	3,9	18,9	3,2	16,6	3,9	18,9	3,2	16,6
95	3,9	19,7	3,2	17,1	3,9	19,7	3,2	17,1
96	4,0	19,0	3,3	16,4	4,0	19,0	3,3	16,4
97	4,1	18,7	3,3	16,9	4,1	18,7	3,3	16,9
98	4,1	19,5	3,4	16,5	4,1	19,5	3,4	16,5
99	4,3	18,8	3,5	16,4	4,3	18,8	3,5	16,4
100	4,5	19,0	3,6	16,6	4,5	19,0	3,6	16,6

Table A 2: Pairs of Beta and Tau used for the parameterization of the stock in Poland (cont.)

Index	Heavy Duty Vehicles								Buses			
	>32t - diesel		16-32t - diesel		3.5-7.5t - diesel		7.5-16t - diesel		Urban Buses Midi <=15 t		Coaches Standard <=18 t	
	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau
1	1,0	20,6	1,0	22,0	1,0	23,6	1,0	22,7	1,0	19,6	1,0	19,6
2	1,0	21,0	1,0	22,4	1,0	24,0	1,0	23,1	1,0	20,0	1,0	20,0
3	1,0	21,4	1,0	22,8	1,0	24,4	1,0	23,5	1,0	20,4	1,0	20,4
4	1,0	21,8	1,0	23,2	1,0	24,8	1,0	23,9	1,0	20,8	1,0	20,8
5	1,0	22,2	1,0	23,6	1,0	25,2	1,0	24,3	1,0	21,2	1,0	21,2
6	1,0	22,6	1,0	24,0	1,0	25,6	1,0	24,7	1,0	21,6	1,0	21,6
7	1,0	23,0	1,0	24,4	1,0	26,0	1,0	25,1	1,0	22,0	1,0	22,0
8	1,0	23,4	1,0	24,8	1,0	26,4	1,0	25,5	1,0	22,4	1,0	22,4
9	1,0	23,8	1,0	25,2	1,0	26,8	1,0	25,9	1,0	22,8	1,0	22,8
10	1,0	24,2	1,0	25,6	1,0	27,2	1,0	26,3	1,0	23,2	1,0	23,2
11	1,0	24,6	1,0	26,0	1,0	27,6	1,0	26,7	1,0	23,6	1,0	23,6
12	1,0	25,0	1,0	26,4	1,0	28,0	1,0	27,1	1,0	24,0	1,0	24,0
13	1,0	25,4	1,0	26,8	1,0	28,4	1,0	27,5	1,0	24,4	1,0	24,4
14	1,0	25,8	1,0	27,2	1,0	28,8	1,0	27,9	1,0	24,8	1,0	24,8
15	1,0	26,2	1,0	27,6	1,0	29,2	1,0	28,3	1,0	25,2	1,0	25,2
16	1,0	26,6	1,0	28,0	1,0	29,6	1,0	28,7	1,0	25,6	1,0	25,6
17	1,0	27,0	1,0	28,4	1,1	22,1	1,0	29,1	1,0	26,0	1,0	26,0
18	1,0	27,4	1,0	28,8	1,1	22,5	1,0	29,5	1,0	26,4	1,0	26,4
19	1,0	27,8	1,0	29,2	1,1	22,9	1,0	29,9	1,0	26,8	1,0	26,8
20	1,0	28,2	1,0	29,6	1,1	23,3	1,1	21,5	1,0	27,2	1,0	27,2
21	1,0	28,6	1,1	20,6	1,1	23,7	1,1	21,9	1,0	27,6	1,0	27,6
22	1,0	29,0	1,1	21,0	1,1	24,1	1,1	22,3	1,0	28,0	1,0	28,0
23	1,0	29,4	1,1	21,4	1,1	24,5	1,1	22,7	1,0	28,4	1,0	28,4
24	1,0	29,8	1,1	21,8	1,1	24,9	1,1	23,1	1,0	28,8	1,0	28,8
25	1,1	19,4	1,1	22,2	1,1	25,3	1,1	23,5	1,0	29,2	1,0	29,2
26	1,1	19,8	1,1	22,6	1,1	25,7	1,1	23,9	1,0	29,6	1,0	29,6
27	1,1	20,2	1,1	23,0	1,1	26,1	1,1	24,3	1,1	18,3	1,1	18,3
28	1,1	20,6	1,1	23,4	1,1	26,5	1,1	24,7	1,1	18,7	1,1	18,7
29	1,1	21,0	1,1	23,8	1,1	26,9	1,1	25,1	1,1	19,1	1,1	19,1
30	1,1	21,4	1,1	24,2	1,1	27,3	1,1	25,5	1,1	19,5	1,1	19,5
31	1,1	21,8	1,1	24,6	1,1	27,7	1,1	25,9	1,1	19,9	1,1	19,9
32	1,1	22,2	1,1	25,0	1,1	28,1	1,1	26,3	1,1	20,3	1,1	20,3
33	1,1	22,6	1,1	25,4	1,1	28,5	1,1	26,7	1,1	20,7	1,1	20,7
34	1,1	23,0	1,1	25,8	1,1	28,9	1,1	27,1	1,1	21,1	1,1	21,1
35	1,1	23,4	1,1	26,2	1,1	29,3	1,1	27,5	1,1	21,5	1,1	21,5
36	1,1	23,8	1,1	26,6	1,1	29,7	1,1	27,9	1,1	21,9	1,1	21,9
37	1,1	24,2	1,1	27,0	1,2	21,8	1,1	28,3	1,1	22,3	1,1	22,3
38	1,1	24,6	1,1	27,4	1,2	22,2	1,1	28,7	1,1	22,7	1,1	22,7
39	1,1	25,0	1,1	27,8	1,2	22,6	1,1	29,1	1,1	23,1	1,1	23,1
40	1,1	25,4	1,1	28,2	1,2	23,0	1,1	29,5	1,1	23,5	1,1	23,5
41	1,1	25,8	1,1	28,6	1,2	23,4	1,1	29,9	1,1	23,9	1,1	23,9
42	1,1	26,2	1,1	29,0	1,2	23,8	1,2	21,2	1,1	24,3	1,1	24,3
43	1,1	26,6	1,1	29,4	1,2	24,2	1,2	21,6	1,1	24,7	1,1	24,7
44	1,1	27,0	1,1	29,8	1,2	24,6	1,2	22,0	1,1	25,1	1,1	25,1
45	1,1	27,4	1,2	20,5	1,2	25,0	1,2	22,4	1,1	25,5	1,1	25,5
46	1,1	27,8	1,2	20,9	1,2	25,4	1,2	22,8	1,1	25,9	1,1	25,9
47	1,1	28,2	1,2	21,3	1,2	25,8	1,2	23,2	1,1	26,3	1,1	26,3
48	1,1	28,6	1,2	21,7	1,2	26,2	1,2	23,6	1,1	26,7	1,1	26,7
49	1,1	29,0	1,2	22,1	1,2	26,6	1,2	24,0	1,1	27,1	1,1	27,1
50	1,1	29,4	1,2	22,5	1,2	27,0	1,2	24,4	1,1	27,5	1,1	27,5
51	1,1	29,8	1,2	22,9	1,2	27,4	1,2	24,8	1,1	27,9	1,1	27,9
52	1,2	20,7	1,2	26,3	1,3	22,5	1,2	28,5	1,1	27,5	1,1	27,5
53	1,2	21,1	1,2	26,7	1,3	22,9	1,2	28,9	1,1	27,9	1,1	27,9
54	1,2	21,5	1,2	27,1	1,3	23,3	1,2	29,3	1,1	28,3	1,1	28,3
55	1,2	21,9	1,2	27,5	1,3	23,7	1,2	29,7	1,2	18,5	1,2	18,5
56	1,2	22,3	1,2	27,9	1,3	24,1	1,3	20,7	1,2	18,9	1,2	18,9
57	1,2	22,7	1,2	28,3	1,3	24,5	1,3	21,1	1,2	19,3	1,2	19,3
58	1,2	23,1	1,2	28,7	1,3	24,9	1,3	21,5	1,2	19,7	1,2	19,7
59	1,2	23,5	1,2	29,1	1,3	25,3	1,3	21,9	1,2	20,1	1,2	20,1
60	1,2	23,9	1,3	20,1	1,3	25,7	1,3	22,3	1,2	20,5	1,2	20,5
61	1,2	24,3	1,3	20,5	1,3	26,1	1,3	22,7	1,2	20,9	1,2	20,9
62	1,2	24,7	1,3	20,9	1,3	26,5	1,3	23,1	1,2	21,3	1,2	21,3
63	1,2	25,1	1,3	21,3	1,3	26,9	1,3	23,5	1,2	21,7	1,2	21,7
64	1,2	25,5	1,3	21,7	1,3	27,3	1,3	23,9	1,2	22,1	1,2	22,1
65	1,2	25,9	1,3	22,1	1,3	27,7	1,3	24,3	1,2	22,5	1,2	22,5
66	1,2	26,3	1,3	22,5	1,3	28,1	1,3	24,7	1,2	22,9	1,2	22,9
67	1,2	26,7	1,3	22,9	1,3	28,5	1,3	25,1	1,2	23,3	1,2	23,3
68	1,3	19,0	1,3	23,3	1,3	28,9	1,3	25,5	1,2	23,7	1,2	23,7
69	1,3	19,4	1,3	23,7	1,4	21,2	1,3	25,9	1,2	24,1	1,2	24,1
70	1,3	19,8	1,3	24,1	1,4	21,6	1,3	26,3	1,2	24,5	1,2	24,5
71	1,3	20,2	1,3	24,5	1,4	22,0	1,3	26,7	1,2	24,9	1,2	24,9
72	1,3	20,6	1,3	24,9	1,4	22,4	1,3	27,1	1,2	25,3	1,2	25,3
73	1,3	21,0	1,3	25,3	1,4	22,8	1,3	27,5	1,3	18,4	1,3	18,4
74	1,3	21,4	1,3	25,7	1,4	23,2	1,4	20,7	1,3	18,8	1,3	18,8
75	1,3	21,8	1,3	26,1	1,4	23,6	1,4	21,1	1,3	19,2	1,3	19,2
76	1,3	22,2	1,3	26,5	1,4	24,0	1,4	21,5	1,3	19,6	1,3	19,6
77	1,3	22,6	1,4	20,2	1,4	24,4	1,4	21,9	1,3	20,0	1,3	20,0
78	1,3	23,0	1,4	20,6	1,4	24,8	1,4	22,3	1,3	20,4	1,3	20,4
79	1,3	23,4	1,4	21,0	1,4	25,2	1,4	22,7	1,3	20,8	1,3	20,8
80	1,3	23,8	1,4	21,4	1,4	25,6	1,4	23,1	1,3	21,2	1,3	21,2
81	1,3	24,2	1,4	21,8	1,4	26,0	1,4	23,5	1,3	21,6	1,3	21,6
82	1,4	19,0	1,4	22,2	1,4	26,4	1,4	23,9	1,3	22,0	1,3	22,0
83	1,4	19,4	1,4	22,6	1,5	21,1	1,4	24,3	1,3	22,4	1,3	22,4
84	1,4	19,8	1,4	23,0	1,5	21,5	1,4	24,7	1,3	22,8	1,3	22,8
85	1,4	20,2	1,4	23,4	1,5	21,9	1,4	25,1	1,4	18,2	1,4	18,2
86	1,4	20,6	1,4	23,8	1,5	22,3	1,5	20,4	1,4	18,6	1,4	18,6
87	1,4	21,0	1,4	24,2	1,5	22,7	1,5	20,8	1,4	19,0	1,4	19,0
88	1,4	21,4	1,5	20,0	1,5	23,1	1,5	21,2	1,4	19,4	1,4	19,4
89	1,4	21,8	1,5	20,4	1,5	23,5	1,5	21,6	1,4	19,8	1,4	19,8
90	1,4	22,2	1,5	20,8	1,5	23,9	1,5	22,0	1,4	20,2	1,4	20,2
91	1,5	18,8	1,5	21,2	1,5	24,3	1,5	22,4	1,4	20,6	1,4	20,6
92	1,5	19,2	1,5	21,6	1,6	20,9	1,5	22,8	1,4	21,0	1,4	21,0
93	1,5	19,6	1,5	22,0	1,6	21,3	1,5	23,2	1,5	18,1	1,5	18,1
94	1,5	20,0	1,5	22,4	1,6	21,7	1,6	20,3	1,5	18,5	1,5	18,5
95	1,5	20,4	1,6	19,8	1,6	22,1	1,6	20,7	1,5	18,9	1,5	18,9
96	1,5	20,8	1,6	20,2	1,6	22,5	1,6	21,1	1,5	19,3	1,5	19,3
97	1,6	18,9	1,6	20,6	1,7	20,5	1,6	21,5	1,5	19,7	1,5	19,7
98	1,6	19,3	1,6	21,0	1,7	20,9	1,6	21,9	1,6	18,1	1,6	18,1
99	1,6	19,7	1,7	19,7	1,7	21,3	1,7	20,3	1,6	18,5	1,6	18,5
100	1,7	18,9	1,7	20,1	1,8	20,5	1,7	20,7	1,6	18,9	1,6	18,9

Table A 2: Pairs of Beta and Tau used for the parameterization of the stock in Poland (cont.)

Index	Mopeds		Motorcycles							
	50 cm³		2-stroke >50 cm³		4-stroke <250 cm³		4-stroke 250 - 750 cm³		4-stroke >750 cm³	
	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau	Beta	Tau
1	1,4	12,1	1,0	16,3	1,0	15,2	3,8	19,4	1,0	15,2
2	1,5	11,5	1,0	16,6	1,0	15,4	3,9	20,0	1,0	15,4
3	1,5	11,8	1,0	16,9	1,0	15,6	4,1	18,8	1,0	15,6
4	1,5	12,1	1,0	17,2	1,0	15,8	4,2	18,8	1,0	15,8
5	1,5	12,4	1,0	17,5	1,0	16,0	4,3	18,6	1,0	16,0
6	1,6	11,3	1,0	17,8	1,0	16,2	4,3	20,3	1,0	16,2
7	1,6	11,6	1,0	18,1	1,0	16,4	4,4	19,9	1,0	16,4
8	1,6	11,9	1,0	18,4	1,0	16,6	4,5	19,3	1,0	16,6
9	1,6	12,2	1,0	18,7	1,0	16,8	4,6	18,8	1,0	16,8
10	1,6	12,5	1,0	19,0	1,0	17,0	4,6	20,5	1,0	17,0
11	1,6	12,8	1,0	19,3	1,0	17,2	4,7	20,0	1,0	17,2
12	1,7	11,2	1,0	19,6	1,0	17,4	4,8	19,5	1,0	17,4
13	1,7	11,5	1,0	19,9	1,0	17,6	4,9	19,1	1,0	17,6
14	1,7	11,8	1,0	20,2	1,0	17,8	4,9	20,8	1,0	17,8
15	1,7	12,1	1,0	20,5	1,0	18,0	5,0	20,4	1,0	18,0
16	1,7	12,4	1,0	20,8	1,0	18,2	5,1	20,0	1,0	18,2
17	1,7	12,7	1,0	21,1	1,0	18,4	5,2	19,6	1,0	18,4
18	1,7	13,0	1,0	21,4	1,0	18,6	5,3	19,3	1,0	18,6
19	1,8	11,0	1,0	21,7	1,0	18,8	5,3	21,0	1,0	18,8
20	1,8	11,3	1,0	22,0	1,0	19,0	5,4	20,7	1,0	19,0
21	1,8	11,6	1,0	22,3	1,0	19,2	5,5	20,5	1,0	19,2
22	1,8	11,9	1,0	22,6	1,0	19,4	5,6	20,3	1,0	19,4
23	1,8	12,2	1,0	22,9	1,0	19,6	5,7	20,1	1,0	19,6
24	1,8	12,5	1,0	23,2	1,0	19,8	5,8	19,9	1,0	19,8
25	1,8	12,8	1,0	23,5	1,0	20,0	5,8	21,6	1,0	20,0
26	1,8	13,1	1,0	23,8	1,0	20,2	5,9	21,4	1,0	20,2
27	1,8	13,4	1,0	24,1	1,0	20,4	6,0	21,2	1,0	20,4
28	1,9	11,1	1,0	24,4	1,0	20,6	6,1	21,1	1,0	20,6
29	1,9	11,4	1,0	24,7	1,0	20,8	6,2	21,1	1,0	20,8
30	1,9	11,7	1,1	15,2	1,0	21,0	6,3	21,1	1,0	21,0
31	1,9	12,0	1,1	15,5	1,0	21,2	6,4	21,1	1,0	21,2
32	1,9	12,3	1,1	15,8	1,0	21,4	6,5	21,1	1,0	21,4
33	1,9	12,6	1,1	16,1	1,0	21,6	6,6	21,1	1,0	21,6
34	1,9	12,9	1,1	16,4	1,0	21,8	6,7	21,1	1,0	21,8
35	1,9	13,2	1,1	16,7	1,0	22,0	6,8	21,1	1,0	22,0
36	2,0	10,8	1,1	17,0	1,0	22,2	6,9	21,1	1,0	22,2
37	2,0	11,1	1,1	17,3	1,0	22,4	7,0	21,1	1,0	22,4
38	2,0	11,4	1,1	17,6	1,0	22,6	7,1	21,2	1,0	22,6
39	2,0	11,7	1,1	17,9	1,0	22,8	7,2	21,3	1,0	22,8
40	2,0	12,0	1,1	18,2	1,1	14,3	7,3	21,5	1,1	14,3
41	2,0	12,3	1,1	18,5	1,1	14,5	7,4	21,7	1,1	14,5
42	2,0	12,6	1,1	18,8	1,1	14,7	7,5	21,9	1,1	14,7
43	2,0	12,9	1,1	19,1	1,1	14,9	7,6	22,1	1,1	14,9
44	2,1	10,7	1,1	19,4	1,1	15,1	7,7	22,3	1,1	15,1
45	2,1	11,0	1,1	19,7	1,1	15,3	7,8	22,5	1,1	15,3
46	2,1	11,3	1,1	20,0	1,1	15,5	7,9	22,7	1,1	15,5
47	2,1	11,6	1,1	20,3	1,1	15,7	8,0	22,9	1,1	15,7
48	2,1	11,9	1,1	20,6	1,1	15,9	8,1	23,1	1,1	15,9
49	2,1	12,2	1,1	20,9	1,1	16,1	8,2	23,3	1,1	16,1
50	2,1	12,5	1,1	21,2	1,1	16,3	8,3	23,5	1,1	16,3
51	2,1	12,8	1,1	21,5	1,1	16,5	8,4	23,8	1,1	16,5
52	2,1	12,3	1,1	19,8	1,2	15,3	8,5	22,8	1,2	15,3
53	2,1	12,6	1,1	20,1	1,2	15,5	8,6	23,1	1,2	15,5
54	2,1	12,9	1,1	20,4	1,2	15,7	8,7	23,4	1,2	15,7
55	2,2	10,9	1,1	20,7	1,2	15,9	8,8	23,7	1,2	15,9
56	2,2	11,2	1,1	21,0	1,2	16,1	8,9	24,0	1,2	16,1
57	2,2	11,5	1,1	21,3	1,2	16,3	9,0	24,3	1,2	16,3
58	2,2	11,8	1,1	21,6	1,2	16,5	9,1	24,6	1,2	16,5
59	2,2	12,1	1,1	21,9	1,2	16,7	9,3	23,7	1,2	16,7
60	2,2	12,4	1,1	22,2	1,2	16,9	9,4	24,1	1,2	16,9
61	2,2	12,7	1,2	15,5	1,2	17,1	9,5	24,5	1,2	17,1
62	2,3	10,8	1,2	15,8	1,2	17,3	9,6	24,9	1,2	17,3
63	2,3	11,1	1,2	16,1	1,2	17,5	9,8	24,0	1,2	17,5
64	2,3	11,4	1,2	16,4	1,2	17,7	9,9	24,4	1,2	17,7
65	2,3	11,7	1,2	16,7	1,2	17,9	10,0	24,8	1,2	17,9
66	2,3	12,0	1,2	17,0	1,2	18,1	10,1	25,2	1,2	18,1
67	2,3	12,3	1,2	17,3	1,2	18,3	10,2	25,7	1,2	18,3
68	2,3	12,6	1,2	17,6	1,2	18,5	10,4	25,0	1,2	18,5
69	2,4	10,8	1,2	17,9	1,2	18,7	10,5	25,5	1,2	18,7
70	2,4	11,1	1,2	18,2	1,2	18,9	10,6	26,0	1,2	18,9
71	2,4	11,4	1,2	18,5	1,3	14,7	10,8	25,3	1,3	14,7
72	2,4	11,7	1,2	18,8	1,3	14,9	10,9	25,8	1,3	14,9
73	2,4	12,0	1,2	19,1	1,3	15,1	11,0	26,3	1,3	15,1
74	2,4	12,3	1,2	19,4	1,3	15,3	11,2	25,6	1,3	15,3
75	2,5	10,6	1,2	19,7	1,3	15,5	11,3	26,1	1,3	15,5
76	2,5	10,9	1,2	20,0	1,3	15,7	11,4	26,6	1,3	15,7
77	2,5	11,2	1,2	20,3	1,3	15,9	11,6	25,9	1,3	15,9
78	2,5	11,5	1,3	15,7	1,3	16,1	11,7	26,4	1,3	16,1
79	2,5	11,8	1,3	16,0	1,3	16,3	11,8	26,9	1,3	16,3
80	2,5	12,1	1,3	16,3	1,3	16,5	11,9	27,4	1,3	16,5
81	2,5	12,4	1,3	16,6	1,3	16,7	12,1	26,7	1,3	16,7
82	2,6	10,9	1,3	16,9	1,3	16,9	12,2	27,2	1,3	16,9
83	2,6	11,2	1,3	17,2	1,3	17,1	12,3	27,7	1,3	17,1
84	2,6	11,5	1,3	17,5	1,3	17,3	12,5	27,1	1,3	17,3
85	2,6	11,8	1,3	17,8	1,3	17,5	12,6	27,7	1,3	17,5
86	2,6	12,1	1,3	18,1	1,4	14,8	12,8	27,2	1,4	14,8
87	2,7	11,0	1,3	18,4	1,4	15,0	12,9	27,8	1,4	15,0
88	2,7	11,3	1,3	18,7	1,4	15,2	13,1	27,5	1,4	15,2
89	2,7	11,6	1,4	15,7	1,4	15,4	13,2	28,2	1,4	15,4
90	2,7	11,9	1,4	16,0	1,4	15,6	13,4	27,9	1,4	15,6
91	2,7	12,2	1,4	16,3	1,4	15,8	13,5	28,6	1,4	15,8
92	2,8	11,4	1,4	16,6	1,4	16,0	13,7	28,3	1,4	16,0
93	2,8	11,7	1,4	16,9	1,4	16,2	13,8	29,0	1,4	16,2
94	2,8	12,0	1,4	17,2	1,4	16,4	14,0	28,7	1,4	16,4
95	2,9	11,5	1,4	17,5	1,4	16,6	14,1	29,4	1,4	16,6
96	2,9	11,8	1,5	15,8	1,5	15,1	14,3	29,1	1,5	15,1
97	2,9	12,1	1,5	16,1	1,5	15,3	14,4	29,8	1,5	15,3
98	3,0	11,8	1,5	16,4	1,5	15,5	14,6	29,5	1,5	15,5
99	3,0	12,1	1,5	16,7	1,5	15,7	14,8	29,5	1,5	15,7
100	3,1	12,1	1,6	16,0	1,6	15,2	15,0	29,9	1,6	15,2

Table A 3: Pairs of bm and Tm used for the parameterization of the mileage

Index	Passenger Cars													
	Gasoline <1,4 l		Gasoline 1,4 - 2,0 l		Gasoline >2,0 l		Diesel <1,4 l		Diesel 1.4-2.0l		Diesel >2,0 l		car - LPG	
	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm
1	1,0	29,8	1,0	29,0	1,0	30,1	1,0	26,4	1,0	26,4	1,0	26,1	1,5	21,0
2	1,0	32,3	1,0	29,9	1,0	31,5	1,0	28,8	1,0	28,8	1,0	30,7	1,6	20,2
3	1,0	34,8	1,0	30,8	1,0	32,9	1,0	31,2	1,0	31,2	1,0	35,3	1,7	17,3
4	1,0	37,3	1,0	31,7	1,0	34,3	1,1	21,5	1,1	21,5	1,1	22,1	1,7	21,7
5	1,0	39,8	1,0	32,6	1,0	35,7	1,1	23,9	1,1	23,9	1,1	26,7	1,8	17,1
6	1,0	42,3	1,0	33,5	1,0	37,1	1,1	26,3	1,1	26,3	1,1	31,3	1,8	21,5
7	1,0	44,8	1,0	34,4	1,0	38,5	1,1	28,7	1,1	28,7	1,1	35,9	1,9	15,3
8	1,1	24,3	1,0	35,3	1,0	39,9	1,1	31,1	1,1	31,1	1,2	20,4	1,9	19,7
9	1,1	26,8	1,0	36,2	1,1	25,6	1,2	18,1	1,2	18,1	1,2	25,0	1,9	24,1
10	1,1	29,3	1,1	24,5	1,1	27,0	1,2	20,5	1,2	20,5	1,2	29,6	2,0	16,7
11	1,1	31,8	1,1	25,4	1,1	28,4	1,2	22,9	1,2	22,9	1,2	34,2	2,0	21,1
12	1,1	34,3	1,1	26,3	1,1	29,8	1,2	25,3	1,2	25,3	1,3	17,5	2,0	25,5
13	1,1	36,8	1,1	27,2	1,1	31,2	1,2	27,7	1,2	27,7	1,3	22,1	2,1	16,8
14	1,1	39,3	1,1	28,1	1,1	32,6	1,2	30,1	1,2	30,1	1,3	26,7	2,1	21,2
15	1,1	41,8	1,1	29,0	1,1	34,0	1,3	17,0	1,3	17,0	1,3	31,3	2,1	25,6
16	1,2	20,4	1,1	29,9	1,1	35,4	1,3	19,4	1,3	19,4	1,3	35,9	2,2	15,9
17	1,2	22,9	1,1	30,8	1,1	36,8	1,3	21,8	1,3	21,8	1,4	19,1	2,2	20,3
18	1,2	25,4	1,1	31,7	1,2	23,2	1,3	24,2	1,3	24,2	1,4	23,7	2,2	24,7
19	1,2	27,9	1,1	32,6	1,2	24,6	1,3	26,6	1,3	26,6	1,4	28,3	2,3	14,3
20	1,2	30,4	1,2	21,6	1,2	26,0	1,3	29,0	1,3	29,0	1,4	32,9	2,3	18,7
21	1,2	32,9	1,2	22,5	1,2	27,4	1,4	16,4	1,4	16,4	1,5	17,5	2,3	23,1
22	1,2	35,4	1,2	23,4	1,2	28,8	1,4	18,8	1,4	18,8	1,5	22,1	2,4	12,2
23	1,2	37,9	1,2	24,3	1,2	30,2	1,4	21,2	1,4	21,2	1,5	26,7	2,4	16,6
24	1,2	40,4	1,2	25,2	1,2	31,6	1,4	23,6	1,4	23,6	1,5	31,3	2,4	21,0
25	1,3	20,2	1,2	26,1	1,2	33,0	1,4	26,0	1,4	26,0	1,6	17,1	2,4	25,4
26	1,3	22,7	1,2	27,0	1,2	34,4	1,4	28,4	1,4	28,4	1,6	21,7	2,5	14,1
27	1,3	25,2	1,2	27,9	1,2	35,8	1,5	16,4	1,5	16,4	1,6	26,3	2,5	18,5
28	1,3	27,7	1,2	28,8	1,3	23,0	1,5	18,8	1,5	18,8	1,6	30,9	2,5	22,9
29	1,3	30,2	1,2	29,7	1,3	24,4	1,5	21,2	1,5	21,2	1,7	17,7	2,5	27,3
30	1,3	32,7	1,3	19,3	1,3	25,8	1,5	23,6	1,5	23,6	1,7	22,3	2,6	15,5
31	1,3	35,2	1,3	20,2	1,3	27,2	1,5	26,0	1,5	26,0	1,7	26,9	2,6	19,9
32	1,3	37,7	1,3	21,1	1,3	28,6	1,5	28,4	1,5	28,4	1,8	14,5	2,6	24,3
33	1,3	40,2	1,3	22,0	1,3	30,0	1,6	16,8	1,6	16,8	1,8	19,1	2,6	28,7
34	1,4	21,1	1,3	22,9	1,3	31,4	1,6	19,2	1,6	19,2	1,8	23,7	2,7	16,6
35	1,4	23,6	1,3	23,8	1,3	32,8	1,6	21,6	1,6	21,6	1,8	28,3	2,7	21,0
36	1,4	26,1	1,3	24,7	1,3	34,2	1,6	24,0	1,6	24,0	1,9	16,6	2,7	25,4
37	1,4	28,6	1,3	25,6	1,4	22,2	1,6	26,4	1,6	26,4	1,9	21,2	2,8	12,9
38	1,4	31,1	1,3	26,5	1,4	23,6	1,6	28,8	1,6	28,8	1,9	25,8	2,8	17,3
39	1,4	33,6	1,3	27,4	1,4	25,0	1,7	18,0	1,7	18,0	2,0	14,7	2,8	21,7
40	1,4	36,1	1,3	28,3	1,4	26,4	1,7	20,4	1,7	20,4	2,0	19,3	2,8	26,1
41	1,4	38,6	1,4	18,3	1,4	27,8	1,7	22,8	1,7	22,8	2,0	23,9	2,9	13,3
42	1,5	20,3	1,4	19,2	1,4	29,2	1,7	25,2	1,7	25,2	2,1	13,5	2,9	17,7
43	1,5	22,8	1,4	20,1	1,4	30,6	1,7	27,6	1,7	27,6	2,1	18,1	2,9	22,1
44	1,5	25,3	1,4	21,0	1,4	32,0	1,8	17,6	1,8	17,6	2,1	22,7	2,9	26,5
45	1,5	27,8	1,4	21,9	1,5	20,6	1,8	20,0	1,8	20,0	2,1	27,3	3,0	13,3
46	1,5	30,3	1,4	22,8	1,5	22,0	1,8	22,4	1,8	22,4	2,2	17,3	3,0	17,7
47	1,5	32,8	1,4	23,7	1,5	23,4	1,8	24,8	1,8	24,8	2,2	21,9	3,0	22,1
48	1,5	35,3	1,4	24,6	1,5	24,8	1,8	27,2	1,8	27,2	2,2	26,5	3,0	26,5
49	1,5	37,8	1,4	25,5	1,5	26,2	1,9	18,0	1,9	18,0	2,3	16,9	3,1	13,0
50	1,6	20,4	1,4	26,4	1,5	27,6	1,9	20,4	1,9	20,4	2,3	21,5	3,1	17,4
51	1,6	22,9	1,5	17,8	1,5	29,0	1,9	22,8	1,9	22,8	2,3	26,1	3,1	21,8
52	1,6	29,8	1,5	18,3	1,6	22,6	1,9	20,9	1,9	20,9	2,3	26,0	3,1	30,9
53	1,6	32,3	1,5	19,2	1,6	24,0	1,9	23,3	1,9	23,3	2,4	16,9	3,2	17,2
54	1,6	34,8	1,5	20,1	1,6	25,4	1,9	25,7	1,9	25,7	2,4	21,5	3,2	21,6
55	1,6	37,3	1,5	21,0	1,6	26,8	2,0	17,3	2,0	17,3	2,4	26,1	3,2	26,0
56	1,7	20,5	1,5	21,9	1,6	28,2	2,0	19,7	2,0	19,7	2,5	17,3	3,3	13,6
57	1,7	23,0	1,5	22,8	1,6	29,6	2,0	22,1	2,0	22,1	2,5	21,9	3,3	18,0
58	1,7	25,5	1,5	23,7	1,6	31,0	2,0	24,5	2,0	24,5	2,6	13,5	3,3	22,4
59	1,7	28,0	1,5	24,6	1,7	20,7	2,1	16,7	2,1	16,7	2,6	18,1	3,3	26,8
60	1,7	30,5	1,5	25,5	1,7	22,1	2,1	19,1	2,1	19,1	2,6	22,7	3,4	15,5
61	1,7	33,0	1,6	18,4	1,7	23,5	2,1	21,5	2,1	21,5	2,7	14,8	3,4	19,9
62	1,7	35,5	1,6	19,3	1,7	24,9	2,1	23,9	2,1	23,9	2,7	19,4	3,4	24,3
63	1,8	19,3	1,6	20,2	1,7	26,3	2,1	26,3	2,1	26,3	2,7	24,0	3,5	14,1
64	1,8	21,8	1,6	21,1	1,7	27,7	2,2	19,1	2,2	19,1	2,8	16,8	3,5	18,5
65	1,8	24,3	1,6	22,0	1,7	29,1	2,2	21,5	2,2	21,5	2,8	21,4	3,5	22,9
66	1,8	26,8	1,6	22,9	1,8	19,1	2,2	23,9	2,2	23,9	2,9	14,8	3,6	13,6
67	1,8	29,3	1,6	23,8	1,8	20,5	2,3	17,2	2,3	17,2	2,9	19,4	3,6	18,0
68	1,8	31,8	1,7	17,9	1,8	21,9	2,3	19,6	2,3	19,6	3,0	13,3	3,6	22,4
69	1,8	34,3	1,7	18,8	1,8	23,3	2,3	22,0	2,3	22,0	3,0	17,9	3,7	14,1
70	1,8	36,8	1,7	19,7	1,8	24,7	2,3	24,4	2,3	24,4	3,0	22,5	3,7	18,5
71	1,9	21,1	1,7	20,6	1,8	26,1	2,4	18,4	2,4	18,4	3,1	16,9	3,7	22,9
72	1,9	23,6	1,7	21,5	1,8	27,5	2,4	20,8	2,4	20,8	3,1	21,5	3,8	15,3
73	1,9	26,1	1,7	22,4	1,8	28,9	2,4	23,2	2,4	23,2	3,2	16,4	3,8	19,7
74	1,9	28,6	1,7	23,3	1,9	19,3	2,5	17,9	2,5	17,9	3,2	21,0	3,8	24,1
75	1,9	31,1	1,8	18,4	1,9	20,7	2,5	20,3	2,5	20,3	3,3	16,4	3,9	17,2
76	1,9	33,6	1,8	19,3	1,9	22,1	2,5	22,7	2,5	22,7	3,3	21,0	3,9	21,6
77	1,9	36,1	1,8	20,2	1,9	23,5	2,6	18,1	2,6	18,1	3,4	16,7	4,0	15,4
78	2,0	20,8	1,8	21,1	1,9	24,9	2,6	20,5	2,6	20,5	3,4	21,3	4,0	19,8
79	2,0	23,3	1,8	22,0	1,9	26,3	2,6	22,9	2,6	22,9	3,5	17,4	4,1	14,2
80	2,0	25,8	1,8	22,9	1,9	27,7	2,7	19,0	2,7	19,0	3,6	13,8	4,1	18,6
81	2,0	28,3	1,9	18,9	1,9	29,1	2,7	21,4	2,7	21,4	3,6	18,4	4,1	23,0
82	2,0	30,8	1,9	19,8	2,0	20,7	2,8	18,1	2,8	18,1	3,7	15,2	4,2	18,0
83	2,0	33,3	1,9	20,7	2,0	22,1	2,8	20,5	2,8	20,5	3,7	19,8	4,2	22,4
84	2,1	19,7	1,9	21,6	2,0	23,5	2,8	22,9	2,8	22,9	3,8	16,8	4,3	17,9
85	2,1	22,2	2,0	18,4	2,0	24,9	2,9	20,1	2,9	20,1	3,9	14,1	4,3	22,3
86	2,1	24,7	2,0	19,3	2,0	26,3	2,9	22,5	2,9	22,5	3,9	18,7	4,4	18,3
87	2,1	27,2	2,0	20,2	2,0	27,7	3,0	20,2	3,0	20,2	4,0	16,2	4,5	14,7
88	2,1	29,7	2,0	21,1	2,1	20,6	3,0	22,6	3,0	22,6	4,1	13,9	4,5	19,1
89	2,1	32,2	2,1	18,6	2,1	22,0	3,1	20,8	3,1	20,8	4,1	18,5	4,6	16,2
90	2,2	22,2	2,1	19,5	2,1	23,4	3,2	19,3	3,2	19,3	4,2	16,4	4,6	20,6
91	2,2	24,7	2,1	20,4	2,1	24,8	3,2	21,7	3,2	21,7	4,3	14,6	4,7	18,3
92	2,2	27,2	2,1	21,3	2,1	26,2	3,3	20,6	3,3	20,6	4,3	19,2	4,8	16,6
93	2,2	29,7	2,2	19,4	2,1	27,6	3,4	19,9	3,4	19,9	4,4	17,9	4,8	21,0
94	2,3	22,8	2,2	20,3	2,2	21,9	3,5	19,6	3,5	19,6	4,5	17,1	4,9	19,9
95	2,3	25,3	2,3	19,0	2,2	23,3	3,6	19,5	3,6	19,5	4,6	16,8	5,0	19,5
96	2,3	27,8	2,3	19,9	2,2	24,7	3,7	19,8	3,7	19,8	4,7	17,0	5,1	19,5
97	2,4	23,5	2,4	19,1	2,2	26,1	3,8	20,4	3,8	20,4	4,8	17,7	5,2	20,1
98	2,4	26,0	2,4	20,0	2,3	22,9	3,9	21,2	3,9	21,2	4,9	19,0	5,4	18,4
99	2,5	23,9	2,5	19,7	2,3	24,3	4,1	21,2	4,1	21,2	5,1	18,4	5,6	18,6
100	2,6	23,9	2,7	19,5	2,4	23,3	4,6	21,1	4,6	21,1	5,5	18,4	6,0	19,9

Table A 3: Pairs of bm and Tm used for the parameterization of the mileage (cont.)

Index	Light Duty Vehicles							
	LDV - Gasoline		LDV - Diesel		Van - Gasoline		Van - Diesel	
	bm	Tm	bm	Tm	bm	Tm	bm	Tm
1	1,0	20,7	1,0	27,3	1,0	20,7	1,0	27,3
2	1,1	16,5	1,0	31,9	1,1	16,5	1,0	31,9
3	1,1	18,9	1,0	36,5	1,1	18,9	1,0	36,5
4	1,1	21,3	1,0	41,1	1,1	21,3	1,0	41,1
5	1,2	15,2	1,1	20,5	1,2	15,2	1,1	20,5
6	1,2	17,6	1,1	25,1	1,2	17,6	1,1	25,1
7	1,2	20,0	1,1	29,7	1,2	20,0	1,1	29,7
8	1,2	22,4	1,1	34,3	1,2	22,4	1,1	34,3
9	1,3	14,9	1,1	38,9	1,3	14,9	1,1	38,9
10	1,3	17,3	1,1	43,5	1,3	17,3	1,1	43,5
11	1,3	19,7	1,2	20,7	1,3	19,7	1,2	20,7
12	1,3	22,1	1,2	25,3	1,3	22,1	1,2	25,3
13	1,4	13,6	1,2	29,9	1,4	13,6	1,2	29,9
14	1,4	16,0	1,2	34,5	1,4	16,0	1,2	34,5
15	1,4	18,4	1,2	39,1	1,4	18,4	1,2	39,1
16	1,4	20,8	1,2	43,7	1,4	20,8	1,2	43,7
17	1,5	11,6	1,3	19,2	1,5	11,6	1,3	19,2
18	1,5	14,0	1,3	23,8	1,5	14,0	1,3	23,8
19	1,5	16,4	1,3	28,4	1,5	16,4	1,3	28,4
20	1,5	18,8	1,3	33,0	1,5	18,8	1,3	33,0
21	1,5	21,2	1,3	37,6	1,5	21,2	1,3	37,6
22	1,6	11,4	1,3	42,2	1,6	11,4	1,3	42,2
23	1,6	13,8	1,4	16,6	1,6	13,8	1,4	16,6
24	1,6	16,2	1,4	21,2	1,6	16,2	1,4	21,2
25	1,6	18,6	1,4	25,8	1,6	18,6	1,4	25,8
26	1,6	21,0	1,4	30,4	1,6	21,0	1,4	30,4
27	1,7	10,7	1,4	35,0	1,7	10,7	1,4	35,0
28	1,7	13,1	1,4	39,6	1,7	13,1	1,4	39,6
29	1,7	15,5	1,5	13,6	1,7	15,5	1,5	13,6
30	1,7	17,9	1,5	18,2	1,7	17,9	1,5	18,2
31	1,7	20,3	1,5	22,8	1,7	20,3	1,5	22,8
32	1,8	9,7	1,5	27,4	1,8	9,7	1,5	27,4
33	1,8	12,1	1,5	32,0	1,8	12,1	1,5	32,0
34	1,8	14,5	1,5	36,6	1,8	14,5	1,5	36,6
35	1,8	16,9	1,5	41,2	1,8	16,9	1,5	41,2
36	1,8	19,3	1,6	16,3	1,8	19,3	1,6	16,3
37	1,8	21,7	1,6	20,9	1,8	21,7	1,6	20,9
38	1,9	11,0	1,6	25,5	1,9	11,0	1,6	25,5
39	1,9	13,4	1,6	30,1	1,9	13,4	1,6	30,1
40	1,9	15,8	1,6	34,7	1,9	15,8	1,6	34,7
41	1,9	18,2	1,6	39,3	1,9	18,2	1,6	39,3
42	1,9	20,6	1,7	15,9	1,9	20,6	1,7	15,9
43	2,0	10,2	1,7	20,5	2,0	10,2	1,7	20,5
44	2,0	12,6	1,7	25,1	2,0	12,6	1,7	25,1
45	2,0	15,0	1,7	29,7	2,0	15,0	1,7	29,7
46	2,0	17,4	1,7	34,3	2,0	17,4	1,7	34,3
47	2,0	19,8	1,8	12,5	2,0	19,8	1,8	12,5
48	2,0	22,2	1,8	17,1	2,0	22,2	1,8	17,1
49	2,1	12,0	1,8	21,7	2,1	12,0	1,8	21,7
50	2,1	14,4	1,8	26,3	2,1	14,4	1,8	26,3
51	2,1	16,8	1,8	30,9	2,1	16,8	1,8	30,9
52	2,1	20,3	1,8	32,4	2,1	20,3	1,8	32,4
53	2,1	22,7	1,8	37,0	2,1	22,7	1,8	37,0
54	2,2	12,7	1,9	16,8	2,2	12,7	1,9	16,8
55	2,2	15,1	1,9	21,4	2,2	15,1	1,9	21,4
56	2,2	17,5	1,9	26,0	2,2	17,5	1,9	26,0
57	2,2	19,9	1,9	30,6	2,2	19,9	1,9	30,6
58	2,2	22,3	1,9	35,2	2,2	22,3	1,9	35,2
59	2,3	13,0	2,0	16,8	2,3	13,0	2,0	16,8
60	2,3	15,4	2,0	21,4	2,3	15,4	2,0	21,4
61	2,3	17,8	2,0	26,0	2,3	17,8	2,0	26,0
62	2,3	20,2	2,0	30,6	2,3	20,2	2,0	30,6
63	2,4	11,8	2,0	35,2	2,4	11,8	2,0	35,2
64	2,4	14,2	2,1	18,4	2,4	14,2	2,1	18,4
65	2,4	16,6	2,1	23,0	2,4	16,6	2,1	23,0
66	2,4	19,0	2,1	27,6	2,4	19,0	2,1	27,6
67	2,5	11,5	2,1	32,2	2,5	11,5	2,1	32,2
68	2,5	13,9	2,2	16,9	2,5	13,9	2,2	16,9
69	2,5	16,3	2,2	21,5	2,5	16,3	2,2	21,5
70	2,5	18,7	2,2	26,1	2,5	18,7	2,2	26,1
71	2,6	12,0	2,2	30,7	2,6	12,0	2,2	30,7
72	2,6	14,4	2,3	16,7	2,6	14,4	2,3	16,7
73	2,6	16,8	2,3	21,3	2,6	16,8	2,3	21,3
74	2,6	19,2	2,3	25,9	2,6	19,2	2,3	25,9
75	2,7	13,2	2,3	30,5	2,7	13,2	2,3	30,5
76	2,7	15,6	2,4	17,8	2,7	15,6	2,4	17,8
77	2,7	18,0	2,4	22,4	2,7	18,0	2,4	22,4
78	2,8	12,7	2,4	27,0	2,8	12,7	2,4	27,0
79	2,8	15,1	2,4	31,6	2,8	15,1	2,4	31,6
80	2,8	17,5	2,5	20,1	2,8	17,5	2,5	20,1
81	2,9	12,7	2,5	24,7	2,9	12,7	2,5	24,7
82	2,9	15,1	2,5	29,3	2,9	15,1	2,5	29,3
83	2,9	17,5	2,6	18,8	2,9	17,5	2,6	18,8
84	3,0	13,3	2,6	23,4	3,0	13,3	2,6	23,4
85	3,0	15,7	2,6	28,0	3,0	15,7	2,6	28,0
86	3,0	18,1	2,7	18,5	3,0	18,1	2,7	18,5
87	3,1	14,4	2,7	23,1	3,1	14,4	2,7	23,1
88	3,1	16,8	2,7	27,7	3,1	16,8	2,7	27,7
89	3,2	13,6	2,8	19,1	3,2	13,6	2,8	19,1
90	3,2	16,0	2,8	23,7	3,2	16,0	2,8	23,7
91	3,3	13,2	2,8	28,3	3,3	13,2	2,8	28,3
92	3,3	15,6	2,9	21,4	3,3	15,6	2,9	21,4
93	3,4	13,4	2,9	26,0	3,4	13,4	2,9	26,0
94	3,4	15,8	3,0	21,1	3,4	15,8	3,0	21,1
95	3,5	14,3	3,0	25,7	3,5	14,3	3,0	25,7
96	3,5	16,7	3,1	22,5	3,5	16,7	3,1	22,5
97	3,6	15,8	3,1	27,1	3,6	15,8	3,1	27,1
98	3,7	15,6	3,2	25,6	3,7	15,6	3,2	25,6
99	3,8	16,0	3,3	25,5	3,8	16,0	3,3	25,5
100	4,0	16,4	3,6	23,5	4,0	16,4	3,6	23,5

Table A 3: Pairs of bm and Tm used for the parameterization of the mileage (cont.)

Index	Heavy Duty Vehicles								Buses			
	>32t - diesel		16-32t - diesel		3.5-7.5t - diesel		7.5-16t - diesel		Urban Buses Midi <=15 t		Coaches Standard <=18 t	
	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm
1	1,1	17,8	1,1	17,8	1,1	17,8	1,1	17,8	1,1	18,4	1,0	23,4
2	1,2	15,7	1,2	15,7	1,1	22,2	1,1	22,2	1,2	16,0	1,0	24,0
3	1,2	17,3	1,2	17,3	1,2	17,6	1,2	17,6	1,2	17,6	1,0	24,6
4	1,3	13,4	1,3	13,4	1,2	22,0	1,2	22,0	1,2	19,2	1,0	25,2
5	1,3	15,0	1,3	15,0	1,3	16,1	1,3	16,1	1,3	14,1	1,0	25,8
6	1,3	16,6	1,3	16,6	1,3	20,5	1,3	20,5	1,3	15,7	1,0	26,4
7	1,3	18,2	1,3	18,2	1,4	13,6	1,4	13,6	1,3	17,3	1,0	27,0
8	1,4	13,0	1,4	13,0	1,4	18,0	1,4	18,0	1,3	18,9	1,0	27,6
9	1,4	14,6	1,4	14,6	1,4	22,4	1,4	22,4	1,3	20,5	1,0	28,2
10	1,4	16,2	1,4	16,2	1,5	14,8	1,5	14,8	1,4	13,1	1,0	28,8
11	1,4	17,8	1,4	17,8	1,5	19,2	1,5	19,2	1,4	14,7	1,0	29,4
12	1,5	11,9	1,5	11,9	1,5	23,6	1,5	23,6	1,4	16,3	1,0	30,0
13	1,5	13,5	1,5	13,5	1,6	15,3	1,6	15,3	1,4	17,9	1,0	30,6
14	1,5	15,1	1,5	15,1	1,6	19,7	1,6	19,7	1,4	19,5	1,0	31,2
15	1,5	16,7	1,5	16,7	1,7	10,9	1,7	10,9	1,4	21,1	1,0	31,8
16	1,5	18,3	1,5	18,3	1,7	15,3	1,7	15,3	1,5	11,8	1,0	32,4
17	1,6	12,3	1,6	12,3	1,7	19,7	1,7	19,7	1,5	13,4	1,0	33,0
18	1,6	13,9	1,6	13,9	1,8	11,3	1,8	11,3	1,5	15,0	1,0	33,6
19	1,6	15,5	1,6	15,5	1,8	15,7	1,8	15,7	1,5	16,6	1,0	34,2
20	1,6	17,1	1,6	17,1	1,8	20,1	1,8	20,1	1,5	18,2	1,1	20,5
21	1,6	18,7	1,6	18,7	1,9	12,0	1,9	12,0	1,5	19,8	1,1	21,1
22	1,7	12,5	1,7	12,5	1,9	16,4	1,9	16,4	1,5	21,4	1,1	21,7
23	1,7	14,1	1,7	14,1	1,9	20,8	1,9	20,8	1,6	11,4	1,1	22,3
24	1,7	15,7	1,7	15,7	2,0	13,0	2,0	13,0	1,6	13,0	1,1	22,9
25	1,7	17,3	1,7	17,3	2,0	17,4	2,0	17,4	1,6	14,6	1,1	23,5
26	1,7	18,9	1,7	18,9	2,0	21,8	2,0	21,8	1,6	16,2	1,1	24,1
27	1,8	12,5	1,8	12,5	2,1	14,1	2,1	14,1	1,6	17,8	1,1	24,7
28	1,8	14,1	1,8	14,1	2,1	18,5	2,1	18,5	1,6	19,4	1,1	25,3
29	1,8	15,7	1,8	15,7	2,1	22,9	2,1	22,9	1,6	21,0	1,1	25,9
30	1,8	17,3	1,8	17,3	2,2	15,7	2,2	15,7	1,7	10,4	1,1	26,5
31	1,8	18,9	1,8	18,9	2,2	20,1	2,2	20,1	1,7	12,0	1,1	27,1
32	1,9	12,7	1,9	12,7	2,3	13,4	2,3	13,4	1,7	13,6	1,1	27,7
33	1,9	14,3	1,9	14,3	2,3	17,8	2,3	17,8	1,7	15,2	1,1	28,3
34	1,9	15,9	1,9	15,9	2,3	22,2	2,3	22,2	1,7	16,8	1,1	28,9
35	1,9	17,5	1,9	17,5	2,4	15,8	2,4	15,8	1,7	18,4	1,1	29,5
36	1,9	19,1	1,9	19,1	2,4	20,2	2,4	20,2	1,7	20,0	1,1	30,1
37	2,0	13,4	2,0	13,4	2,5	14,3	2,5	14,3	1,7	21,6	1,1	30,7
38	2,0	15,0	2,0	15,0	2,5	18,7	2,5	18,7	1,8	10,5	1,1	31,3
39	2,0	16,6	2,0	16,6	2,5	23,1	2,5	23,1	1,8	12,1	1,1	31,9
40	2,0	18,2	2,0	18,2	2,6	17,6	2,6	17,6	1,8	13,7	1,2	18,7
41	2,0	19,8	2,0	19,8	2,6	22,0	2,6	22,0	1,8	15,3	1,2	19,3
42	2,1	14,4	2,1	14,4	2,7	16,9	2,7	16,9	1,8	16,9	1,2	19,9
43	2,1	16,0	2,1	16,0	2,7	21,3	2,7	21,3	1,8	18,5	1,2	20,5
44	2,1	17,6	2,1	17,6	2,8	16,5	2,8	16,5	1,8	20,1	1,2	21,1
45	2,1	19,2	2,1	19,2	2,8	20,9	2,8	20,9	1,8	21,7	1,2	21,7
46	2,1	20,8	2,1	20,8	2,9	16,5	2,9	16,5	1,9	10,4	1,2	22,3
47	2,2	15,7	2,2	15,7	2,9	20,9	2,9	20,9	1,9	12,0	1,2	22,9
48	2,2	17,3	2,2	17,3	3,0	16,8	3,0	16,8	1,9	13,6	1,2	23,5
49	2,2	18,9	2,2	18,9	3,0	21,2	3,0	21,2	1,9	15,2	1,2	24,1
50	2,2	20,5	2,2	20,5	3,1	17,3	3,1	17,3	1,9	16,8	1,2	24,7
51	2,3	15,8	2,3	15,8	3,1	21,7	3,1	21,7	1,9	18,4	1,2	25,3
52	2,3	18,4	2,3	18,4	3,1	23,4	3,1	23,4	1,9	21,5	1,2	27,5
53	2,3	20,0	2,3	20,0	3,2	19,9	3,2	19,9	2,0	10,9	1,2	28,1
54	2,4	15,7	2,4	15,7	3,3	16,6	3,3	16,6	2,0	12,5	1,2	28,7
55	2,4	17,3	2,4	17,3	3,3	21,0	3,3	21,0	2,0	14,1	1,2	29,3
56	2,4	18,9	2,4	18,9	3,4	18,0	3,4	18,0	2,0	15,7	1,3	17,1
57	2,4	20,5	2,4	20,5	3,4	22,4	3,4	22,4	2,0	17,3	1,3	17,7
58	2,5	16,5	2,5	16,5	3,5	19,7	3,5	19,7	2,0	18,9	1,3	18,3
59	2,5	18,1	2,5	18,1	3,5	24,1	3,5	24,1	2,0	20,5	1,3	18,9
60	2,5	19,7	2,5	19,7	3,6	21,6	3,6	21,6	2,0	22,1	1,3	19,5
61	2,5	21,3	2,5	21,3	3,7	19,3	3,7	19,3	2,1	12,1	1,3	20,1
62	2,6	17,6	2,6	17,6	3,7	23,7	3,7	23,7	2,1	13,7	1,3	20,7
63	2,6	19,2	2,6	19,2	3,8	21,6	3,8	21,6	2,1	15,3	1,3	21,3
64	2,6	20,8	2,6	20,8	3,9	19,7	3,9	19,7	2,1	16,9	1,3	21,9
65	2,7	17,4	2,7	17,4	3,9	24,1	3,9	24,1	2,1	18,5	1,3	22,5
66	2,7	19,0	2,7	19,0	4,0	22,5	4,0	22,5	2,1	20,1	1,3	23,1
67	2,7	20,6	2,7	20,6	4,1	21,1	4,1	21,1	2,1	21,7	1,3	23,7
68	2,7	22,2	2,7	22,2	4,2	19,9	4,2	19,9	2,2	12,4	1,3	24,3
69	2,8	19,1	2,8	19,1	4,2	24,3	4,2	24,3	2,2	14,0	1,3	24,9
70	2,8	20,7	2,8	20,7	4,3	23,2	4,3	23,2	2,2	15,6	1,4	16,0
71	2,8	22,3	2,8	22,3	4,4	22,3	4,4	22,3	2,2	17,2	1,4	16,6
72	2,9	19,5	2,9	19,5	4,5	21,6	4,5	21,6	2,2	18,8	1,4	17,2
73	2,9	21,1	2,9	21,1	4,6	21,1	4,6	21,1	2,2	20,4	1,4	17,8
74	3,0	18,6	3,0	18,6	4,7	20,7	4,7	20,7	2,2	22,0	1,4	18,4
75	3,0	20,2	3,0	20,2	4,7	25,1	4,7	25,1	2,3	13,4	1,4	19,0
76	3,0	21,8	3,0	21,8	4,8	24,9	4,8	24,9	2,3	15,0	1,4	19,6
77	3,1	19,6	3,1	19,6	4,9	24,8	4,9	24,8	2,3	16,6	1,4	20,2
78	3,1	21,2	3,1	21,2	5,0	24,9	5,0	24,9	2,3	18,2	1,4	20,8
79	3,1	22,8	3,1	22,8	5,1	25,1	5,1	25,1	2,3	19,8	1,4	21,4
80	3,2	20,9	3,2	20,9	5,2	25,4	5,2	25,4	2,3	21,4	1,4	22,0
81	3,2	22,5	3,2	22,5	5,3	25,9	5,3	25,9	2,3	23,0	1,5	15,5
82	3,3	20,8	3,3	20,8	5,5	22,8	5,5	22,8	2,4	14,9	1,5	16,1
83	3,3	22,4	3,3	22,4	5,6	23,7	5,6	23,7	2,4	16,5	1,5	16,7
84	3,4	21,0	3,4	21,0	5,7	24,7	5,7	24,7	2,4	18,1	1,5	17,3
85	3,4	22,6	3,4	22,6	5,8	25,8	5,8	25,8	2,4	19,7	1,5	17,9
86	3,5	21,4	3,5	21,4	6,0	23,9	6,0	23,9	2,4	21,3	1,5	18,5
87	3,5	23,0	3,5	23,0	6,1	25,3	6,1	25,3	2,5	15,0	1,5	19,1
88	3,6	22,0	3,6	22,0	6,2	26,7	6,2	26,7	2,5	16,6	1,5	19,7
89	3,7	21,2	3,7	21,2	6,4	25,5	6,4	25,5	2,5	18,2	1,6	15,3
90	3,7	22,8	3,7	22,8	6,6	24,8	6,6	24,8	2,5	19,8	1,6	15,9
91	3,8	22,3	3,8	22,3	6,7	26,8	6,7	26,8	2,6	15,1	1,6	16,5
92	3,9	22,0	3,9	22,0	6,9	26,7	6,9	26,7	2,6	16,7	1,6	17,1
93	3,9	23,6	3,9	23,6	7,1	26,8	7,1	26,8	2,6	18,3	1,6	17,7
94	4,0	23,4	4,0	23,4	7,3	27,3	7,3	27,3	2,6	19,9	1,6	18,3
95	4,1	23,4	4,1	23,4	7,6	26,4	7,6	26,4	2,7	16,7	1,7	15,4
96	4,2	23,6	4,2	23,6	7,8	27,8	7,8	27,8	2,7	18,3	1,7	16,0
97	4,3	24,0	4,3	24,0	8,1	28,2	8,1	28,2	2,8	16,4	1,7	16,6
98	4,5	23,8	4,5	23,8	8,5	28,5	8,5	28,5	2,8	18,0	1,8	15,0
99	4,6	24,7	4,6	24,7	9,0	29,0	9,0	29,0	2,9	17,3	1,8	15,6
100	5,0	25,1	5,0	25,1	10,1	30,3	10,1	30,3	3,0	17,8	1,9	15,0

Table A 3: Pairs of bm and Tm used for the parameterization of the mileage (cont.)

Index	Mopeds		Motorcycles							
	50 cm³		2-stroke >50 cm³		4-stroke <250 cm³		4-stroke 250 - 750 cm³		4-stroke >750 cm³	
	bm	Tm	bm	Tm	bm	Tm	bm	Tm	bm	Tm
1	1,0	49,0	1,0	25,8	1,5	29,4	1,3	20,9	1,4	20,0
2	1,0	50,2	1,0	30,1	1,5	30,7	1,3	21,0	1,4	20,7
3	1,0	51,4	1,0	34,4	1,5	32,0	1,3	21,1	1,5	17,7
4	1,0	52,6	1,0	38,7	1,6	26,4	1,3	21,2	1,5	18,4
5	1,0	53,8	1,0	43,0	1,6	27,7	1,3	21,3	1,5	19,1
6	1,0	55,0	1,0	47,3	1,6	29,0	1,4	20,0	1,5	19,8
7	1,1	37,9	1,1	20,6	1,6	30,3	1,4	20,1	1,5	20,5
8	1,1	39,1	1,1	24,9	1,6	31,6	1,4	20,2	1,6	16,2
9	1,1	40,3	1,1	29,2	1,6	32,9	1,4	20,3	1,6	16,9
10	1,1	41,5	1,1	33,5	1,7	24,8	1,4	20,4	1,6	17,6
11	1,1	42,7	1,1	37,8	1,7	26,1	1,4	20,5	1,6	18,3
12	1,1	43,9	1,1	42,1	1,7	27,4	1,4	20,6	1,6	19,0
13	1,1	45,1	1,1	46,4	1,7	28,7	1,4	20,7	1,6	19,7
14	1,1	46,3	1,2	18,0	1,7	30,0	1,4	20,8	1,6	20,4
15	1,1	47,5	1,2	22,3	1,7	31,3	1,4	20,9	1,7	15,5
16	1,1	48,7	1,2	26,6	1,7	32,6	1,4	21,0	1,7	16,2
17	1,1	49,9	1,2	30,9	1,8	22,4	1,4	21,1	1,7	16,9
18	1,1	51,1	1,2	35,2	1,8	23,7	1,5	20,0	1,7	17,6
19	1,1	52,3	1,2	39,5	1,8	25,0	1,5	20,1	1,7	18,3
20	1,2	32,0	1,2	43,8	1,8	26,3	1,5	20,2	1,7	19,0
21	1,2	33,2	1,3	14,8	1,8	27,6	1,5	20,3	1,7	19,7
22	1,2	34,4	1,3	19,1	1,8	28,9	1,5	20,4	1,8	14,4
23	1,2	35,6	1,3	23,4	1,8	30,2	1,5	20,5	1,8	15,1
24	1,2	36,8	1,3	27,7	1,8	31,5	1,5	20,6	1,8	15,8
25	1,2	38,0	1,3	32,0	1,8	32,8	1,5	20,7	1,8	16,5
26	1,2	39,2	1,3	36,3	1,9	20,8	1,5	20,8	1,8	17,2
27	1,2	40,4	1,3	40,6	1,9	22,1	1,5	20,9	1,8	17,9
28	1,2	41,6	1,3	44,9	1,9	23,4	1,5	21,0	1,8	18,6
29	1,2	42,8	1,4	16,3	1,9	24,7	1,6	20,0	1,8	19,3
30	1,2	44,0	1,4	20,6	1,9	26,0	1,6	20,1	1,9	13,6
31	1,2	45,2	1,4	24,9	1,9	27,3	1,6	20,2	1,9	14,3
32	1,3	27,4	1,4	29,2	1,9	28,6	1,6	20,3	1,9	15,0
33	1,3	28,6	1,4	33,5	1,9	29,9	1,6	20,4	1,9	15,7
34	1,3	29,8	1,4	37,8	1,9	31,2	1,6	20,5	1,9	16,4
35	1,3	31,0	1,4	42,1	2,0	20,2	1,6	20,6	1,9	17,1
36	1,3	32,2	1,4	46,4	2,0	21,5	1,6	20,7	1,9	17,8
37	1,3	33,4	1,5	18,1	2,0	22,8	1,6	20,8	1,9	18,5
38	1,3	34,6	1,5	22,4	2,0	24,1	1,7	20,0	1,9	19,2
39	1,3	35,8	1,5	26,7	2,0	25,4	1,7	20,1	2,0	13,6
40	1,3	37,0	1,5	31,0	2,0	26,7	1,7	20,2	2,0	14,3
41	1,3	38,2	1,5	35,3	2,0	28,0	1,7	20,3	2,0	15,0
42	1,3	39,4	1,5	39,6	2,0	29,3	1,7	20,4	2,0	15,7
43	1,4	23,8	1,5	43,9	2,1	19,8	1,7	20,5	2,0	16,4
44	1,4	25,0	1,6	15,9	2,1	21,1	1,7	20,6	2,0	17,1
45	1,4	26,2	1,6	20,2	2,1	22,4	1,7	20,7	2,0	17,8
46	1,4	27,4	1,6	24,5	2,1	23,7	1,7	20,8	2,0	18,5
47	1,4	28,6	1,6	28,8	2,1	25,0	1,8	20,1	2,0	19,2
48	1,4	29,8	1,6	33,1	2,1	26,3	1,8	20,2	2,1	14,3
49	1,4	31,0	1,6	37,4	2,1	27,6	1,8	20,3	2,1	15,0
50	1,4	32,2	1,6	41,7	2,2	19,3	1,8	20,4	2,1	15,7
51	1,4	33,4	1,6	46,0	2,2	20,6	1,8	20,5	2,1	16,4
52	1,4	32,7	1,7	18,8	2,3	18,1	1,5	20,8	2,1	15,4
53	1,4	33,9	1,7	23,1	2,3	19,4	1,5	20,9	2,1	16,1
54	1,4	35,1	1,7	27,4	2,3	20,7	1,5	21,0	2,1	16,8
55	1,5	21,2	1,7	31,7	2,3	22,0	1,6	20,0	2,1	17,5
56	1,5	22,4	1,7	36,0	2,3	23,3	1,6	20,1	2,1	18,2
57	1,5	23,6	1,7	40,3	2,3	24,6	1,6	20,2	2,1	18,9
58	1,5	24,8	1,7	44,6	2,4	18,5	1,6	20,3	2,2	14,5
59	1,5	26,0	1,8	17,0	2,4	19,8	1,6	20,4	2,2	15,2
60	1,5	27,2	1,8	21,3	2,4	21,1	1,6	20,5	2,2	15,9
61	1,5	28,4	1,8	25,6	2,4	22,4	1,6	20,6	2,2	16,6
62	1,5	29,6	1,8	29,9	2,5	17,1	1,6	20,7	2,2	17,3
63	1,5	30,8	1,8	34,2	2,5	18,4	1,6	20,8	2,2	18,0
64	1,5	32,0	1,8	38,5	2,5	19,7	1,7	20,0	2,2	18,7
65	1,6	19,3	1,9	15,5	2,5	21,0	1,7	20,1	2,3	14,9
66	1,6	20,5	1,9	19,8	2,5	22,3	1,7	20,2	2,3	15,6
67	1,6	21,7	1,9	24,1	2,6	17,8	1,7	20,3	2,3	16,3
68	1,6	22,9	1,9	28,4	2,6	19,1	1,7	20,4	2,3	17,0
69	1,6	24,1	1,9	32,7	2,6	20,4	1,7	20,5	2,3	17,7
70	1,6	25,3	1,9	37,0	2,7	16,6	1,7	20,6	2,3	18,4
71	1,6	26,5	2,0	18,3	2,7	17,9	1,7	20,7	2,4	15,0
72	1,6	27,7	2,0	22,6	2,7	19,2	1,7	20,8	2,4	15,7
73	1,6	28,9	2,0	26,9	2,7	20,5	1,8	20,1	2,4	16,4
74	1,6	30,1	2,0	31,2	2,8	17,2	1,8	20,2	2,4	17,1
75	1,7	19,3	2,1	16,0	2,8	18,5	1,8	20,3	2,4	17,8
76	1,7	20,5	2,1	20,3	2,8	19,8	1,8	20,4	2,4	18,5
77	1,7	21,7	2,1	24,6	2,9	17,0	1,8	20,5	2,5	15,6
78	1,7	22,9	2,1	28,9	2,9	18,3	1,8	20,6	2,5	16,3
79	1,7	24,1	2,2	16,4	3,0	15,9	1,8	20,7	2,5	17,0
80	1,7	25,3	2,2	20,7	3,0	17,2	1,9	20,1	2,5	17,7
81	1,7	26,5	2,2	25,0	3,0	18,5	1,9	20,2	2,6	15,4
82	1,7	27,7	2,3	14,8	3,1	16,4	1,9	20,3	2,6	16,1
83	1,8	19,5	2,3	19,1	3,1	17,7	1,9	20,4	2,6	16,8
84	1,8	20,7	2,3	23,4	3,2	15,9	1,9	20,5	2,6	17,5
85	1,8	21,9	2,4	15,1	3,2	17,2	1,9	20,6	2,6	18,2
86	1,8	23,1	2,4	19,4	3,3	15,7	2,0	20,2	2,7	16,3
87	1,8	24,3	2,4	23,7	3,3	17,0	2,0	20,3	2,7	17,0
88	1,8	25,5	2,5	17,0	3,4	15,7	2,0	20,4	2,7	17,7
89	1,9	19,6	2,5	21,3	3,4	17,0	2,0	20,5	2,8	16,2
90	1,9	20,8	2,6	16,0	3,5	16,0	2,0	20,6	2,8	16,9
91	1,9	22,0	2,6	20,3	3,6	15,1	2,1	20,3	2,8	17,6
92	1,9	23,2	2,7	16,3	3,6	16,4	2,1	20,4	2,9	16,5
93	1,9	24,4	2,7	20,6	3,7	15,7	2,1	20,5	2,9	17,2
94	2,0	20,5	2,8	17,6	3,8	15,2	2,1	20,6	2,9	17,9
95	2,0	21,7	2,9	15,5	3,9	14,8	2,2	20,4	3,0	17,1
96	2,0	22,9	2,9	19,8	4,0	14,6	2,2	20,5	3,0	17,8
97	2,0	24,1	3,0	18,5	4,0	15,9	2,2	20,6	3,1	17,3
98	2,1	21,9	3,1	18,1	4,2	14,5	2,3	20,5	3,2	17,2
99	2,1	23,1	3,2	18,7	4,3	14,7	2,3	20,6	3,3	17,3
100	2,2	22,3	3,5	18,0	4,4	15,4	2,4	20,6	3,4	17,7

Table A 4: Standard deviation (g/km) of CO emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9	class 10	class 11	class 12	class 13	class 14
Passenger Cars	Gasoline <1,4 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/03	4.303	10.465	9.680	8.872	8.087	4.165	0.243	3.677	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/04	30.005	18.190	16.706	16.862	8.487	7.239	5.991	8.596	9.402	10.233	11.040	4.934	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	8.189	4.825	3.711	2.627	2.351	1.519	1.008	6.478	0.550	2.836	5.123	6.624	2.818	11.828
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	5.566	1.366	1.284	0.824	0.977	0.873	1.829	0.481	1.037	0.675	1.713	2.748	2.425	7.079
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	1.677	1.253	1.090	1.264	0.639	0.694	0.673	1.314	1.216	2.326	3.436	4.347	4.053	6.287
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	0.346	0.183	0.067	0.088	0.246	0.251	1.219	0.117	0.110	0.103	0.096	0.516	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	25.589	9.025	3.892	4.749	3.781	2.117	0.452	3.285	4.490	5.696	6.902	8.107	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	4.635	6.082	2.211	1.900	2.439	2.642	2.845	1.118	1.393	1.669	4.292	5.697	1.287	4.144
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	2.431	1.803	1.420	0.979	1.183	0.760	0.551	0.600	0.570	0.505	0.916	1.117	1.345	2.712
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	1.333	0.843	0.729	1.142	0.976	1.237	0.723	1.413	0.427	0.959	1.491	5.884	3.476	8.321
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.352	0.154	0.214	0.145	0.069	0.327	0.191	0.413	0.284	0.310	0.338	0.364	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/04	22.949	15.038	7.128	5.649	4.171	4.790	5.428	6.048	5.876	5.700	5.528	10.965	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	4.482	1.207	1.507	1.808	1.253	0.682	0.128	0.144	0.161	0.178	3.405	8.781	14.157
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	12.716	2.254	0.409	0.571	2.148	0.241	0.351	0.409	0.549	0.127	1.783	4.416	1.515	0.012
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.886	0.679	0.319	0.139	0.349	0.225	0.282	0.611	0.291	0.354	0.417	0.521	0.821	-1.000

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	0.270	0.223	0.146	0.069	0.060	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.394	0.312	0.238	0.152	0.186	0.160	0.070	11.229	0.044	0.072	0.101	0.180	0.111	0.377
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.568	0.386	0.351	0.416	0.242	0.214	0.154	0.184	0.124	0.098	0.073	0.068	0.061	0.053
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.499	0.316	0.219	0.233	0.176	0.025	0.077	0.027	0.015	0.006	0.022	0.007	0.017	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	-1.000	0.380	0.321	0.262	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.599	0.385	0.325	0.341	0.275	0.275	0.201	0.215	0.178	0.195	0.211	0.213	0.232	0.400
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.310	0.077	0.319	0.225	0.131	0.069	0.007	-1.000	-1.000	-1.000	-1.000	0.011	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles Diesel <3,5 t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles Diesel <3,5 t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks Rigid <=7,5 t	Conventional	3.839	2.497	1.783	1.398	1.181	1.056	0.983	0.940	0.915	0.913	0.913	0.913	0.913	0.913
Heavy Duty Trucks Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	1.145	0.761	0.519	0.390	0.326	0.299	0.293	0.300	0.314	0.316	0.316	0.316	0.316	0.316
Heavy Duty Trucks Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	0.620	0.355	0.254	0.207	0.181	0.168	0.162	0.162	0.168	0.169	0.169	0.169	0.169	0.169
Heavy Duty Trucks Rigid <=7,5 t	HD Euro III - 2000 Standards	0.685	0.411	0.290	0.223	0.184	0.160	0.145	0.137	0.131	0.131	0.131	0.131	0.131	0.131
Heavy Duty Trucks Rigid <=7,5 t	HD Euro IV - 2005 Standards	0.054	0.033	0.023	0.018	0.015	0.013	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Heavy Duty Trucks Rigid <=7,5 t	HD Euro V - 2008 Standards	0.054	0.033	0.023	0.018	0.015	0.013	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Heavy Duty Trucks Rigid <=7,5 t	HD Euro VI	0.054	0.033	0.023	0.018	0.015	0.013	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Heavy Duty Trucks Rigid 7,5 - 12 t	Conventional	6.047	3.205	2.138	1.620	1.338	1.181	1.095	1.046	1.019	1.018	1.018	1.018	1.018	1.018
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	2.175	1.249	0.840	0.641	0.535	0.476	0.442	0.423	0.411	0.410	0.410	0.410	0.410	0.410
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	1.077	0.599	0.421	0.338	0.292	0.266	0.252	0.246	0.248	0.249	0.249	0.249	0.249	0.249
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	1.316	0.732	0.489	0.365	0.296	0.256	0.234	0.221	0.214	0.213	0.213	0.213	0.213	0.213
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	0.100	0.057	0.037	0.027	0.023	0.020	0.018	0.017	0.016	0.016	0.016	0.016	0.016	0.016
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	0.100	0.057	0.037	0.027	0.023	0.020	0.018	0.017	0.016	0.016	0.016	0.016	0.016	0.016
Heavy Duty Trucks Rigid 7,5 - 12 t	HD Euro VI	0.100	0.057	0.037	0.027	0.023	0.020	0.018	0.017	0.016	0.016	0.016	0.016	0.016	0.016
Heavy Duty Trucks Rigid 12 - 14 t	Conventional	6.597	3.452	2.305	1.762	1.465	1.298	1.204	1.151	1.121	1.118	1.118	1.118	1.118	1.118
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	2.455	1.345	0.927	0.714	0.595	0.527	0.489	0.468	0.455	0.455	0.455	0.455	0.455	0.455
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	1.158	0.658	0.467	0.377	0.328	0.299	0.285	0.280	0.283	0.284	0.284	0.284	0.284	0.284
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro III - 2000 Standards	1.500	0.795	0.529	0.400	0.329	0.288	0.265	0.252	0.245	0.245	0.245	0.245	0.245	0.245
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro IV - 2005 Standards	0.106	0.058	0.038	0.029	0.024	0.021	0.020	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro V - 2008 Standards	0.106	0.058	0.038	0.029	0.024	0.021	0.020	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Heavy Duty Trucks Rigid 12 - 14 t	HD Euro VI	0.106	0.058	0.038	0.029	0.024	0.021	0.020	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Heavy Duty Trucks Rigid 14 - 20 t	Conventional	9.490	4.867	3.190	2.403	1.971	1.726	1.586	1.506	1.460	1.456	1.456	1.456	1.456	1.456
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	3.469	1.855	1.253	0.952	0.783	0.687	0.631	0.600	0.582	0.581	0.581	0.581	0.581	0.581
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	1.600	0.877	0.611	0.487	0.419	0.379	0.356	0.345	0.343	0.344	0.344	0.344	0.344	0.344
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro III - 2000 Standards	2.111	1.111	0.723	0.539	0.439	0.382	0.350	0.332	0.322	0.321	0.321	0.321	0.321	0.321
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro IV - 2005 Standards	0.155	0.084	0.053	0.040	0.033	0.029	0.026	0.024	0.023	0.023	0.023	0.023	0.023	0.023
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro V - 2008 Standards	0.155	0.084	0.053	0.040	0.033	0.029	0.026	0.024	0.023	0.023	0.023	0.023	0.023	0.023
Heavy Duty Trucks Rigid 14 - 20 t	HD Euro VI	0.155	0.084	0.053	0.040	0.033	0.029	0.026	0.024	0.023	0.023	0.023	0.023	0.023	0.023
Heavy Duty Trucks Rigid 20 - 26 t	Conventional	6.826	3.566	2.382	1.789	1.463	1.282	1.180	1.124	1.092	1.090	1.090	1.090	1.090	1.090

Heavy Duty Trucks Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	4.540	2.319	1.584	1.214	1.002	0.878	0.806	0.764	0.739	0.737	0.737	0.737	0.737	0.737
Heavy Duty Trucks Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	1.983	1.108	0.779	0.625	0.539	0.490	0.462	0.449	0.450	0.451	0.451	0.451	0.451	0.451
Heavy Duty Trucks Rigid 20 - 26 t	HD Euro III - 2000 Standards	2.712	1.387	0.912	0.682	0.556	0.485	0.445	0.422	0.410	0.409	0.409	0.409	0.409	0.409
Heavy Duty Trucks Rigid 20 - 26 t	HD Euro IV - 2005 Standards	0.189	0.101	0.065	0.049	0.040	0.035	0.032	0.030	0.028	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 20 - 26 t	HD Euro V - 2008 Standards	0.189	0.101	0.065	0.049	0.040	0.035	0.032	0.030	0.028	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 20 - 26 t	HD Euro VI	0.189	0.101	0.065	0.049	0.040	0.035	0.032	0.030	0.028	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 26 - 28 t	Conventional	6.959	3.628	2.476	1.887	1.550	1.355	1.241	1.175	1.136	1.133	1.133	1.133	1.133	1.133
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	4.539	2.341	1.636	1.274	1.062	0.935	0.860	0.814	0.787	0.785	0.785	0.785	0.785	0.785
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	1.993	1.131	0.800	0.643	0.556	0.505	0.476	0.464	0.464	0.465	0.465	0.465	0.465	0.465
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro III - 2000 Standards	2.710	1.429	0.936	0.705	0.581	0.510	0.469	0.443	0.428	0.426	0.426	0.426	0.426	0.426
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro IV - 2005 Standards	0.194	0.102	0.066	0.051	0.043	0.037	0.033	0.030	0.029	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro V - 2008 Standards	0.194	0.102	0.066	0.051	0.043	0.037	0.033	0.030	0.029	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 26 - 28 t	HD Euro VI	0.194	0.102	0.066	0.051	0.043	0.037	0.033	0.030	0.029	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks Rigid 28 - 32 t	Conventional	6.810	3.971	2.703	2.060	1.701	1.490	1.363	1.285	1.237	1.234	1.234	1.234	1.234	1.234
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	4.509	2.508	1.820	1.437	1.207	1.069	0.986	0.936	0.906	0.903	0.903	0.903	0.903	0.903
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	2.128	1.271	0.914	0.740	0.640	0.580	0.544	0.526	0.521	0.522	0.522	0.522	0.522	0.522
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro III - 2000 Standards	2.541	1.509	1.025	0.778	0.643	0.566	0.521	0.494	0.478	0.477	0.477	0.477	0.477	0.477
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro IV - 2005 Standards	0.182	0.108	0.073	0.056	0.047	0.041	0.037	0.034	0.032	0.032	0.032	0.032	0.032	0.032
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro V - 2008 Standards	0.182	0.108	0.073	0.056	0.047	0.041	0.037	0.034	0.032	0.032	0.032	0.032	0.032	0.032
Heavy Duty Trucks Rigid 28 - 32 t	HD Euro VI	0.182	0.108	0.073	0.056	0.047	0.041	0.037	0.034	0.032	0.032	0.032	0.032	0.032	0.032
Heavy Duty Trucks Rigid >32 t	Conventional	7.750	4.039	2.746	2.081	1.709	1.501	1.383	1.317	1.280	1.277	1.277	1.277	1.277	1.277
Heavy Duty Trucks Rigid >32 t	HD Euro I - 91/542/EEC Stage I	5.169	2.681	1.884	1.469	1.226	1.081	0.995	0.943	0.913	0.911	0.911	0.911	0.911	0.911
Heavy Duty Trucks Rigid >32 t	HD Euro II - 91/542/EEC Stage II	2.292	1.317	0.937	0.757	0.657	0.600	0.568	0.556	0.561	0.563	0.563	0.563	0.563	0.563
Heavy Duty Trucks Rigid >32 t	HD Euro III - 2000 Standards	3.011	1.628	1.067	0.802	0.662	0.584	0.539	0.512	0.496	0.495	0.495	0.495	0.495	0.495
Heavy Duty Trucks Rigid >32 t	HD Euro IV - 2005 Standards	0.209	0.112	0.074	0.056	0.046	0.040	0.037	0.034	0.033	0.033	0.033	0.033	0.033	0.033
Heavy Duty Trucks Rigid >32 t	HD Euro V - 2008 Standards	0.209	0.112	0.074	0.056	0.046	0.040	0.037	0.034	0.033	0.033	0.033	0.033	0.033	0.033
Heavy Duty Trucks Rigid >32 t	HD Euro VI	0.209	0.112	0.074	0.056	0.046	0.040	0.037	0.034	0.033	0.033	0.033	0.033	0.033	0.033
Heavy Duty Trucks Articulated 14 - 20 t	Conventional	8.690	4.509	2.984	2.264	1.865	1.634	1.500	1.422	1.376	1.373	1.373	1.373	1.373	1.373
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	3.197	1.736	1.189	0.911	0.754	0.663	0.610	0.580	0.562	0.561	0.561	0.561	0.561	0.561
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	1.516	0.844	0.592	0.474	0.408	0.369	0.346	0.336	0.334	0.335	0.335	0.335	0.335	0.335
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro III - 2000 Standards	1.956	1.040	0.685	0.514	0.420	0.367	0.337	0.321	0.311	0.310	0.310	0.310	0.310	0.310
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro IV - 2005 Standards	0.140	0.077	0.049	0.037	0.031	0.027	0.024	0.023	0.022	0.022	0.022	0.022	0.022	0.022
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro V - 2008 Standards	0.140	0.077	0.049	0.037	0.031	0.027	0.024	0.023	0.022	0.022	0.022	0.022	0.022	0.022
Heavy Duty Trucks Articulated 14 - 20 t	HD Euro VI	0.140	0.077	0.049	0.037	0.031	0.027	0.024	0.023	0.022	0.022	0.022	0.022	0.022	0.022
Heavy Duty Trucks Articulated 20 - 28 t	Conventional	6.247	3.399	2.303	1.749	1.439	1.265	1.166	1.109	1.078	1.075	1.075	1.075	1.075	1.075
Heavy Duty Trucks Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	4.124	2.234	1.570	1.224	1.022	0.903	0.832	0.790	0.765	0.763	0.763	0.763	0.763	0.763

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	1.882	1.095	0.780	0.628	0.542	0.491	0.460	0.445	0.441	0.441	0.441	0.441	0.441
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	2.426	1.344	0.886	0.666	0.550	0.485	0.448	0.427	0.414	0.414	0.414	0.414	0.414
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	0.170	0.095	0.062	0.047	0.039	0.034	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	0.170	0.095	0.062	0.047	0.039	0.034	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	0.170	0.095	0.062	0.047	0.039	0.034	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	6.311	3.568	2.384	1.805	1.493	1.317	1.215	1.155	1.119	1.117	1.117	1.117	1.117
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	4.202	2.339	1.628	1.288	1.095	0.975	0.899	0.851	0.825	0.823	0.823	0.823	0.823
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	1.962	1.159	0.830	0.669	0.578	0.522	0.489	0.471	0.465	0.465	0.465	0.465	0.465
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	2.468	1.386	0.922	0.698	0.578	0.510	0.472	0.449	0.435	0.434	0.434	0.434	0.434
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	0.170	0.096	0.063	0.048	0.040	0.035	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	0.170	0.096	0.063	0.048	0.040	0.035	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	0.170	0.096	0.063	0.048	0.040	0.035	0.031	0.029	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	7.805	4.092	2.796	2.120	1.739	1.523	1.401	1.332	1.293	1.290	1.290	1.290	1.290
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	5.257	2.733	1.940	1.518	1.268	1.118	1.027	0.973	0.941	0.938	0.938	0.938	0.938
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	2.325	1.359	0.970	0.782	0.676	0.612	0.575	0.556	0.553	0.553	0.553	0.553	0.553
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	3.030	1.656	1.091	0.821	0.678	0.598	0.551	0.524	0.508	0.507	0.507	0.507	0.507
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	0.204	0.113	0.074	0.056	0.046	0.040	0.036	0.033	0.031	0.031	0.031	0.031	0.031
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	0.204	0.113	0.074	0.056	0.046	0.040	0.036	0.033	0.031	0.031	0.031	0.031	0.031
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	0.204	0.113	0.074	0.056	0.046	0.040	0.036	0.033	0.031	0.031	0.031	0.031	0.031
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	8.216	4.337	2.996	2.288	1.887	1.658	1.528	1.453	1.411	1.408	1.408	1.408	1.408
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	5.481	3.010	2.088	1.653	1.409	1.259	1.166	1.111	1.085	1.083	1.083	1.083	1.083
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	2.511	1.493	1.073	0.868	0.752	0.682	0.641	0.620	0.616	0.616	0.616	0.616	0.616
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	3.204	1.781	1.182	0.895	0.741	0.655	0.605	0.576	0.559	0.557	0.557	0.557	0.557
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	0.213	0.119	0.078	0.059	0.049	0.043	0.038	0.036	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	0.213	0.119	0.078	0.059	0.049	0.043	0.038	0.036	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	0.213	0.119	0.078	0.059	0.049	0.043	0.038	0.036	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	9.342	5.232	3.511	2.673	2.219	1.958	1.805	1.712	1.656	1.652	1.652	1.652	1.652
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	6.427	3.509	2.552	2.018	1.696	1.500	1.381	1.309	1.265	1.262	1.262	1.262	1.262
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	2.767	1.972	1.393	1.039	0.842	0.754	0.742	0.782	0.859	0.869	0.869	0.869	0.869
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	3.677	2.089	1.398	1.061	0.880	0.779	0.721	0.687	0.666	0.665	0.665	0.665	0.665
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	0.239	0.136	0.090	0.068	0.056	0.049	0.044	0.041	0.039	0.038	0.038	0.038	0.038
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	0.239	0.136	0.090	0.068	0.056	0.049	0.044	0.041	0.039	0.038	0.038	0.038	0.038
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	0.239	0.136	0.090	0.068	0.056	0.049	0.044	0.041	0.039	0.038	0.038	0.038	0.038
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Buses	Urban CNG Buses	EEV	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Buses Midi <=15 t	Conventional	10.408	5.425	3.621	2.705	2.220	1.962	1.825	1.752	1.752	1.752	1.752	1.752	1.752	1.752
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	3.193	1.698	1.094	0.807	0.648	0.557	0.504	0.473	0.473	0.473	0.473	0.473	0.473	0.473
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	2.045	1.076	0.649	0.462	0.364	0.307	0.270	0.245	0.245	0.245	0.245	0.245	0.245	0.245
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	1.791	0.983	0.635	0.466	0.367	0.303	0.257	0.223	0.223	0.223	0.223	0.223	0.223	0.223
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	0.175	0.087	0.054	0.038	0.029	0.024	0.022	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	0.175	0.087	0.054	0.038	0.029	0.024	0.022	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Buses	Urban Buses Midi <=15 t	HD Euro VI	0.175	0.087	0.054	0.038	0.029	0.024	0.022	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Buses	Urban Buses Standard 15 - 18 t	Conventional	11.794	5.863	3.763	2.771	2.206	1.869	1.666	1.544	1.544	1.544	1.544	1.544	1.544	1.544
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	4.172	2.273	1.509	1.130	0.903	0.752	0.644	0.563	0.563	0.563	0.563	0.563	0.563	0.563
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	2.611	1.418	0.869	0.632	0.509	0.428	0.362	0.302	0.302	0.302	0.302	0.302	0.302	0.302
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	2.329	1.320	0.859	0.632	0.499	0.411	0.349	0.303	0.303	0.303	0.303	0.303	0.303	0.303
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	0.220	0.114	0.072	0.050	0.039	0.032	0.028	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	0.220	0.114	0.072	0.050	0.039	0.032	0.028	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	0.220	0.114	0.072	0.050	0.039	0.032	0.028	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Buses	Urban Buses Articulated >18 t	Conventional	13.571	7.362	4.725	3.500	2.819	2.406	2.147	1.982	1.982	1.982	1.982	1.982	1.982	1.982
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	5.020	2.895	1.969	1.492	1.201	1.005	0.864	0.757	0.757	0.757	0.757	0.757	0.757	0.757
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	3.221	1.856	1.182	0.851	0.659	0.534	0.448	0.384	0.384	0.384	0.384	0.384	0.384	0.384
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	2.847	1.714	1.112	0.810	0.632	0.516	0.434	0.374	0.374	0.374	0.374	0.374	0.374	0.374
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	0.262	0.149	0.091	0.064	0.048	0.038	0.032	0.027	0.027	0.027	0.027	0.027	0.027	0.027
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	0.262	0.149	0.091	0.064	0.048	0.038	0.032	0.027	0.027	0.027	0.027	0.027	0.027	0.027
Buses	Urban Buses Articulated >18 t	HD Euro VI	0.262	0.149	0.091	0.064	0.048	0.038	0.032	0.027	0.027	0.027	0.027	0.027	0.027	0.027
Buses	Coaches Standard <=18 t	Conventional	8.055	3.968	2.575	1.892	1.486	1.234	1.077	0.979	0.918	0.879	0.859	0.859	0.859	0.859
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	5.274	2.649	1.732	1.295	1.033	0.867	0.760	0.692	0.647	0.619	0.603	0.603	0.603	0.603
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	3.209	1.459	0.934	0.691	0.553	0.473	0.425	0.397	0.380	0.370	0.365	0.365	0.365	0.365
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	3.204	1.569	1.030	0.770	0.614	0.517	0.455	0.416	0.392	0.376	0.368	0.368	0.368	0.368
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	0.293	0.137	0.083	0.060	0.047	0.040	0.035	0.032	0.029	0.028	0.027	0.027	0.027	0.027
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	0.293	0.137	0.083	0.060	0.047	0.040	0.035	0.032	0.029	0.028	0.027	0.027	0.027	0.027
Buses	Coaches Standard <=18 t	HD Euro VI	0.293	0.137	0.083	0.060	0.047	0.040	0.035	0.032	0.029	0.028	0.027	0.027	0.027	0.027

Buses	Coaches Articulated >18 t	Conventional	9.513	4.476	2.889	2.147	1.718	1.458	1.299	1.203	1.144	1.108	1.090	1.090	1.090	1.090
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	6.164	2.973	1.942	1.474	1.198	1.024	0.912	0.840	0.793	0.763	0.747	0.747	0.747	0.747
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	3.620	1.637	1.053	0.792	0.643	0.554	0.500	0.467	0.447	0.435	0.429	0.429	0.429	0.429
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	3.865	1.758	1.133	0.856	0.689	0.580	0.509	0.462	0.431	0.410	0.399	0.399	0.399	0.399
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	0.317	0.142	0.087	0.064	0.051	0.043	0.038	0.034	0.032	0.031	0.030	0.030	0.030	0.030
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	0.317	0.142	0.087	0.064	0.051	0.043	0.038	0.034	0.032	0.031	0.030	0.030	0.030	0.030
Buses	Coaches Articulated >18 t	HD Euro VI	0.317	0.142	0.087	0.064	0.051	0.043	0.038	0.034	0.032	0.031	0.030	0.030	0.030	0.030
Mopeds	<50 cm³	Conventional	2.000	2.000	2.000	2.000	2.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	1.500	1.500	1.500	1.500	1.500	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	0.200	0.200	0.200	0.200	0.200	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	9.628	10.850	8.455	7.769	11.200	7.783	-1.000	3.655	3.443	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	6.890	2.953	1.890	1.287	4.921	7.692	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	0.000	-1.000	-1.000	-1.000	0.618	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	0.177	1.322	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	5.521	4.199	-1.000	-1.000	6.314	4.391	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	2.838	3.528	-1.000	-1.000	5.821	4.126	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	1.921	1.845	-1.000	-1.000	3.100	5.868	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	0.559	0.559	-1.000	2.900	2.900	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	16.106	19.355	7.626	-1.000	21.250	10.388	-1.000	6.235	10.032	11.623	13.912	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	4.709	8.555	0.037	-1.000	6.451	5.473	-1.000	0.141	11.784	0.153	9.519	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	4.614	6.500	-1.000	-1.000	4.089	6.074	-1.000	-1.000	3.669	-1.000	10.878	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	0.232	0.232	0.809	0.809	0.611	0.611	0.791	0.791	0.791	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	4.199	4.391	-1.000	-1.000	14.548	5.382	-1.000	3.542	-1.000	-1.000	10.032	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	6.951	7.116	-1.000	-1.000	4.272	5.553	-1.000	-1.000	3.127	-1.000	20.704	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	2.463	4.303	-1.000	-1.000	1.979	2.303	-1.000	0.533	5.362	0.180	8.999	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	0.232	0.232	0.809	0.809	0.611	0.611	0.791	0.791	0.791	-1.000	-1.000	-1.000	-1.000

Table A 5: Standard deviation (g/km) of NOx emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9	class 10	class 11	class 12	class 13	class 14
Passenger Cars	Gasoline <1,4 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/03	0.476	0.512	0.547	0.584	0.619	0.553	0.486	0.587	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/04	0.484	0.460	0.452	0.492	0.455	0.639	0.823	0.681	0.631	0.580	0.531	0.731	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	0.633	0.294	0.203	0.169	0.237	0.211	0.102	0.271	0.066	0.251	0.435	0.251	0.303	0.455
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	0.269	0.182	0.161	0.126	0.139	0.079	0.102	0.187	0.134	0.070	0.149	0.236	0.197	0.038
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	0.055	0.068	0.057	0.057	0.059	0.070	0.083	0.097	0.109	0.105	0.100	0.115	0.172	0.411
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	0.182	0.174	0.035	0.025	0.025	0.018	0.019	0.014	0.024	0.017	0.011	0.005	0.008	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1.621	1.576	1.709	1.745	0.995	0.882	0.768	1.195	1.166	1.137	1.109	1.080	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	1.012	0.620	0.236	0.631	0.275	0.546	0.817	0.475	0.534	0.592	0.690	0.499	1.969	1.116
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	0.239	0.222	0.174	0.159	0.180	0.123	0.254	0.161	0.172	0.516	0.193	0.387	0.337	0.217
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.111	0.150	0.127	0.081	0.093	0.070	0.071	0.120	0.043	0.040	0.036	0.074	0.063	0.049
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.047	0.135	0.242	0.073	0.036	0.025	0.049	0.025	0.009	0.014	0.018	0.023	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/04	0.649	0.613	0.576	0.518	0.459	0.503	0.548	0.591	0.541	0.490	0.440	1.285	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	0.634	0.187	0.207	0.226	0.213	0.199	0.187	0.167	0.147	0.127	0.240	0.516	0.792
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	0.721	0.273	0.186	0.225	0.260	0.150	0.125	0.173	0.176	0.147	0.362	0.402	0.015	0.185
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.092	0.055	0.051	0.037	0.071	0.068	0.041	0.042	0.019	0.038	0.058	0.051	0.056	-1.000

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	0.130	0.083	0.049	0.015	0.017	0.074	-1.000	-1.000	-1.000	-1.000	0.007	0.062	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.661	0.207	0.201	0.112	0.152	0.128	0.144	0.135	0.049	0.179	0.310	0.199	0.131	0.125
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.663	0.288	0.218	0.222	0.158	0.196	0.146	0.251	0.117	0.186	0.256	0.249	0.299	0.502
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.491	0.331	0.267	0.272	0.178	0.200	0.216	0.298	0.243	0.180	0.266	0.310	0.331	0.360
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	-1.000	0.605	0.566	0.528	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.857	0.467	0.317	0.310	0.265	0.300	0.265	0.362	0.254	0.300	0.347	0.385	0.464	0.523
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.228	0.539	0.349	0.286	0.223	0.159	0.096	-1.000	-1.000	-1.000	-1.000	0.344	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	1.950	1.521	1.246	1.110	1.062	1.071	1.117	1.186	1.270	1.279	1.279	1.279	1.279	1.279
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	1.084	0.774	0.609	0.544	0.532	0.546	0.573	0.608	0.647	0.651	0.651	0.651	0.651	0.651
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	1.667	1.181	0.922	0.817	0.788	0.797	0.826	0.865	0.908	0.913	0.913	0.913	0.913	0.913
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	0.572	0.294	0.216	0.186	0.175	0.173	0.176	0.183	0.192	0.193	0.193	0.193	0.193	0.193
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	0.289	0.160	0.125	0.113	0.109	0.109	0.112	0.118	0.126	0.127	0.127	0.127	0.127	0.127
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	0.165	0.100	0.075	0.067	0.064	0.063	0.065	0.069	0.073	0.074	0.074	0.074	0.074	0.074
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	0.032	0.018	0.014	0.012	0.012	0.012	0.012	0.013	0.014	0.014	0.014	0.014	0.014	0.014
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	4.068	3.057	2.429	2.109	1.967	1.927	1.946	1.999	2.072	2.080	2.080	2.080	2.080	2.080
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	1.863	1.315	1.016	0.881	0.827	0.814	0.820	0.836	0.856	0.859	0.859	0.859	0.859	0.859
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	2.868	1.992	1.523	1.313	1.225	1.195	1.193	1.204	1.221	1.223	1.223	1.223	1.223	1.223
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	0.943	0.481	0.356	0.303	0.279	0.267	0.262	0.260	0.259	0.259	0.259	0.259	0.259	0.259
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	0.471	0.270	0.210	0.184	0.172	0.166	0.164	0.166	0.169	0.170	0.170	0.170	0.170	0.170
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	0.319	0.166	0.126	0.109	0.101	0.098	0.097	0.096	0.096	0.096	0.096	0.096	0.096	0.096
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	0.052	0.030	0.023	0.020	0.019	0.018	0.018	0.018	0.019	0.019	0.019	0.019	0.019	0.019
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	4.732	3.511	2.758	2.366	2.176	2.097	2.081	2.100	2.138	2.142	2.142	2.142	2.142	2.142
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	2.141	1.514	1.163	0.996	0.919	0.887	0.877	0.877	0.882	0.883	0.883	0.883	0.883	0.883
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	3.429	2.267	1.746	1.493	1.369	1.309	1.279	1.265	1.258	1.258	1.258	1.258	1.258	1.258
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	1.061	0.557	0.422	0.355	0.318	0.298	0.286	0.280	0.276	0.276	0.276	0.276	0.276	0.276
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	0.544	0.318	0.248	0.212	0.193	0.184	0.179	0.176	0.174	0.174	0.174	0.174	0.174	0.174
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	0.356	0.192	0.149	0.127	0.115	0.109	0.105	0.103	0.102	0.102	0.102	0.102	0.102	0.102
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	0.060	0.035	0.027	0.023	0.021	0.020	0.020	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	6.691	4.556	3.550	3.013	2.727	2.573	2.491	2.447	2.424	2.422	2.422	2.422	2.422	2.422
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	3.077	1.953	1.502	1.266	1.142	1.077	1.042	1.024	1.014	1.014	1.014	1.014	1.014	1.014
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	4.752	2.970	2.285	1.919	1.718	1.608	1.548	1.515	1.497	1.496	1.496	1.496	1.496	1.496
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	1.465	0.764	0.552	0.457	0.404	0.372	0.352	0.339	0.331	0.330	0.330	0.330	0.330	0.330
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	0.751	0.416	0.321	0.270	0.241	0.224	0.214	0.208	0.205	0.205	0.205	0.205	0.205	0.205
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	0.492	0.254	0.194	0.162	0.143	0.133	0.126	0.123	0.121	0.120	0.120	0.120	0.120	0.120
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	0.083	0.046	0.035	0.030	0.026	0.025	0.024	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	7.270	4.862	3.892	3.306	2.947	2.727	2.593	2.510	2.459	2.455	2.455	2.455	2.455	2.455

Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	3.755	2.413	1.927	1.635	1.458	1.351	1.286	1.247	1.223	1.221	1.221	1.221	1.221	1.221
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	5.766	3.673	2.904	2.448	2.171	2.002	1.900	1.837	1.799	1.797	1.797	1.797	1.797	1.797
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	1.682	0.909	0.688	0.574	0.505	0.463	0.437	0.422	0.412	0.412	0.412	0.412	0.412	0.412
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	0.880	0.513	0.407	0.345	0.306	0.283	0.268	0.259	0.254	0.254	0.254	0.254	0.254	0.254
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	0.566	0.310	0.244	0.205	0.182	0.168	0.159	0.153	0.150	0.150	0.150	0.150	0.150	0.150
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	0.097	0.056	0.045	0.038	0.034	0.031	0.030	0.029	0.028	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	7.240	5.011	4.070	3.482	3.112	2.878	2.731	2.638	2.580	2.575	2.575	2.575	2.575	2.575
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	3.794	2.514	2.027	1.725	1.537	1.420	1.346	1.301	1.272	1.270	1.270	1.270	1.270	1.270
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	5.807	3.795	3.022	2.554	2.263	2.083	1.972	1.903	1.860	1.856	1.856	1.856	1.856	1.856
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	1.696	0.926	0.699	0.580	0.510	0.467	0.442	0.427	0.417	0.417	0.417	0.417	0.417	0.417
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	0.887	0.529	0.421	0.356	0.316	0.291	0.275	0.266	0.260	0.260	0.260	0.260	0.260	0.260
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	0.571	0.320	0.250	0.210	0.186	0.171	0.162	0.156	0.153	0.152	0.152	0.152	0.152	0.152
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	0.098	0.058	0.046	0.039	0.035	0.032	0.030	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	6.991	5.323	4.490	3.935	3.564	3.316	3.151	3.041	2.968	2.962	2.962	2.962	2.962	2.962
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	4.023	2.764	2.284	1.976	1.778	1.650	1.567	1.514	1.480	1.477	1.477	1.477	1.477	1.477
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	5.850	4.279	3.369	2.888	2.611	2.429	2.294	2.180	2.076	2.066	2.066	2.066	2.066	2.066
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	1.862	1.059	0.792	0.666	0.592	0.545	0.513	0.490	0.474	0.473	0.473	0.473	0.473	0.473
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	0.952	0.605	0.476	0.410	0.370	0.343	0.323	0.308	0.296	0.295	0.295	0.295	0.295	0.295
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	0.642	0.365	0.284	0.244	0.219	0.202	0.189	0.179	0.170	0.170	0.170	0.170	0.170	0.170
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	0.105	0.067	0.052	0.045	0.041	0.038	0.035	0.034	0.033	0.032	0.032	0.032	0.032	0.032
Heavy Duty Trucks	Rigid >32 t	Conventional	7.930	5.651	4.689	4.043	3.609	3.318	3.123	2.991	2.903	2.896	2.896	2.896	2.896	2.896
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	4.244	2.863	2.351	2.017	1.797	1.651	1.555	1.492	1.450	1.447	1.447	1.447	1.447	1.447
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	6.409	4.394	3.482	2.974	2.650	2.430	2.275	2.164	2.081	2.075	2.075	2.075	2.075	2.075
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	1.877	1.089	0.820	0.690	0.612	0.561	0.525	0.499	0.479	0.478	0.478	0.478	0.478	0.478
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	1.000	0.610	0.495	0.423	0.376	0.345	0.325	0.311	0.303	0.302	0.302	0.302	0.302	0.302
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	0.641	0.368	0.295	0.251	0.222	0.203	0.191	0.183	0.178	0.178	0.178	0.178	0.178	0.178
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	0.110	0.067	0.055	0.047	0.041	0.038	0.036	0.034	0.033	0.033	0.033	0.033	0.033	0.033
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	6.437	4.423	3.496	2.959	2.649	2.470	2.366	2.305	2.271	2.268	2.268	2.268	2.268	2.268
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	2.866	1.880	1.478	1.248	1.114	1.037	0.992	0.965	0.950	0.949	0.949	0.949	0.949	0.949
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	4.435	2.856	2.231	1.875	1.663	1.538	1.463	1.419	1.392	1.390	1.390	1.390	1.390	1.390
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	1.389	0.714	0.536	0.443	0.387	0.353	0.332	0.319	0.311	0.310	0.310	0.310	0.310	0.310
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	0.708	0.401	0.315	0.265	0.234	0.216	0.204	0.197	0.193	0.193	0.193	0.193	0.193	0.193
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	0.464	0.244	0.189	0.158	0.139	0.128	0.121	0.116	0.113	0.113	0.113	0.113	0.113	0.113
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	0.078	0.044	0.035	0.029	0.026	0.024	0.022	0.022	0.021	0.021	0.021	0.021	0.021	0.021
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	6.727	4.772	3.935	3.377	3.003	2.752	2.584	2.472	2.397	2.391	2.391	2.391	2.391	2.391
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	3.530	2.549	1.985	1.686	1.511	1.393	1.303	1.225	1.153	1.146	1.146	1.146	1.146	1.146

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	5.234	3.752	2.902	2.453	2.190	2.013	1.876	1.758	1.647	1.637	1.637	1.637	1.637	1.637
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	1.634	0.908	0.689	0.579	0.509	0.461	0.424	0.395	0.372	0.369	0.369	0.369	0.369	0.369
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	0.855	0.512	0.416	0.353	0.311	0.282	0.263	0.250	0.242	0.241	0.241	0.241	0.241	0.241
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	0.558	0.310	0.249	0.210	0.184	0.167	0.155	0.147	0.141	0.141	0.141	0.141	0.141	0.141
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	0.094	0.056	0.046	0.039	0.034	0.031	0.029	0.028	0.027	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	6.672	5.065	4.171	3.625	3.248	2.968	2.749	2.571	2.424	2.411	2.411	2.411	2.411	2.411
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	3.602	2.607	2.102	1.810	1.614	1.471	1.361	1.273	1.200	1.194	1.194	1.194	1.194	1.194
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	5.314	3.903	3.061	2.596	2.313	2.116	1.962	1.827	1.702	1.690	1.690	1.690	1.690	1.690
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	1.659	0.947	0.725	0.610	0.536	0.484	0.444	0.413	0.387	0.385	0.385	0.385	0.385	0.385
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	0.866	0.538	0.441	0.375	0.330	0.298	0.276	0.261	0.251	0.250	0.250	0.250	0.250	0.250
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	0.569	0.325	0.264	0.223	0.194	0.175	0.162	0.153	0.146	0.146	0.146	0.146	0.146	0.146
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	0.095	0.059	0.049	0.041	0.036	0.033	0.030	0.029	0.028	0.028	0.028	0.028	0.028	0.028
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	7.642	5.873	4.830	4.178	3.723	3.383	3.118	2.903	2.724	2.708	2.708	2.708	2.708	2.708
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	4.118	2.972	2.407	2.073	1.845	1.677	1.547	1.441	1.354	1.346	1.346	1.346	1.346	1.346
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	6.366	4.473	3.564	3.044	2.697	2.446	2.252	2.097	1.970	1.959	1.959	1.959	1.959	1.959
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	1.885	1.096	0.838	0.706	0.622	0.563	0.518	0.483	0.454	0.452	0.452	0.452	0.452	0.452
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	1.004	0.621	0.510	0.435	0.383	0.346	0.321	0.303	0.291	0.290	0.290	0.290	0.290	0.290
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	0.644	0.374	0.304	0.257	0.225	0.203	0.188	0.178	0.171	0.170	0.170	0.170	0.170	0.170
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	0.110	0.068	0.056	0.048	0.042	0.038	0.035	0.033	0.032	0.032	0.032	0.032	0.032	0.032
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	8.087	6.463	5.399	4.697	4.193	3.810	3.507	3.259	3.053	3.034	3.034	3.034	3.034	3.034
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	4.332	3.261	2.675	2.314	2.062	1.873	1.724	1.603	1.503	1.493	1.493	1.493	1.493	1.493
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	6.733	4.883	3.941	3.381	2.997	2.713	2.493	2.315	2.167	2.154	2.154	2.154	2.154	2.154
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	1.984	1.202	0.925	0.781	0.690	0.625	0.575	0.536	0.504	0.501	0.501	0.501	0.501	0.501
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	1.072	0.686	0.569	0.487	0.429	0.388	0.358	0.338	0.323	0.322	0.322	0.322	0.322	0.322
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	0.688	0.413	0.338	0.286	0.251	0.226	0.209	0.197	0.189	0.188	0.188	0.188	0.188	0.188
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	0.118	0.075	0.063	0.054	0.047	0.043	0.039	0.037	0.036	0.035	0.035	0.035	0.035	0.035
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	9.331	7.757	6.599	5.771	5.144	4.649	4.248	3.915	3.634	3.609	3.609	3.609	3.609	3.609
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	5.006	3.848	3.231	2.825	2.520	2.274	2.068	1.891	1.736	1.722	1.722	1.722	1.722	1.722
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	7.714	5.818	4.742	4.070	3.600	3.246	2.969	2.745	2.559	2.542	2.542	2.542	2.542	2.542
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	2.255	1.436	1.114	0.940	0.828	0.747	0.685	0.635	0.595	0.591	0.591	0.591	0.591	0.591
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	1.242	0.822	0.688	0.590	0.519	0.467	0.429	0.401	0.381	0.379	0.379	0.379	0.379	0.379
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	0.794	0.494	0.406	0.345	0.301	0.270	0.249	0.233	0.222	0.221	0.221	0.221	0.221	0.221
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	0.137	0.090	0.076	0.065	0.057	0.051	0.047	0.044	0.042	0.042	0.042	0.042	0.042	0.042
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Buses	Urban CNG Buses	EEV	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Buses Midi <=15 t	Conventional	5.836	3.474	2.567	2.138	1.936	1.840	1.794	1.773	1.773	1.773	1.773	1.773	1.773	1.773
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	3.238	1.868	1.341	1.096	0.981	0.927	0.902	0.891	0.891	0.891	0.891	0.891	0.891	0.891
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	4.954	2.819	2.027	1.649	1.469	1.383	1.342	1.322	1.322	1.322	1.322	1.322	1.322	1.322
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	1.738	0.799	0.525	0.407	0.344	0.304	0.277	0.257	0.257	0.257	0.257	0.257	0.257	0.257
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	0.846	0.436	0.300	0.240	0.208	0.189	0.176	0.168	0.168	0.168	0.168	0.168	0.168	0.168
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	0.594	0.284	0.188	0.146	0.124	0.112	0.103	0.097	0.097	0.097	0.097	0.097	0.097	0.097
Buses	Urban Buses Midi <=15 t	HD Euro VI	0.093	0.048	0.033	0.026	0.023	0.021	0.019	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Buses	Urban Buses Standard 15 - 18 t	Conventional	8.219	5.609	4.139	3.423	3.074	2.904	2.821	2.781	2.781	2.781	2.781	2.781	2.781	2.781
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	3.873	2.476	1.779	1.468	1.317	1.233	1.175	1.129	1.129	1.129	1.129	1.129	1.129	1.129
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	6.004	3.678	2.676	2.197	1.946	1.808	1.731	1.687	1.687	1.687	1.687	1.687	1.687	1.687
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	2.177	1.029	0.678	0.530	0.452	0.405	0.374	0.353	0.353	0.353	0.353	0.353	0.353	0.353
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	1.049	0.582	0.392	0.318	0.281	0.256	0.235	0.215	0.215	0.215	0.215	0.215	0.215	0.215
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	0.729	0.374	0.241	0.193	0.169	0.151	0.136	0.122	0.122	0.122	0.122	0.122	0.122	0.122
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	0.115	0.064	0.043	0.035	0.031	0.028	0.026	0.024	0.024	0.024	0.024	0.024	0.024	0.024
Buses	Urban Buses Articulated >18 t	Conventional	9.387	6.879	5.296	4.426	3.947	3.684	3.539	3.459	3.459	3.459	3.459	3.459	3.459	3.459
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	4.368	3.062	2.284	1.882	1.673	1.566	1.510	1.481	1.481	1.481	1.481	1.481	1.481	1.481
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	6.709	4.506	3.330	2.760	2.456	2.269	2.132	2.018	2.018	2.018	2.018	2.018	2.018	2.018
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	2.424	1.275	0.834	0.667	0.581	0.519	0.463	0.410	0.410	0.410	0.410	0.410	0.410	0.410
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	1.202	0.719	0.503	0.410	0.361	0.328	0.300	0.273	0.273	0.273	0.273	0.273	0.273	0.273
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	0.833	0.459	0.306	0.246	0.214	0.192	0.172	0.153	0.153	0.153	0.153	0.153	0.153	0.153
Buses	Urban Buses Articulated >18 t	HD Euro VI	0.132	0.079	0.055	0.045	0.040	0.036	0.033	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Buses	Coaches Standard <=18 t	Conventional	8.381	5.055	3.664	2.982	2.598	2.371	2.242	2.187	2.193	2.263	2.373	2.373	2.373	2.373
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	5.310	2.745	1.999	1.608	1.390	1.268	1.201	1.163	1.142	1.130	1.124	1.124	1.124	1.124
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	8.335	4.366	3.162	2.528	2.169	1.966	1.850	1.784	1.747	1.726	1.715	1.715	1.715	1.715
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	3.008	1.257	0.817	0.632	0.529	0.469	0.434	0.413	0.401	0.394	0.390	0.390	0.390	0.390
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	1.533	0.694	0.478	0.377	0.320	0.286	0.266	0.254	0.248	0.244	0.242	0.242	0.242	0.242
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	1.056	0.445	0.294	0.229	0.192	0.171	0.159	0.151	0.147	0.144	0.143	0.143	0.143	0.143
Buses	Coaches Standard <=18 t	HD Euro VI	0.169	0.076	0.053	0.041	0.035	0.031	0.029	0.028	0.027	0.027	0.027	0.027	0.027	0.027

Buses	Coaches Articulated >18 t	Conventional	10.456	6.006	4.555	3.729	3.232	2.934	2.753	2.645	2.580	2.540	2.520	2.520	2.520	2.520
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	6.199	3.307	2.448	1.975	1.696	1.531	1.434	1.376	1.342	1.322	1.312	1.312	1.312	1.312
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	9.524	5.078	3.735	3.006	2.571	2.311	2.156	2.062	2.006	1.973	1.956	1.956	1.956	1.956
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	3.149	1.384	0.909	0.707	0.598	0.531	0.487	0.457	0.437	0.423	0.415	0.415	0.415	0.415
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	1.621	0.783	0.537	0.427	0.365	0.325	0.299	0.280	0.266	0.256	0.250	0.250	0.250	0.250
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	1.074	0.491	0.329	0.258	0.219	0.195	0.179	0.168	0.160	0.155	0.152	0.152	0.152	0.152
Buses	Coaches Articulated >18 t	HD Euro VI	0.178	0.086	0.059	0.047	0.040	0.036	0.033	0.031	0.029	0.028	0.028	0.028	0.028	0.028
Mopeds	<50 cm³	Conventional	0.010	0.010	0.010	0.010	0.010	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	0.010	0.010	0.010	0.010	0.010	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	0.050	0.050	0.050	0.050	0.050	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	0.036	0.054	0.098	0.045	0.091	0.058	-1.000	0.135	0.016	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	0.140	0.058	0.060	0.016	0.155	0.042	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	0.001	-1.000	-1.000	-1.000	0.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	0.000	0.007	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	0.134	0.139	-1.000	-1.000	0.167	0.125	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	0.082	0.084	-1.000	-1.000	0.089	0.120	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	0.084	0.069	-1.000	-1.000	0.122	0.104	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	0.019	-1.000	0.266	0.266	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	0.074	0.106	0.057	-1.000	0.123	0.161	-1.000	0.062	0.366	0.286	0.375	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	0.099	0.147	0.011	-1.000	0.170	0.173	-1.000	0.003	0.315	0.001	0.376	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	0.153	0.121	-1.000	-1.000	0.111	0.173	-1.000	-1.000	0.201	-1.000	0.363	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	0.023	0.023	0.077	0.077	0.120	0.120	0.193	0.193	0.193	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	0.085	0.125	0.109	-1.000	0.136	0.157	-1.000	0.137	0.448	0.287	0.467	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	0.049	0.049	-1.000	-1.000	0.195	0.088	-1.000	-1.000	0.374	-1.000	0.658	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	0.065	0.148	-1.000	-1.000	0.141	0.141	-1.000	0.128	0.394	0.391	0.474	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	0.023	0.023	0.077	0.077	0.120	0.120	0.193	0.193	0.193	-1.000	-1.000	-1.000	-1.000

Table A 6: Standard deviation (g/km) of VOC emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9	class 10	class 11	class 12	class 13	class 14
Passenger Cars	Gasoline <1,4 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1.573	1.412	1.123	0.825	0.535	0.339	0.143	0.180	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/04	4.077	1.855	1.486	1.195	0.715	0.492	0.269	0.555	0.522	0.489	0.456	0.166	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	0.649	0.419	0.227	0.187	0.161	0.094	0.033	0.102	0.012	0.091	0.169	0.125	0.063	0.093
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	1.488	0.101	0.068	0.050	0.092	0.032	0.038	0.024	0.033	0.029	0.050	0.058	0.024	0.068
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	0.082	0.117	0.030	0.039	0.019	0.019	0.021	0.038	0.018	0.046	0.075	0.129	0.122	0.067
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	0.011	0.027	0.014	0.001	0.003	0.006	0.020	0.016	0.012	0.008	0.004	0.002	0.002
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	3.406	1.801	0.527	2.177	0.311	0.234	0.157	0.279	0.269	0.259	0.248	0.238	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	1.361	0.911	0.166	0.432	0.213	0.381	0.549	0.203	0.172	0.140	0.209	0.083	0.509	0.247
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	0.230	0.177	0.134	0.169	0.199	0.062	0.050	0.044	0.080	0.039	0.036	0.032	0.059	0.072
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.073	0.130	0.017	0.015	0.018	0.021	0.013	0.025	0.011	0.018	0.025	0.030	0.022	0.034
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.011	0.013	0.015	0.004	0.003	0.044	0.003	0.005	0.004	0.006	0.008	0.010	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1.980	2.321	2.662	2.039	1.416	1.020	0.612	0.216	0.502	0.797	1.083	0.459	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	1.257	0.093	0.168	0.243	0.173	0.100	0.030	0.022	0.014	0.006	0.095	0.244	0.394
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	2.613	0.191	0.074	0.126	0.211	0.032	0.019	0.121	0.026	0.011	0.052	0.102	0.001	0.003
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.011	0.012	0.011	0.003	0.006	0.008	0.003	0.008	0.004	0.007	0.009	0.006	0.007	0.007

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	0.007	0.046	0.024	0.001	0.097	0.002	-1.000	-1.000	-1.000	-1.000	0.056	0.059	0.059
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.069	0.036	0.045	0.021	0.031	0.018	0.013	0.021	0.008	0.009	0.011	0.037	0.008	0.022
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.097	0.057	0.036	0.032	0.029	0.032	0.023	0.013	0.015	0.012	0.009	0.010	0.009	0.010
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.056	0.037	0.024	0.022	0.020	0.011	0.013	0.010	0.010	0.002	0.004	0.009	0.004	0.001
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	-1.000	0.114	0.090	0.066	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.217	0.093	0.073	0.057	0.048	0.046	0.030	0.034	0.023	0.024	0.025	0.021	0.029	0.039
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.082	0.016	0.053	0.037	0.022	0.013	0.005	-1.000	-1.000	-1.000	-1.000	0.017	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	3.680	2.153	1.460	1.096	0.873	0.721	0.612	0.530	0.465	0.460	0.460	0.460	0.460	0.460
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	0.306	0.190	0.135	0.104	0.085	0.072	0.064	0.058	0.055	0.054	0.054	0.054	0.054	0.054
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	0.144	0.089	0.062	0.048	0.039	0.033	0.029	0.026	0.024	0.024	0.024	0.024	0.024	0.024
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	0.246	0.156	0.108	0.083	0.067	0.057	0.049	0.043	0.039	0.038	0.038	0.038	0.038	0.038
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	0.014	0.008	0.006	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	0.014	0.008	0.006	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	0.014	0.008	0.006	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	3.379	1.792	1.112	0.807	0.637	0.529	0.455	0.403	0.365	0.362	0.362	0.362	0.362	0.362
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	0.574	0.338	0.217	0.160	0.129	0.111	0.099	0.091	0.085	0.084	0.084	0.084	0.084	0.084
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	0.270	0.157	0.101	0.075	0.060	0.051	0.045	0.041	0.038	0.038	0.038	0.038	0.038	0.038
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	0.480	0.281	0.177	0.128	0.102	0.086	0.076	0.069	0.065	0.064	0.064	0.064	0.064	0.064
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	0.027	0.015	0.009	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	0.027	0.015	0.009	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	0.027	0.015	0.009	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	3.785	1.938	1.179	0.850	0.677	0.574	0.507	0.462	0.429	0.426	0.426	0.426	0.426	0.426
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	0.653	0.366	0.232	0.172	0.141	0.122	0.110	0.102	0.096	0.096	0.096	0.096	0.096	0.096
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	0.307	0.168	0.107	0.079	0.064	0.056	0.050	0.046	0.043	0.043	0.043	0.043	0.043	0.043
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	0.548	0.300	0.182	0.132	0.107	0.092	0.083	0.077	0.073	0.073	0.073	0.073	0.073	0.073
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	0.030	0.016	0.009	0.007	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	0.030	0.016	0.009	0.007	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	0.030	0.016	0.009	0.007	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	5.536	2.828	1.727	1.252	1.004	0.856	0.761	0.695	0.647	0.643	0.643	0.643	0.643	0.643
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	0.950	0.523	0.332	0.246	0.200	0.173	0.155	0.142	0.134	0.133	0.133	0.133	0.133	0.133
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	0.448	0.240	0.153	0.114	0.092	0.079	0.070	0.065	0.061	0.061	0.061	0.061	0.061	0.061
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	0.810	0.436	0.266	0.192	0.155	0.133	0.119	0.110	0.103	0.103	0.103	0.103	0.103	0.103
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	0.045	0.023	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	0.045	0.023	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	0.045	0.023	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	3.109	1.617	0.980	0.704	0.558	0.467	0.405	0.360	0.328	0.325	0.325	0.325	0.325	0.325

Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	1.216	0.643	0.406	0.298	0.240	0.205	0.181	0.165	0.153	0.152	0.152	0.152	0.152
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	0.554	0.296	0.185	0.137	0.111	0.094	0.082	0.074	0.068	0.067	0.067	0.067	0.067	0.067
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	1.031	0.529	0.321	0.231	0.184	0.156	0.138	0.126	0.117	0.116	0.116	0.116	0.116	0.116
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	0.057	0.028	0.017	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	0.057	0.028	0.017	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	0.057	0.028	0.017	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	3.154	1.640	1.009	0.739	0.593	0.497	0.428	0.375	0.334	0.331	0.331	0.331	0.331	0.331
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	1.227	0.648	0.410	0.307	0.250	0.214	0.188	0.170	0.156	0.155	0.155	0.155	0.155	0.155
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	0.560	0.300	0.190	0.143	0.116	0.099	0.086	0.077	0.069	0.068	0.068	0.068	0.068	0.068
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	1.044	0.538	0.330	0.243	0.197	0.168	0.146	0.129	0.116	0.115	0.115	0.115	0.115	0.115
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	0.058	0.029	0.017	0.012	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	0.058	0.029	0.017	0.012	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	0.058	0.029	0.017	0.012	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	3.014	1.645	1.044	0.763	0.604	0.504	0.439	0.394	0.365	0.362	0.362	0.362	0.362	0.362
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	1.158	0.657	0.433	0.324	0.263	0.225	0.200	0.183	0.170	0.169	0.169	0.169	0.169	0.169
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	0.532	0.302	0.199	0.150	0.121	0.103	0.091	0.082	0.076	0.075	0.075	0.075	0.075	0.075
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	0.945	0.535	0.343	0.253	0.203	0.173	0.153	0.139	0.129	0.128	0.128	0.128	0.128	0.128
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	0.053	0.028	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	0.053	0.028	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	0.053	0.028	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid >32 t	Conventional	3.474	1.760	1.071	0.766	0.602	0.503	0.437	0.391	0.357	0.354	0.354	0.354	0.354	0.354
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	1.361	0.718	0.454	0.334	0.269	0.229	0.202	0.184	0.170	0.169	0.169	0.169	0.169	0.169
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	0.616	0.329	0.206	0.152	0.123	0.105	0.092	0.082	0.074	0.074	0.074	0.074	0.074	0.074
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	1.132	0.582	0.354	0.255	0.203	0.172	0.152	0.138	0.128	0.128	0.128	0.128	0.128	0.128
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	0.062	0.031	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	0.062	0.031	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	0.062	0.031	0.018	0.013	0.010	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	5.021	2.569	1.550	1.125	0.905	0.770	0.678	0.612	0.564	0.560	0.560	0.560	0.560	0.560
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	0.862	0.478	0.304	0.225	0.183	0.157	0.141	0.129	0.121	0.120	0.120	0.120	0.120	0.120
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	0.404	0.222	0.140	0.104	0.085	0.073	0.064	0.058	0.054	0.053	0.053	0.053	0.053	0.053
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	0.724	0.396	0.241	0.175	0.140	0.121	0.108	0.100	0.094	0.094	0.094	0.094	0.094	0.094
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	0.040	0.021	0.013	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	0.040	0.021	0.013	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	0.040	0.021	0.013	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	2.791	1.479	0.898	0.645	0.513	0.435	0.385	0.351	0.327	0.325	0.325	0.325	0.325	0.325
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	1.078	0.594	0.377	0.279	0.227	0.195	0.175	0.160	0.150	0.149	0.149	0.149	0.149	0.149

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	0.501	0.273	0.173	0.128	0.104	0.089	0.079	0.072	0.067	0.067	0.067	0.067	0.067	0.067
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	0.902	0.487	0.296	0.214	0.172	0.148	0.133	0.123	0.116	0.115	0.115	0.115	0.115	0.115
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	2.782	1.464	0.886	0.636	0.506	0.431	0.382	0.349	0.326	0.324	0.324	0.324	0.324	0.324
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	1.073	0.592	0.378	0.280	0.228	0.196	0.175	0.161	0.150	0.149	0.149	0.149	0.149	0.149
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	0.501	0.273	0.172	0.128	0.105	0.090	0.079	0.071	0.066	0.065	0.065	0.065	0.065	0.065
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	0.893	0.483	0.294	0.213	0.172	0.148	0.132	0.122	0.115	0.114	0.114	0.114	0.114	0.114
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	0.050	0.026	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	3.430	1.747	1.058	0.756	0.596	0.500	0.437	0.393	0.362	0.359	0.359	0.359	0.359	0.359
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	1.346	0.716	0.453	0.333	0.268	0.228	0.201	0.183	0.169	0.168	0.168	0.168	0.168	0.168
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	0.610	0.327	0.205	0.152	0.123	0.104	0.091	0.081	0.074	0.073	0.073	0.073	0.073	0.073
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	1.112	0.577	0.351	0.253	0.202	0.171	0.152	0.138	0.128	0.127	0.127	0.127	0.127	0.127
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	0.061	0.031	0.018	0.013	0.010	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	0.061	0.031	0.018	0.013	0.010	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	0.061	0.031	0.018	0.013	0.010	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	3.547	1.808	1.089	0.777	0.613	0.515	0.452	0.408	0.377	0.375	0.375	0.375	0.375	0.375
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	1.390	0.747	0.470	0.348	0.282	0.240	0.212	0.191	0.176	0.175	0.175	0.175	0.175	0.175
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	0.632	0.341	0.214	0.159	0.129	0.110	0.096	0.085	0.076	0.075	0.075	0.075	0.075	0.075
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	1.145	0.596	0.361	0.262	0.211	0.179	0.157	0.141	0.128	0.127	0.127	0.127	0.127	0.127
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	0.063	0.032	0.019	0.013	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	0.063	0.032	0.019	0.013	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	0.063	0.032	0.019	0.013	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	3.973	2.016	1.212	0.865	0.685	0.577	0.508	0.460	0.426	0.423	0.423	0.423	0.423	0.423
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	1.560	0.839	0.534	0.396	0.320	0.274	0.243	0.222	0.206	0.205	0.205	0.205	0.205	0.205
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	0.710	0.383	0.241	0.180	0.147	0.125	0.109	0.096	0.086	0.085	0.085	0.085	0.085	0.085
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	1.274	0.665	0.404	0.294	0.238	0.203	0.178	0.158	0.143	0.142	0.142	0.142	0.142	0.142
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	0.070	0.035	0.021	0.015	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	0.070	0.035	0.021	0.015	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	0.070	0.035	0.021	0.015	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Buses	Urban CNG Buses	EEV	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Buses Midi <=15 t	Conventional	8.931	3.998	2.684	1.996	1.620	1.414	1.302	1.240	1.240	1.240	1.240	1.240	1.240	1.240
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	0.721	0.354	0.244	0.185	0.154	0.137	0.128	0.123	0.123	0.123	0.123	0.123	0.123	0.123
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	0.355	0.168	0.115	0.086	0.071	0.063	0.059	0.057	0.057	0.057	0.057	0.057	0.057	0.057
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	0.578	0.281	0.194	0.147	0.122	0.108	0.101	0.097	0.097	0.097	0.097	0.097	0.097	0.097
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	0.033	0.015	0.010	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	0.033	0.015	0.010	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Midi <=15 t	HD Euro VI	0.033	0.015	0.010	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Standard 15 - 18 t	Conventional	6.025	2.503	1.655	1.207	0.943	0.786	0.693	0.638	0.638	0.638	0.638	0.638	0.638	0.638
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	0.972	0.459	0.320	0.240	0.193	0.166	0.149	0.140	0.140	0.140	0.140	0.140	0.140	0.140
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	0.459	0.219	0.150	0.112	0.090	0.078	0.071	0.067	0.067	0.067	0.067	0.067	0.067	0.067
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	0.752	0.366	0.254	0.191	0.153	0.132	0.119	0.112	0.112	0.112	0.112	0.112	0.112	0.112
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	0.043	0.020	0.013	0.010	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	0.043	0.020	0.013	0.010	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	0.043	0.020	0.013	0.010	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Articulated >18 t	Conventional	6.559	2.649	1.730	1.254	0.977	0.813	0.717	0.660	0.660	0.660	0.660	0.660	0.660	0.660
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	1.054	0.498	0.347	0.263	0.213	0.183	0.166	0.155	0.155	0.155	0.155	0.155	0.155	0.155
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	0.498	0.237	0.163	0.122	0.098	0.085	0.078	0.073	0.073	0.073	0.073	0.073	0.073	0.073
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	0.816	0.391	0.272	0.204	0.164	0.141	0.128	0.120	0.120	0.120	0.120	0.120	0.120	0.120
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	0.047	0.021	0.014	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	0.047	0.021	0.014	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Urban Buses Articulated >18 t	HD Euro VI	0.047	0.021	0.014	0.010	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Coaches Standard <=18 t	Conventional	3.141	1.673	1.069	0.772	0.598	0.485	0.405	0.347	0.303	0.267	0.244	0.244	0.244	0.244
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	1.257	0.702	0.460	0.341	0.270	0.223	0.191	0.169	0.154	0.144	0.138	0.138	0.138	0.138
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	0.630	0.334	0.219	0.163	0.130	0.108	0.093	0.081	0.072	0.065	0.060	0.060	0.060	0.060
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	1.170	0.608	0.392	0.287	0.227	0.190	0.166	0.150	0.139	0.132	0.127	0.127	0.127	0.127
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	0.066	0.033	0.021	0.015	0.012	0.010	0.008	0.008	0.007	0.007	0.006	0.006	0.006	0.006
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	0.066	0.033	0.021	0.015	0.012	0.010	0.008	0.008	0.007	0.007	0.006	0.006	0.006	0.006
Buses	Coaches Standard <=18 t	HD Euro VI	0.066	0.033	0.021	0.015	0.012	0.010	0.008	0.008	0.007	0.007	0.006	0.006	0.006	0.006

Buses	Coaches Articulated >18 t	Conventional	3.840	1.873	1.170	0.845	0.664	0.552	0.478	0.427	0.391	0.365	0.348	0.348	0.348	0.348
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	1.504	0.771	0.498	0.368	0.295	0.249	0.219	0.198	0.183	0.173	0.166	0.166	0.166	0.166
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	0.727	0.366	0.235	0.173	0.137	0.115	0.101	0.091	0.084	0.080	0.077	0.077	0.077	0.077
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	1.528	0.723	0.425	0.301	0.237	0.200	0.176	0.160	0.148	0.139	0.134	0.134	0.134	0.134
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	0.085	0.039	0.022	0.016	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	0.085	0.039	0.022	0.016	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Buses	Coaches Articulated >18 t	HD Euro VI	0.085	0.039	0.022	0.016	0.012	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007
Mopeds	<50 cm³	Conventional	2.000	2.000	2.000	2.000	2.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	0.500	0.500	0.500	0.500	0.500	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	0.200	0.200	0.200	0.200	0.200	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	5.920	5.536	3.450	4.637	3.548	3.575	-1.000	2.724	2.180	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	0.913	1.078	0.487	0.453	0.923	0.977	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	0.002	-1.000	-1.000	-1.000	0.169	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	-1.000	0.141	0.226	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	0.798	0.732	-1.000	-1.000	0.929	0.467	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	0.427	0.571	-1.000	-1.000	0.556	0.245	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	0.279	0.293	-1.000	-1.000	0.135	0.173	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	0.007	0.007	-1.000	0.066	0.066	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	2.341	2.485	1.444	-1.000	1.735	1.285	-1.000	0.326	0.503	0.318	0.626	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	0.818	0.802	0.025	-1.000	0.455	0.307	-1.000	0.022	0.205	0.004	0.463	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	0.439	0.587	-1.000	-1.000	0.263	0.254	-1.000	-1.000	0.216	-1.000	0.429	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	0.024	0.024	0.081	0.081	0.060	0.060	0.096	0.096	0.096	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	2.378	3.285	2.327	-1.000	2.041	0.857	-1.000	0.368	0.513	0.546	0.975	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	0.708	0.742	-1.000	-1.000	0.409	0.304	-1.000	-1.000	0.183	-1.000	0.517	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	0.294	0.504	-1.000	-1.000	0.183	0.178	-1.000	0.014	0.237	0.076	0.415	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	0.024	0.024	0.081	0.081	0.060	0.060	0.096	0.096	0.096	-1.000	-1.000	-1.000	-1.000

Table A 7: Standard deviation (g/km) of exhaust PM emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9	class 10	class 11	class 12	class 13	class 14
Passenger Cars	Gasoline <1,4 l	PRE ECE	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	ECE 15/02	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	ECE 15/03	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	ECE 15/04	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	Improved Conventional	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	Open Loop	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline <1,4 l	PC Euro 6	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PRE ECE	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	ECE 15/02	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	ECE 15/03	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	ECE 15/04	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Gasoline >2,0 l	PC Euro 6	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Passenger Cars	Diesel <2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.034	0.027	0.042	0.039	0.036	0.030	0.024	0.059	0.057	0.055	0.053	0.051	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.028	0.037	0.022	0.024	0.015	0.046	0.020	0.012	0.010	0.012	0.015	0.037	0.042	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.011	0.021	0.012	0.012	0.012	0.018	0.018	0.014	0.011	0.008	0.012	0.031	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	-1.000	0.035	0.038	0.041	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.069	0.118	0.040	0.033	0.041	0.012	0.110	0.010	0.020	0.025	0.030	0.058	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.003	0.024	0.003	0.004	0.004	0.013	0.021	-1.000	-1.000	-1.000	-1.000	0.023	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	Conventional	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Light Duty Vehicles	Diesel <3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	0.694	0.392	0.275	0.216	0.183	0.165	0.154	0.148	0.145	0.145	0.145	0.145	0.145	0.145
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	0.156	0.097	0.067	0.052	0.044	0.039	0.037	0.036	0.035	0.035	0.035	0.035	0.035	0.035
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	0.033	0.023	0.018	0.016	0.015	0.014	0.014	0.014	0.016	0.016	0.016	0.016	0.016	0.016
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	0.043	0.031	0.023	0.018	0.015	0.013	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	0.014	0.007	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	0.014	0.007	0.005	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	0.843	0.440	0.293	0.223	0.184	0.163	0.150	0.143	0.140	0.139	0.139	0.139	0.139	0.139
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	0.302	0.170	0.110	0.082	0.067	0.059	0.055	0.053	0.052	0.052	0.052	0.052	0.052	0.052
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	0.059	0.043	0.032	0.025	0.022	0.021	0.021	0.022	0.024	0.024	0.024	0.024	0.024	0.024
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	0.092	0.057	0.038	0.028	0.023	0.020	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	0.025	0.012	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	0.026	0.012	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	0.642	0.330	0.222	0.171	0.142	0.126	0.117	0.112	0.109	0.108	0.108	0.108	0.108	0.108
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	0.330	0.180	0.118	0.089	0.074	0.065	0.061	0.058	0.057	0.057	0.057	0.057	0.057	0.057
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	0.062	0.046	0.035	0.028	0.024	0.022	0.023	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	0.104	0.060	0.039	0.029	0.024	0.021	0.020	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	0.026	0.012	0.008	0.006	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	0.027	0.013	0.008	0.006	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	0.923	0.467	0.306	0.232	0.191	0.168	0.154	0.145	0.141	0.140	0.140	0.140	0.140	0.140
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	0.483	0.261	0.161	0.119	0.098	0.086	0.079	0.074	0.071	0.071	0.071	0.071	0.071	0.071
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	0.092	0.057	0.042	0.035	0.031	0.029	0.028	0.028	0.029	0.030	0.030	0.030	0.030	0.030
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	0.155	0.088	0.054	0.040	0.033	0.029	0.027	0.025	0.025	0.024	0.024	0.024	0.024	0.024
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	0.038	0.018	0.011	0.008	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	0.039	0.018	0.011	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	0.739	0.407	0.281	0.217	0.181	0.160	0.148	0.141	0.137	0.136	0.136	0.136	0.136	0.136

Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	0.674	0.330	0.210	0.155	0.125	0.108	0.097	0.091	0.088	0.088	0.088	0.088	0.088	0.088
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	0.110	0.082	0.060	0.047	0.039	0.035	0.035	0.037	0.041	0.041	0.041	0.041	0.041	0.041
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	0.201	0.109	0.069	0.050	0.041	0.035	0.032	0.030	0.029	0.029	0.029	0.029	0.029	0.029
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	0.046	0.022	0.013	0.010	0.008	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	0.046	0.022	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	0.756	0.416	0.294	0.231	0.193	0.170	0.156	0.147	0.142	0.142	0.142	0.142	0.142	0.142
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	0.681	0.330	0.215	0.162	0.133	0.115	0.104	0.097	0.093	0.093	0.093	0.093	0.093	0.093
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	0.110	0.084	0.063	0.050	0.041	0.038	0.037	0.039	0.043	0.044	0.044	0.044	0.044	0.044
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	0.203	0.108	0.071	0.054	0.044	0.038	0.034	0.032	0.030	0.030	0.030	0.030	0.030	0.030
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	0.046	0.022	0.013	0.010	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	0.047	0.022	0.014	0.010	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	0.752	0.440	0.322	0.255	0.214	0.189	0.173	0.164	0.157	0.157	0.157	0.157	0.157	0.157
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	0.650	0.340	0.232	0.178	0.147	0.128	0.117	0.110	0.106	0.106	0.106	0.106	0.106	0.106
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	0.112	0.091	0.072	0.058	0.048	0.042	0.042	0.046	0.054	0.056	0.056	0.056	0.056	0.056
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	0.175	0.108	0.075	0.058	0.048	0.041	0.038	0.035	0.034	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	0.049	0.023	0.014	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	0.050	0.024	0.015	0.011	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Rigid >32 t	Conventional	0.851	0.464	0.328	0.256	0.214	0.189	0.174	0.166	0.160	0.160	0.160	0.160	0.160	0.160
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	0.751	0.373	0.246	0.185	0.151	0.130	0.118	0.111	0.107	0.106	0.106	0.106	0.106	0.106
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	0.127	0.099	0.075	0.059	0.048	0.043	0.043	0.046	0.054	0.055	0.055	0.055	0.055	0.055
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	0.221	0.120	0.078	0.059	0.048	0.041	0.037	0.035	0.034	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	0.050	0.024	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	0.051	0.025	0.015	0.011	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	0.844	0.433	0.287	0.218	0.180	0.157	0.144	0.136	0.132	0.131	0.131	0.131	0.131	0.131
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	0.436	0.236	0.153	0.114	0.094	0.082	0.075	0.071	0.068	0.068	0.068	0.068	0.068	0.068
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	0.081	0.060	0.044	0.035	0.029	0.027	0.027	0.028	0.030	0.031	0.031	0.031	0.031	0.031
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	0.137	0.080	0.051	0.038	0.031	0.027	0.025	0.024	0.023	0.023	0.023	0.023	0.023	0.023
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	0.034	0.016	0.010	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	0.035	0.017	0.010	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	0.731	0.418	0.295	0.231	0.193	0.171	0.157	0.149	0.144	0.144	0.144	0.144	0.144	0.144
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	0.554	0.298	0.199	0.151	0.125	0.109	0.100	0.094	0.091	0.090	0.090	0.090	0.090	0.090

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	0.102	0.080	0.061	0.048	0.039	0.035	0.035	0.038	0.044	0.044	0.044	0.044	0.044	0.044
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	0.173	0.100	0.065	0.048	0.040	0.035	0.032	0.031	0.030	0.030	0.030	0.030	0.030	0.030
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	0.043	0.020	0.012	0.009	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	0.044	0.021	0.013	0.009	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	0.741	0.430	0.307	0.241	0.202	0.179	0.164	0.155	0.150	0.150	0.150	0.150	0.150	0.150
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	0.555	0.303	0.206	0.159	0.132	0.115	0.105	0.099	0.095	0.095	0.095	0.095	0.095	0.095
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	0.106	0.085	0.066	0.052	0.042	0.037	0.037	0.041	0.049	0.050	0.050	0.050	0.050	0.050
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	0.174	0.099	0.066	0.050	0.041	0.036	0.033	0.031	0.030	0.030	0.030	0.030	0.030	0.030
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	0.043	0.020	0.013	0.009	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	0.044	0.021	0.013	0.009	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	0.856	0.471	0.335	0.262	0.218	0.192	0.175	0.165	0.159	0.159	0.159	0.159	0.159	0.159
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	0.755	0.378	0.252	0.191	0.155	0.134	0.121	0.113	0.108	0.108	0.108	0.108	0.108	0.108
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	0.128	0.102	0.079	0.062	0.050	0.043	0.042	0.047	0.057	0.058	0.058	0.058	0.058	0.058
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	0.219	0.120	0.079	0.060	0.049	0.042	0.038	0.035	0.034	0.034	0.034	0.034	0.034	0.034
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	0.050	0.024	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	0.051	0.025	0.015	0.011	0.009	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	0.896	0.500	0.362	0.286	0.239	0.211	0.193	0.182	0.176	0.175	0.175	0.175	0.175	0.175
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	0.781	0.398	0.272	0.208	0.171	0.149	0.135	0.127	0.122	0.121	0.121	0.121	0.121	0.121
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	0.141	0.114	0.089	0.069	0.056	0.049	0.048	0.053	0.064	0.065	0.065	0.065	0.065	0.065
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	0.227	0.125	0.084	0.064	0.053	0.046	0.041	0.038	0.037	0.037	0.037	0.037	0.037	0.037
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	0.052	0.025	0.016	0.011	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	0.053	0.026	0.016	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	1.031	0.584	0.428	0.340	0.285	0.251	0.229	0.216	0.207	0.207	0.207	0.207	0.207	0.207
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	0.885	0.462	0.322	0.250	0.207	0.180	0.164	0.153	0.147	0.147	0.147	0.147	0.147	0.147
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	0.171	0.138	0.108	0.085	0.069	0.060	0.059	0.065	0.077	0.079	0.079	0.079	0.079	0.079
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	0.254	0.142	0.098	0.076	0.062	0.054	0.049	0.046	0.044	0.043	0.043	0.043	0.043	0.043
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	0.058	0.028	0.018	0.013	0.010	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	0.059	0.029	0.018	0.013	0.011	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	0.003	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Buses	Urban CNG Buses	EEV	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Buses Midi <=15 t	Conventional	1.340	0.638	0.412	0.302	0.243	0.211	0.194	0.185	0.185	0.185	0.185	0.185	0.185	0.185
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	0.311	0.182	0.124	0.094	0.078	0.070	0.066	0.064	0.064	0.064	0.064	0.064	0.064	0.064
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	0.091	0.058	0.040	0.031	0.027	0.025	0.024	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	0.087	0.058	0.040	0.031	0.027	0.024	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	0.037	0.015	0.009	0.007	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	0.038	0.016	0.010	0.007	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Buses	Urban Buses Midi <=15 t	HD Euro VI	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buses	Urban Buses Standard 15 - 18 t	Conventional	1.217	0.583	0.368	0.269	0.213	0.180	0.161	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	0.426	0.246	0.169	0.131	0.107	0.092	0.081	0.072	0.072	0.072	0.072	0.072	0.072	0.072
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	0.119	0.080	0.056	0.043	0.037	0.033	0.031	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	0.121	0.077	0.055	0.042	0.035	0.031	0.028	0.027	0.027	0.027	0.027	0.027	0.027	0.027
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	0.047	0.020	0.012	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	0.048	0.020	0.012	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buses	Urban Buses Articulated >18 t	Conventional	1.397	0.713	0.452	0.333	0.267	0.228	0.204	0.189	0.189	0.189	0.189	0.189	0.189	0.189
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	0.491	0.296	0.209	0.163	0.135	0.117	0.103	0.093	0.093	0.093	0.093	0.093	0.093	0.093
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	0.148	0.104	0.075	0.058	0.049	0.043	0.040	0.038	0.038	0.038	0.038	0.038	0.038	0.038
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	0.132	0.091	0.065	0.050	0.041	0.036	0.034	0.032	0.032	0.032	0.032	0.032	0.032	0.032
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	0.052	0.023	0.014	0.010	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	0.053	0.023	0.014	0.010	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Buses	Urban Buses Articulated >18 t	HD Euro VI	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buses	Coaches Standard <=18 t	Conventional	0.789	0.423	0.289	0.220	0.178	0.151	0.134	0.123	0.116	0.112	0.110	0.110	0.110	0.110
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	0.552	0.318	0.217	0.164	0.131	0.109	0.095	0.085	0.079	0.075	0.072	0.072	0.072	0.072
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	0.153	0.087	0.064	0.051	0.042	0.037	0.034	0.032	0.030	0.029	0.029	0.029	0.029	0.029
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	0.188	0.113	0.077	0.059	0.048	0.041	0.036	0.033	0.031	0.029	0.028	0.028	0.028	0.028
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	0.065	0.027	0.016	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	0.067	0.028	0.017	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Coaches Standard <=18 t	HD Euro VI	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Buses	Coaches Articulated >18 t	Conventional	0.948	0.480	0.330	0.254	0.208	0.179	0.161	0.150	0.143	0.138	0.136	0.136	0.136	0.136
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	0.661	0.352	0.239	0.182	0.148	0.126	0.112	0.103	0.097	0.094	0.092	0.092	0.092	0.092
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	0.178	0.099	0.072	0.058	0.049	0.043	0.040	0.038	0.037	0.036	0.035	0.035	0.035	0.035
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	0.262	0.135	0.085	0.063	0.051	0.044	0.039	0.036	0.033	0.031	0.030	0.030	0.030	0.030
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	0.070	0.029	0.017	0.012	0.010	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	0.072	0.030	0.018	0.013	0.010	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006
Buses	Coaches Articulated >18 t	HD Euro VI	0.004	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mopeds	<50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Table A 8: Standard deviation (g/km) of fuel consumption factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9	class 10	class 11	class 12	class 13	class 14
Passenger Cars	Gasoline <1,4 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/03	2.156	0.435	0.306	0.172	0.042	0.312	0.581	0.729	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	ECE 15/04	3.030	1.056	0.773	0.975	0.257	0.271	0.285	0.754	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	31.376	11.601	7.949	9.087	6.088	7.444	4.945	6.580	4.039	5.754	7.469	14.082	6.865	13.276
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	44.841	15.568	9.987	9.059	6.135	6.019	5.807	8.765	3.987	2.097	6.657	6.265	5.752	5.624
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	38.185	18.976	11.721	11.836	7.200	11.125	6.531	9.880	5.302	6.299	7.295	7.256	7.658	7.819
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	19.397	17.667	12.667	10.667	4.120	6.990	5.662	4.613	6.770	4.823	2.816	0.869	2.006	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	6.529	2.190	1.584	1.443	0.681	0.774	0.868	1.645	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	28.927	13.496	9.102	8.944	7.463	6.120	4.776	6.159	5.463	4.767	7.733	6.156	4.394	9.118
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	59.864	20.304	11.275	13.645	8.505	7.643	6.957	9.527	6.157	4.699	10.178	11.411	6.572	9.183
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	40.937	19.166	12.086	11.349	7.297	11.954	7.765	11.787	4.785	5.905	7.025	6.353	9.059	10.867
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	11.941	13.952	9.221	8.610	4.696	10.057	6.027	7.288	8.427	6.728	4.978	3.279	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PRE ECE	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/02	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/03	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	ECE 15/04	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	-1.000	21.321	12.419	13.024	13.630	10.699	7.680	4.750	8.519	12.401	16.170	18.721	24.080	29.440
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	150.196	28.940	20.822	13.915	17.716	17.481	8.620	15.937	18.292	16.335	16.099	17.265	4.752	1.246
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	34.677	23.331	11.865	12.203	5.025	13.586	6.140	12.860	4.965	5.962	6.959	3.913	5.572	-1.000

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	33.675	25.501	16.543	7.585	11.394	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	38.851	12.010	8.490	8.466	6.388	8.928	5.694	11.317	4.789	8.325	11.861	7.761	9.638	11.885
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	26.781	12.405	7.527	8.789	6.521	10.143	5.922	11.295	4.125	5.796	7.467	7.258	7.296	7.520
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	30.142	13.036	11.786	8.775	7.457	7.931	5.663	7.283	5.484	2.818	5.052	7.669	8.335	1.942
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	34.981	20.239	17.622	20.412	17.927	23.638	10.459	23.550	16.787	20.224	23.661	33.429	32.300	41.580
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	20.379	13.884	10.802	9.267	8.472	8.134	8.155	8.539	9.401	9.523	9.523	9.523	9.523	9.523
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	11.147	7.471	6.040	5.355	5.035	4.962	5.093	5.411	5.911	5.971	5.971	5.971	5.971	5.971
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	8.159	5.993	4.785	4.227	4.007	3.985	4.107	4.374	4.827	4.886	4.886	4.886	4.886	4.886
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	8.045	5.487	4.484	4.006	3.787	3.741	3.835	4.056	4.398	4.438	4.438	4.438	4.438	4.438
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	7.657	5.468	4.288	3.756	3.545	3.509	3.595	3.799	4.159	4.206	4.206	4.206	4.206	4.206
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	7.657	5.468	4.288	3.756	3.545	3.509	3.595	3.799	4.159	4.206	4.206	4.206	4.206	4.206
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	7.657	5.468	4.288	3.756	3.545	3.509	3.595	3.799	4.159	4.206	4.206	4.206	4.206	4.206
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	34.223	21.804	16.341	13.661	12.213	11.464	11.204	11.370	12.001	12.095	12.095	12.095	12.095	12.095
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	19.364	12.871	9.869	8.377	7.585	7.209	7.143	7.370	7.949	8.032	8.032	8.032	8.032	8.032
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	14.602	10.022	7.810	6.690	6.095	5.820	5.790	5.996	6.493	6.564	6.564	6.564	6.564	6.564
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	14.153	9.545	7.369	6.277	5.696	5.420	5.374	5.545	5.979	6.041	6.041	6.041	6.041	6.041
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	13.627	9.076	6.963	5.910	5.349	5.081	5.029	5.180	5.575	5.632	5.632	5.632	5.632	5.632
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	13.627	9.076	6.963	5.910	5.349	5.081	5.029	5.180	5.575	5.632	5.632	5.632	5.632	5.632
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	13.627	9.076	6.963	5.910	5.349	5.081	5.029	5.180	5.575	5.632	5.632	5.632	5.632	5.632
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	39.125	24.302	17.984	14.916	13.251	12.366	12.011	12.103	12.661	12.747	12.747	12.747	12.747	12.747
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	22.108	14.421	10.931	9.198	8.261	7.782	7.632	7.772	8.236	8.304	8.304	8.304	8.304	8.304
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	16.745	11.288	8.691	7.374	6.654	6.288	6.177	6.295	6.671	6.726	6.726	6.726	6.726	6.726
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	16.199	10.699	8.153	6.875	6.179	5.819	5.700	5.792	6.117	6.165	6.165	6.165	6.165	6.165
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	15.455	10.125	7.683	6.462	5.796	5.449	5.327	5.403	5.692	5.735	5.735	5.735	5.735	5.735
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	15.455	10.125	7.683	6.462	5.796	5.449	5.327	5.403	5.692	5.735	5.735	5.735	5.735	5.735
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	15.455	10.125	7.683	6.462	5.796	5.449	5.327	5.403	5.692	5.735	5.735	5.735	5.735	5.735
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	57.216	33.248	24.096	19.364	16.915	15.647	14.992	14.652	14.476	14.464	14.464	14.464	14.464	14.464
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	30.012	18.711	13.826	11.422	10.090	9.346	8.990	8.944	9.198	9.242	9.242	9.242	9.242	9.242
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	23.185	14.310	10.949	9.217	8.179	7.557	7.251	7.238	7.524	7.570	7.570	7.570	7.570	7.570
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	22.541	13.592	10.271	8.585	7.586	6.987	6.679	6.621	6.801	6.833	6.833	6.833	6.833	6.833
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	21.164	13.177	9.722	8.017	7.067	6.528	6.260	6.203	6.346	6.372	6.372	6.372	6.372	6.372
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	21.164	13.177	9.722	8.017	7.067	6.528	6.260	6.203	6.346	6.372	6.372	6.372	6.372	6.372
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	21.164	13.177	9.722	8.017	7.067	6.528	6.260	6.203	6.346	6.372	6.372	6.372	6.372	6.372
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	65.969	38.795	29.221	23.738	20.564	18.727	17.663	17.047	16.691	16.665	16.665	16.665	16.665	16.665

Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	37.571	23.030	17.723	14.602	12.766	11.686	11.050	10.676	10.456	10.440	10.440	10.440	10.440	10.440
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	27.020	18.438	14.109	11.781	10.389	9.523	8.999	8.726	8.662	8.666	8.666	8.666	8.666	8.666
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	26.848	16.978	13.167	10.891	9.524	8.703	8.210	7.913	7.735	7.722	7.722	7.722	7.722	7.722
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	25.726	15.920	12.318	10.172	8.888	8.119	7.659	7.383	7.218	7.206	7.206	7.206	7.206	7.206
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	25.726	15.920	12.318	10.172	8.888	8.119	7.659	7.383	7.218	7.206	7.206	7.206	7.206	7.206
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	25.726	15.920	12.318	10.172	8.888	8.119	7.659	7.383	7.218	7.206	7.206	7.206	7.206	7.206
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	66.405	39.841	30.642	25.174	21.892	19.922	18.740	18.030	17.604	17.573	17.573	17.573	17.573	17.573
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	38.254	23.779	18.649	15.523	13.616	12.452	11.742	11.309	11.045	11.025	11.025	11.025	11.025	11.025
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	29.017	18.700	14.906	12.540	11.064	10.143	9.568	9.210	8.986	8.969	8.969	8.969	8.969	8.969
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	27.216	17.461	13.841	11.586	10.172	9.284	8.727	8.378	8.159	8.142	8.142	8.142	8.142	8.142
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	26.106	16.369	12.946	10.817	9.483	8.648	8.124	7.796	7.591	7.575	7.575	7.575	7.575	7.575
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	26.106	16.369	12.946	10.817	9.483	8.648	8.124	7.796	7.591	7.575	7.575	7.575	7.575	7.575
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	26.106	16.369	12.946	10.817	9.483	8.648	8.124	7.796	7.591	7.575	7.575	7.575	7.575	7.575
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	62.954	41.706	33.130	27.831	24.556	22.532	21.282	20.509	20.031	19.995	19.995	19.995	19.995	19.995
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	36.044	26.146	20.639	17.509	15.569	14.325	13.542	13.100	12.939	12.938	12.938	12.938	12.938	12.938
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	27.369	20.588	16.581	14.220	12.720	11.739	11.107	10.735	10.575	10.570	10.570	10.570	10.570	10.570
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	25.797	19.158	15.306	13.058	11.636	10.706	10.102	9.738	9.569	9.562	9.562	9.562	9.562	9.562
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	26.142	17.750	14.372	12.216	10.841	9.963	9.403	9.045	8.817	8.800	8.800	8.800	8.800	8.800
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	26.142	17.750	14.372	12.216	10.841	9.963	9.403	9.045	8.817	8.800	8.800	8.800	8.800	8.800
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	26.142	17.750	14.372	12.216	10.841	9.963	9.403	9.045	8.817	8.800	8.800	8.800	8.800	8.800
Heavy Duty Trucks	Rigid >32 t	Conventional	70.674	44.070	34.427	28.461	24.754	22.450	21.018	20.128	19.575	19.533	19.533	19.533	19.533	19.533
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	42.707	27.079	21.414	17.857	15.622	14.218	13.336	12.782	12.434	12.407	12.407	12.407	12.407	12.407
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	32.529	21.451	17.227	14.515	12.773	11.655	10.937	10.476	10.179	10.156	10.156	10.156	10.156	10.156
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	30.318	19.907	15.864	13.283	11.628	10.568	9.888	9.453	9.173	9.152	9.152	9.152	9.152	9.152
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	28.945	18.593	14.794	12.371	10.820	9.828	9.193	8.787	8.527	8.507	8.507	8.507	8.507	8.507
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	28.945	18.593	14.794	12.371	10.820	9.828	9.193	8.787	8.527	8.507	8.507	8.507	8.507	8.507
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	28.945	18.593	14.794	12.371	10.820	9.828	9.193	8.787	8.527	8.507	8.507	8.507	8.507	8.507
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	52.770	31.394	23.266	18.773	16.281	14.897	14.130	13.704	13.468	13.451	13.451	13.451	13.451	13.451
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	29.515	18.048	13.741	11.307	9.931	9.152	8.712	8.463	8.323	8.313	8.313	8.313	8.313	8.313
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	21.412	14.349	10.909	9.100	8.042	7.404	7.042	6.887	6.913	6.926	6.926	6.926	6.926	6.926
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	20.658	13.571	10.212	8.466	7.448	6.833	6.477	6.314	6.316	6.325	6.325	6.325	6.325	6.325
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	20.395	12.558	9.629	7.943	6.967	6.402	6.074	5.885	5.775	5.767	5.767	5.767	5.767	5.767
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	20.395	12.558	9.629	7.943	6.967	6.402	6.074	5.885	5.775	5.767	5.767	5.767	5.767	5.767
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	20.395	12.558	9.629	7.943	6.967	6.402	6.074	5.885	5.775	5.767	5.767	5.767	5.767	5.767
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	59.698	37.343	28.927	23.824	20.692	18.770	17.591	16.867	16.423	16.389	16.389	16.389	16.389	16.389
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	36.715	23.273	18.264	15.161	13.235	12.040	11.297	10.837	10.551	10.529	10.529	10.529	10.529	10.529

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	26.710	17.839	14.325	12.066	10.613	9.679	9.078	8.692	8.444	8.424	8.424	8.424	8.424
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	25.001	16.704	13.286	11.113	9.730	8.849	8.288	7.931	7.704	7.686	7.686	7.686	7.686	7.686
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	23.788	15.636	12.429	10.391	9.091	8.263	7.735	7.399	7.185	7.168	7.168	7.168	7.168	7.168
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	23.788	15.636	12.429	10.391	9.091	8.263	7.735	7.399	7.185	7.168	7.168	7.168	7.168	7.168
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	23.788	15.636	12.429	10.391	9.091	8.263	7.735	7.399	7.185	7.168	7.168	7.168	7.168	7.168
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	60.913	38.702	30.442	25.243	21.942	19.846	18.516	17.671	17.135	17.094	17.094	17.094	17.094	17.094
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	37.560	24.337	19.367	16.170	14.111	12.786	11.932	11.382	11.028	11.001	11.001	11.001	11.001	11.001
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	27.346	18.766	15.263	12.925	11.363	10.320	9.624	9.159	8.849	8.824	8.824	8.824	8.824	8.824
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	25.461	17.500	14.108	11.869	10.388	9.410	8.763	8.336	8.053	8.031	8.031	8.031	8.031	8.031
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	24.355	16.373	13.184	11.077	9.683	8.760	8.150	7.747	7.480	7.459	7.459	7.459	7.459	7.459
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	24.355	16.373	13.184	11.077	9.683	8.760	8.150	7.747	7.480	7.459	7.459	7.459	7.459	7.459
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	24.355	16.373	13.184	11.077	9.683	8.760	8.150	7.747	7.480	7.459	7.459	7.459	7.459	7.459
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	70.495	44.744	35.404	29.308	25.314	22.697	20.981	19.857	19.121	19.063	19.063	19.063	19.063	19.063
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	42.653	27.648	22.132	18.467	16.029	14.409	13.332	12.615	12.139	12.101	12.101	12.101	12.101	12.101
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	32.633	21.933	17.831	15.035	13.130	11.831	10.945	10.341	9.930	9.897	9.897	9.897	9.897	9.897
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	30.326	20.283	16.383	13.742	11.948	10.730	9.902	9.339	8.957	8.926	8.926	8.926	8.926	8.926
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	28.869	18.921	15.260	12.784	11.105	9.966	9.193	8.670	8.314	8.286	8.286	8.286	8.286	8.286
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	28.869	18.921	15.260	12.784	11.105	9.966	9.193	8.670	8.314	8.286	8.286	8.286	8.286	8.286
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	28.869	18.921	15.260	12.784	11.105	9.966	9.193	8.670	8.314	8.286	8.286	8.286	8.286	8.286
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	74.404	48.631	38.998	32.560	28.244	25.352	23.413	22.114	21.243	21.174	21.174	21.174	21.174	21.174
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	44.950	30.105	24.420	20.546	17.904	16.103	14.874	14.037	13.466	13.420	13.420	13.420	13.420	13.420
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	34.766	24.111	19.844	16.853	14.756	13.286	12.256	11.533	11.027	10.985	10.985	10.985	10.985	10.985
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	32.248	22.267	18.175	15.335	13.362	11.992	11.041	10.380	9.921	9.884	9.884	9.884	9.884	9.884
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	30.524	20.698	16.903	14.261	12.418	11.134	10.238	9.614	9.178	9.143	9.143	9.143	9.143	9.143
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	30.524	20.698	16.903	14.261	12.418	11.134	10.238	9.614	9.178	9.143	9.143	9.143	9.143	9.143
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	30.524	20.698	16.903	14.261	12.418	11.134	10.238	9.614	9.178	9.143	9.143	9.143	9.143	9.143
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	85.188	57.799	47.014	39.533	34.336	30.726	28.218	26.476	25.266	25.167	25.167	25.167	25.167	25.167
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	51.713	35.791	29.387	24.870	21.684	19.437	17.852	16.734	15.945	15.880	15.880	15.880	15.880	15.880
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	40.032	28.614	23.850	20.384	17.861	16.024	14.688	13.716	13.008	12.949	12.949	12.949	12.949	12.949
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	36.975	26.328	21.756	18.470	16.108	14.411	13.192	12.315	11.685	11.633	11.633	11.633	11.633	11.633
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	35.040	24.565	20.311	17.241	15.025	13.425	12.269	11.435	10.833	10.783	10.783	10.783	10.783	10.783
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	35.040	24.565	20.311	17.241	15.025	13.425	12.269	11.435	10.833	10.783	10.783	10.783	10.783	10.783
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	35.040	24.565	20.311	17.241	15.025	13.425	12.269	11.435	10.833	10.783	10.783	10.783	10.783	10.783
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Buses	Urban CNG Buses	EEV	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Buses	Urban Buses Midi <=15 t	Conventional	55.744	30.108	21.143	17.051	15.183	14.331	13.942	13.765	13.765	13.765	13.765	13.765	13.765	13.765
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	27.708	16.592	12.112	9.997	8.874	8.297	8.095	8.215	8.215	8.215	8.215	8.215	8.215	8.215
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	22.716	13.317	9.720	8.010	7.197	6.810	6.626	6.539	6.539	6.539	6.539	6.539	6.539	6.539
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	21.408	12.505	9.102	7.489	6.724	6.361	6.189	6.108	6.108	6.108	6.108	6.108	6.108	6.108
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	19.701	11.831	8.651	7.149	6.354	5.950	5.814	5.913	5.913	5.913	5.913	5.913	5.913	5.913
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	19.701	11.831	8.651	7.149	6.354	5.950	5.814	5.913	5.913	5.913	5.913	5.913	5.913	5.913
Buses	Urban Buses Midi <=15 t	HD Euro VI	19.701	11.831	8.651	7.149	6.354	5.950	5.814	5.913	5.913	5.913	5.913	5.913	5.913	5.913
Buses	Urban Buses Standard 15 - 18 t	Conventional	67.490	37.498	26.863	21.465	18.726	17.336	16.630	16.272	16.272	16.272	16.272	16.272	16.272	16.272
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	38.174	22.411	16.296	13.184	11.600	10.794	10.384	10.175	10.175	10.175	10.175	10.175	10.175	10.175
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	26.769	18.058	13.121	10.699	9.512	8.930	8.645	8.505	8.505	8.505	8.505	8.505	8.505	8.505
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	27.287	16.563	12.224	9.980	8.819	8.219	7.908	7.747	7.747	7.747	7.747	7.747	7.747	7.747
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	26.598	15.821	11.559	9.391	8.288	7.727	7.442	7.297	7.297	7.297	7.297	7.297	7.297	7.297
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	26.598	15.821	11.559	9.391	8.288	7.727	7.442	7.297	7.297	7.297	7.297	7.297	7.297	7.297
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	26.598	15.821	11.559	9.391	8.288	7.727	7.442	7.297	7.297	7.297	7.297	7.297	7.297	7.297
Buses	Urban Buses Articulated >18 t	Conventional	76.448	45.217	33.254	26.904	23.534	21.745	20.796	20.292	20.292	20.292	20.292	20.292	20.292	20.292
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	39.923	27.905	20.650	16.846	14.851	13.806	13.257	12.970	12.970	12.970	12.970	12.970	12.970	12.970
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	30.673	22.201	16.857	13.921	12.307	11.421	10.934	10.666	10.666	10.666	10.666	10.666	10.666	10.666
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	28.451	20.473	15.474	12.747	11.259	10.447	10.004	9.763	9.763	9.763	9.763	9.763	9.763	9.763
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	27.767	19.572	14.582	11.941	10.543	9.804	9.412	9.205	9.205	9.205	9.205	9.205	9.205	9.205
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	27.767	19.572	14.582	11.941	10.543	9.804	9.412	9.205	9.205	9.205	9.205	9.205	9.205	9.205
Buses	Urban Buses Articulated >18 t	HD Euro VI	27.767	19.572	14.582	11.941	10.543	9.804	9.412	9.205	9.205	9.205	9.205	9.205	9.205	9.205
Buses	Coaches Standard <=18 t	Conventional	71.143	39.096	28.462	22.520	19.030	16.977	15.768	15.057	14.639	14.393	14.271	14.271	14.271	14.271
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	46.659	25.235	18.653	14.862	12.597	11.243	10.433	9.949	9.659	9.486	9.399	9.399	9.399	9.399
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	37.249	20.426	15.387	12.395	10.562	9.439	8.751	8.329	8.071	7.912	7.831	7.831	7.831	7.831
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	37.319	20.045	14.789	11.787	10.018	8.975	8.360	7.998	7.784	7.658	7.596	7.596	7.596	7.596
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	36.682	19.207	14.070	11.160	9.460	8.466	7.884	7.544	7.346	7.229	7.172	7.172	7.172	7.172
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	36.682	19.207	14.070	11.160	9.460	8.466	7.884	7.544	7.346	7.229	7.172	7.172	7.172	7.172
Buses	Coaches Standard <=18 t	HD Euro VI	36.682	19.207	14.070	11.160	9.460	8.466	7.884	7.544	7.346	7.229	7.172	7.172	7.172	7.172

Buses	Coaches Articulated >18 t	Conventional	87.013	46.988	34.347	27.199	23.036	20.611	19.198	18.374	17.894	17.615	17.478	17.478	17.478
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	54.250	29.254	21.757	17.387	14.778	13.221	12.291	11.736	11.405	11.207	11.108	11.108	11.108	11.108
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	42.615	23.521	17.746	14.306	12.223	10.960	10.196	9.732	9.452	9.282	9.195	9.195	9.195	9.195
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	43.668	23.231	16.618	13.149	11.063	9.790	9.012	8.536	8.246	8.068	7.977	7.977	7.977	7.977
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	42.207	22.093	15.780	12.438	10.439	9.230	8.499	8.056	7.788	7.625	7.543	7.543	7.543	7.543
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	42.207	22.093	15.780	12.438	10.439	9.230	8.499	8.056	7.788	7.625	7.543	7.543	7.543	7.543
Buses	Coaches Articulated >18 t	HD Euro VI	42.207	22.093	15.780	12.438	10.439	9.230	8.499	8.056	7.788	7.625	7.543	7.543	7.543	7.543
Mopeds	<50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Table A 9: Standard deviation (g/km) of methane emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	urbanC	urbanH	rural	highway
Passenger Cars	Gasoline <1,4 l	PRE ECE	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	ECE 15/02	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	ECE 15/03	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	ECE 15/04	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	Improved Conventional	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	Open Loop	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	0.0302	0.0227	0.0089	0.0095
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	0.1381	0.0395	0.0135	0.0157
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	0.1204	0.0052	0.0040	0.0055
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	0.0585	0.0005	0.0010	
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	0.0302	0.0227	0.0089	0.0095
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	0.1381	0.0395	0.0135	0.0157
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.1204	0.0052	0.0040	0.0055
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.0585	0.0005	0.0010	
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PRE ECE	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline >2,0 l	ECE 15/02	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline >2,0 l	ECE 15/03	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline >2,0 l	ECE 15/04	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	0.0302	0.0227	0.0089	0.0095
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	0.1381	0.0395	0.0135	0.0157

Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.1204	0.0052	0.0040	0.0055
Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.0585	0.0005	0.0010	
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	Conventional	0.0179	0.0266	0.0077	0.0054
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.0217	0.0173	0.0092	0.0029
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.0037	0.0040	0.0016	0.0024
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.0043	0.0018	0.0003	
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005				
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	Conventional	0.0179	0.0266	0.0077	0.0054
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	0.0217	0.0173	0.0092	0.0029
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.0037	0.0040	0.0016	0.0024
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.0043	0.0018	0.0003	
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005				
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	Conventional	0.2803	0.1432	0.0764	0.0293
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	0.0302	0.0227	0.0089	0.0095
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	0.1381	0.0395	0.0135	0.0157
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	0.1204	0.0052	0.0040	0.0055
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	0.0585	0.0005	0.0010	
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.000	-1.000	-1.000	-1.000
Passenger Cars	LPG	PC Euro 6	-1.000	-1.000	-1.000	-1.000
Passenger Cars	2-Stroke	Conventional	0.2803	0.1432	0.0764	0.0293
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	0	0	0	0
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	0	0	0	0
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	0.2803	0.1432	0.0764	0.0293
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	0.0302	0.0227	0.0089	0.0095
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	0.1381	0.0395	0.0135	0.0157
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	0.1204	0.0052	0.0040	0.0055
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	0.0585	0.0005	0.0010	
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.000	-1.000	-1.000	-1.000

Light Duty Vehicles	Diesel <3,5 t	Conventional	0.0179	0.0266	0.0077	0.0054
Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	0.0217	0.0173	0.0092	0.0029
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	0.0037	0.0040	0.0016	0.0024
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	0.0043	0.0018	0.0003	
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005				
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.000	-1.000	-1.000	-1.000
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.000	-1.000	-1.000	-1.000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	-1.000	0.0809	0.0153	0.0138
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.1287	0.0245	0.0179
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0295	0.0114	0.0062
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	-1.000	0.0302	0.0055	0.0016
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	-1.000	0.0809	0.0153	0.0138
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.1287	0.0245	0.0179
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0295	0.0114	0.0062
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	-1.000	0.0302	0.0055	0.0016
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	-1.000	0.0809	0.0153	0.0138
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.1287	0.0245	0.0179
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0295	0.0114	0.0062
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	-1.000	0.0302	0.0055	0.0016
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	-1.000	0.0016	0.0013	0.0010
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034

Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid >32 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	-1.000	0.1665	0.0531	0.0482

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	-1.000	0.1665	0.0531	0.0482
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0608	0.0396	0.0217
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	-1.000	0.0623	0.0191	0.0056
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0045	0.0034
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	-1.000	0.0033	0.0045	0.0034
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.000	0.0000	0.0000	0.0000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.000	0.0000	0.0000	0.0000

Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.000	0.0000	0.0000	0.0000
Buses	Urban CNG Buses	EEV	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	Conventional	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.000	0.0000	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	Conventional	-1.000	0.1665	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0618	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	-1.000	0.0656	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro VI	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	Conventional	-1.000	0.1665	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0618	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	-1.000	0.0656	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	Conventional	-1.000	0.1665	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0618	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	-1.000	0.0656	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro VI	-1.000	0.0033	0.0019	0.0017
Buses	Coaches Standard <=18 t	Conventional	-1.000	0.1665	0.0531	0.0482
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0618	0.0296	0.0469
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	-1.000	0.0656	0.0377	0.0329
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0019	0.0017
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0019	0.0017

Buses	Coaches Standard <=18 t	HD Euro VI	-1.000	0.0033	0.0019	0.0017
Buses	Coaches Articulated >18 t	Conventional	-1.000	0.1665	0.0531	0.0482
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	-1.000	0.2650	0.0853	0.0625
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	-1.000	0.0618	0.0296	0.0469
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	-1.000	0.0656	0.0377	0.0329
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	-1.000	0.0033	0.0019	0.0017
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	-1.000	0.0033	0.0019	0.0017
Buses	Coaches Articulated >18 t	HD Euro VI	-1.000	0.0033	0.0019	0.0017
Mopeds	<50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro I	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro II	-1.000	-1.000	-1.000	-1.000
Mopeds	<50 cm³	Mop - Euro III	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Conventional	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Conventional	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Conventional	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.000	-1.000	-1.000	-1.000
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.000	-1.000	-1.000	-1.000

Table A 10: Standard deviation (g/km) of **N_2O** emission factors for different technologies ("-1" denotes no data)

Sector	Subsector	Technology	urbanC	urbanH	rural	highway
Passenger Cars	Gasoline <1,4 l	PRE ECE	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	ECE 15/02	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	ECE 15/03	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	ECE 15/04	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	Improved Conventional	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	Open Loop	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	29.7000	18.8000	17.1000	6.2400
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	10.3000	3.4800	1.9200	1.3300
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	14.2000	2.3400	1.9700	1.1231
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	6.3000	4.2900	1.9200	1.0979
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Gasoline <1,4 l	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	29.7000	18.8000	17.1000	6.2400
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	10.3000	3.4800	1.9200	1.3300
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	14.2000	2.3400	1.9700	1.1231
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	6.3000	4.2900	1.9200	1.0979
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Gasoline >2,0 l	PRE ECE	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline >2,0 l	ECE 15/02	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline >2,0 l	ECE 15/03	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline >2,0 l	ECE 15/04	3.1300	0.3190	1.1600	N/A
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	29.7000	18.8000	17.1000	6.2400
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	10.3000	3.4800	1.9200	1.3300
Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	14.2000	2.3400	1.9700	1.1231

Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	6.3000	4.2900	1.9200	1.0979
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Gasoline >2,0 l	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Diesel <2,0 l	Conventional	0.0000	0.0000	0.0000	0.0000
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	0.0000	0.0003	0.0003	0.0007
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	0.0005	0.0007	0.0007	0.0010
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.0025	0.0015	0.0015	0.0007
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.0025	0.0015	0.0015	0.0007
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Diesel <2,0 l	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Diesel >2,0 l	Conventional	0.0000	0.0000	0.0000	0.0000
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	0.0000	0.0003	0.0003	0.0007
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	0.0005	0.0007	0.0007	0.0010
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	0.0025	0.0015	0.0015	0.0007
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	0.0025	0.0015	0.0015	0.0007
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Diesel >2,0 l	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	LPG	Conventional	3.1300	0.3190	1.1600	N/A
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	29.7000	18.8000	17.1000	6.2400
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	10.3000	3.4800	1.9200	1.3300
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	14.2000	2.3400	1.9700	1.1231
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	6.3000	4.2900	1.9200	1.0979
Passenger Cars	LPG	PC Euro 5 (post 2005)	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	LPG	PC Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	2-Stroke	Conventional	3.1300	0.3190	1.1600	N/A
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.0000	-1.0000	-1.0000	-1.0000
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	-1.0000	-1.0000	-1.0000	-1.0000
Light Duty Vehicles	Gasoline <3,5t	Conventional	3.1300	0.3190	1.1600	N/A
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	90.5000	54.3000	13.2000	13.2000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	0.0000	0.0000	0.0000	0.0000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	6.3400	11.5000	4.1900	4.1900
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	2.3000	1.0500	1.6400	1.6400
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	-1.0000	-1.0000	-1.0000	-1.0000
Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	-1.0000	-1.0000	-1.0000	-1.0000
Light Duty Vehicles	Diesel <3,5 t	Conventional	0.0000	0.0000	0.0000	0.0000

Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	0.0000	0.0003	0.0007	0.0007
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	0.0005	0.0007	0.0010	0.0010
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	0.0025	0.0015	0.0007	0.0007
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	0.0025	0.0015	0.0007	0.0007
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	-1.0000	0.0015	0.0007	0.0007
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	-1.0000	0.0015	0.0007	0.0007
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	-1.0000	-1.0000	-1.0000	-1.0000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0010	0.0008	0.0005
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0008	0.0008	0.0005
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	-1.0000	0.0005	0.0005	0.0003
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	-1.0000	0.0010	0.0012	0.0010
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	-1.0000	0.0025	0.0033	0.0029
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	-1.0000	0.0031	0.0032	0.0025
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0010	0.0008	0.0005
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0008	0.0008	0.0005
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	-1.0000	0.0005	0.0005	0.0003
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	-1.0000	0.0010	0.0012	0.0010
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	-1.0000	0.0025	0.0033	0.0029
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	-1.0000	0.0031	0.0032	0.0025
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	-1.0000	0.0050	0.0050	0.0050

Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	-1.0000	0.0013	0.0013	0.0010
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	-1.0000	0.0029	0.0036	0.0029
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	-1.0000	0.0076	0.0103	0.0086
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	-1.0000	0.0094	0.0099	0.0074
Heavy Duty Trucks	Rigid >32 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	-1.0000	0.0013	0.0013	0.0010
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	-1.0000	0.0029	0.0036	0.0029
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	-1.0000	0.0076	0.0103	0.0086
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	-1.0000	0.0094	0.0099	0.0074
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012

Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0028	0.0023	0.0017
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	-1.0000	0.0013	0.0013	0.0010
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	-1.0000	0.0029	0.0036	0.0029
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	-1.0000	0.0076	0.0103	0.0086
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	-1.0000	0.0094	0.0099	0.0074
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0030	0.0025	0.0018
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0030	0.0025	0.0017
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	-1.0000	0.0015	0.0015	0.0012
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	-1.0000	0.0032	0.0039	0.0032
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	-1.0000	0.0082	0.0111	0.0093
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	-1.0000	0.0102	0.0107	0.0080
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0030	0.0025	0.0018
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0030	0.0025	0.0017
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	-1.0000	0.0015	0.0015	0.0012
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	-1.0000	0.0032	0.0039	0.0032
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	-1.0000	0.0082	0.0111	0.0093
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	-1.0000	0.0102	0.0107	0.0080
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0030	0.0025	0.0018
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0030	0.0025	0.0017
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	-1.0000	0.0015	0.0015	0.0012
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	-1.0000	0.0032	0.0039	0.0032
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	-1.0000	0.0082	0.0111	0.0093
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	-1.0000	0.0102	0.0107	0.0080
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0000	0.0000	0.0000
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0000	0.0000	0.0000
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	-1.0000	0.0000	0.0000	0.0000

Buses	Urban CNG Buses	EEV	-1.0000	0.0000	0.0000	0.0000
Buses	Urban Biodiesel Buses	Conventional	-1.0000	0.0050	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	-1.0000	0.0010	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	-1.0000	0.0021	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	-1.0000	0.0055	0.0000	0.0000
Buses	Urban Biodiesel Buses	HD Euro VI	-1.0000	0.0069	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	Conventional	-1.0000	0.0050	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	-1.0000	0.0010	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	-1.0000	0.0021	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	-1.0000	0.0055	0.0000	0.0000
Buses	Urban Buses Midi <=15 t	HD Euro VI	-1.0000	0.0069	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	Conventional	-1.0000	0.0050	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	-1.0000	0.0001	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	-1.0000	0.0021	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	-1.0000	0.0055	0.0000	0.0000
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	-1.0000	0.0069	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	Conventional	-1.0000	0.0050	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0020	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	-1.0000	0.0010	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	-1.0000	0.0021	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	-1.0000	0.0055	0.0000	0.0000
Buses	Urban Buses Articulated >18 t	HD Euro VI	-1.0000	0.0069	0.0000	0.0000
Buses	Coaches Standard <=18 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Buses	Coaches Standard <=18 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048

Buses	Coaches Articulated >18 t	Conventional	-1.0000	0.0050	0.0050	0.0050
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	-1.0000	0.0018	0.0015	0.0012
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	-1.0000	0.0018	0.0015	0.0010
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	-1.0000	0.0008	0.0008	0.0007
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	-1.0000	0.0019	0.0023	0.0019
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	-1.0000	0.0050	0.0067	0.0056
Buses	Coaches Articulated >18 t	HD Euro VI	-1.0000	0.0062	0.0065	0.0048
Mopeds	<50 cm³	Conventional	-1.0000	0.0002	0.0002	0.0002
Mopeds	<50 cm³	Mop - Euro I	-1.0000	0.0002	0.0002	0.0002
Mopeds	<50 cm³	Mop - Euro II	-1.0000	0.0002	0.0002	0.0002
Mopeds	<50 cm³	Mop - Euro III	-1.0000	0.0002	0.0002	0.0002
Motorcycles	2-stroke >50 cm³	Conventional	-1.0000	0.0003	0.0003	0.0003
Motorcycles	2-stroke >50 cm³	Mot - Euro I	-1.0000	0.0003	0.0003	0.0003
Motorcycles	2-stroke >50 cm³	Mot - Euro II	-1.0000	0.0003	0.0003	0.0003
Motorcycles	2-stroke >50 cm³	Mot - Euro III	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke <250 cm³	Conventional	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke <250 cm³	Mot - Euro I	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke <250 cm³	Mot - Euro II	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke <250 cm³	Mot - Euro III	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke 250 - 750 cm³	Conventional	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke >750 cm³	Conventional	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke >750 cm³	Mot - Euro I	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke >750 cm³	Mot - Euro II	-1.0000	0.0003	0.0003	0.0003
Motorcycles	4-stroke >750 cm³	Mot - Euro III	-1.0000	0.0003	0.0003	0.0003

Table A 11: Standard deviation (g/km) of total suspended non exhaust PM emission factors for different vehicle categories ("-1" denotes no data)

Sector	tyre	brake
Passenger Cars	0.0014	0.0008
Light Duty Vehicles	0.0018	0.0008
Heavy Duty Trucks	0.0112	0.0031
Buses	0.0112	0.0031
Two-wheel vehicles	0.0002	0.0004

Table A 12: ID codes used in the data.mdb tables required to run the COPERT Monte Carlo

Sector	Subsector	Technology	Sector ID	Subsector ID	Technology ID
Passenger Cars	Gasoline <1,4 l	PRE ECE	1	1	1
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1	1	2
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1	1	3
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1	1	4
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1	1	5
Passenger Cars	Gasoline <1,4 l	Improved Conventional	1	1	6
Passenger Cars	Gasoline <1,4 l	Open Loop	1	1	7
Passenger Cars	Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	1	1	8
Passenger Cars	Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	1	1	9
Passenger Cars	Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	1	1	10
Passenger Cars	Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	1	1	11
Passenger Cars	Gasoline <1,4 l	PC Euro 5 (post 2005)	1	1	12
Passenger Cars	Gasoline <1,4 l	PC Euro 6	1	1	42
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	1	2	1
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1	2	2
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1	2	3
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1	2	4
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1	2	5
Passenger Cars	Gasoline 1,4 - 2,0 l	Improved Conventional	1	2	6
Passenger Cars	Gasoline 1,4 - 2,0 l	Open Loop	1	2	7
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	1	2	8
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	1	2	9
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	1	2	10
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	2	11
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 5 (post 2005)	1	2	12
Passenger Cars	Gasoline 1,4 - 2,0 l	PC Euro 6	1	2	42
Passenger Cars	Gasoline >2,0 l	PRE ECE	1	3	1
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1	3	2
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1	3	3
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1	3	4
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1	3	5
Passenger Cars	Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	1	3	8
Passenger Cars	Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	1	3	9

Passenger Cars	Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	1	3	10
Passenger Cars	Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	3	11
Passenger Cars	Gasoline >2,0 l	PC Euro 5 (post 2005)	1	3	12
Passenger Cars	Gasoline >2,0 l	PC Euro 6	1	3	42
Passenger Cars	Diesel <2,0 l	Conventional	1	4	22
Passenger Cars	Diesel <2,0 l	PC Euro 1 - 91/441/EEC	1	4	8
Passenger Cars	Diesel <2,0 l	PC Euro 2 - 94/12/EEC	1	4	9
Passenger Cars	Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	1	4	10
Passenger Cars	Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	4	11
Passenger Cars	Diesel <2,0 l	PC Euro 5 (post 2005)	1	4	12
Passenger Cars	Diesel <2,0 l	PC Euro 6	1	4	42
Passenger Cars	Diesel >2,0 l	Conventional	1	5	22
Passenger Cars	Diesel >2,0 l	PC Euro 1 - 91/441/EEC	1	5	8
Passenger Cars	Diesel >2,0 l	PC Euro 2 - 94/12/EEC	1	5	9
Passenger Cars	Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	1	5	10
Passenger Cars	Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	5	11
Passenger Cars	Diesel >2,0 l	PC Euro 5 (post 2005)	1	5	12
Passenger Cars	Diesel >2,0 l	PC Euro 6	1	5	42
Passenger Cars	LPG	Conventional	1	6	22
Passenger Cars	LPG	PC Euro 1 - 91/441/EEC	1	6	8
Passenger Cars	LPG	PC Euro 2 - 94/12/EEC	1	6	9
Passenger Cars	LPG	PC Euro 3 - 98/69/EC Stage2000	1	6	10
Passenger Cars	LPG	PC Euro 4 - 98/69/EC Stage2005	1	6	11
Passenger Cars	LPG	PC Euro 5 (post 2005)	1	6	12
Passenger Cars	LPG	PC Euro 6	1	6	42
Passenger Cars	2-Stroke	Conventional	1	26	22
Passenger Cars	Hybrid Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	1	27	11
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	28	11
Passenger Cars	Hybrid Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	1	29	11
Light Duty Vehicles	Gasoline <3,5t	Conventional	2	12	22
Light Duty Vehicles	Gasoline <3,5t	LD Euro 1 - 93/59/EEC	2	12	13
Light Duty Vehicles	Gasoline <3,5t	LD Euro 2 - 96/69/EEC	2	12	14
Light Duty Vehicles	Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	2	12	24
Light Duty Vehicles	Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	2	12	25
Light Duty Vehicles	Gasoline <3,5t	LD Euro 5 - 2008 Standards	2	12	26

Light Duty Vehicles	Gasoline <3,5t	LD Euro 6	2	12	43
Light Duty Vehicles	Diesel <3,5 t	Conventional	2	13	22
Light Duty Vehicles	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	2	13	13
Light Duty Vehicles	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	2	13	14
Light Duty Vehicles	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	2	13	24
Light Duty Vehicles	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	2	13	25
Light Duty Vehicles	Diesel <3,5 t	LD Euro 5 - 2008 Standards	2	13	26
Light Duty Vehicles	Diesel <3,5 t	LD Euro 6	2	13	43
Heavy Duty Trucks	Gasoline >3,5 t	Conventional	3	14	22
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	3	35	22
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	3	35	15
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	3	35	16
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro III - 2000 Standards	3	35	17
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro IV - 2005 Standards	3	35	18
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro V - 2008 Standards	3	35	19
Heavy Duty Trucks	Rigid <=7,5 t	HD Euro VI	3	35	44
Heavy Duty Trucks	Rigid 7,5 - 12 t	Conventional	3	36	22
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	3	36	15
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	3	36	16
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	3	36	17
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	3	36	18
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	3	36	19
Heavy Duty Trucks	Rigid 7,5 - 12 t	HD Euro VI	3	36	44
Heavy Duty Trucks	Rigid 12 - 14 t	Conventional	3	37	22
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	3	37	15
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	3	37	16
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro III - 2000 Standards	3	37	17
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	3	37	18
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro V - 2008 Standards	3	37	19
Heavy Duty Trucks	Rigid 12 - 14 t	HD Euro VI	3	37	44
Heavy Duty Trucks	Rigid 14 - 20 t	Conventional	3	38	22
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	3	38	15
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	3	38	16
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro III - 2000 Standards	3	38	17
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	3	38	18

Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro V - 2008 Standards	3	38	19
Heavy Duty Trucks	Rigid 14 - 20 t	HD Euro VI	3	38	44
Heavy Duty Trucks	Rigid 20 - 26 t	Conventional	3	39	22
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	3	39	15
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	3	39	16
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro III - 2000 Standards	3	39	17
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro IV - 2005 Standards	3	39	18
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro V - 2008 Standards	3	39	19
Heavy Duty Trucks	Rigid 20 - 26 t	HD Euro VI	3	39	44
Heavy Duty Trucks	Rigid 26 - 28 t	Conventional	3	40	22
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	3	40	15
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	3	40	16
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro III - 2000 Standards	3	40	17
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro IV - 2005 Standards	3	40	18
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro V - 2008 Standards	3	40	19
Heavy Duty Trucks	Rigid 26 - 28 t	HD Euro VI	3	40	44
Heavy Duty Trucks	Rigid 28 - 32 t	Conventional	3	41	22
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	3	41	15
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	3	41	16
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro III - 2000 Standards	3	41	17
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro IV - 2005 Standards	3	41	18
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro V - 2008 Standards	3	41	19
Heavy Duty Trucks	Rigid 28 - 32 t	HD Euro VI	3	41	44
Heavy Duty Trucks	Rigid >32 t	Conventional	3	42	22
Heavy Duty Trucks	Rigid >32 t	HD Euro I - 91/542/EEC Stage I	3	42	15
Heavy Duty Trucks	Rigid >32 t	HD Euro II - 91/542/EEC Stage II	3	42	16
Heavy Duty Trucks	Rigid >32 t	HD Euro III - 2000 Standards	3	42	17
Heavy Duty Trucks	Rigid >32 t	HD Euro IV - 2005 Standards	3	42	18
Heavy Duty Trucks	Rigid >32 t	HD Euro V - 2008 Standards	3	42	19
Heavy Duty Trucks	Rigid >32 t	HD Euro VI	3	42	44
Heavy Duty Trucks	Articulated 14 - 20 t	Conventional	3	43	22
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	3	43	15
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	3	43	16
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro III - 2000 Standards	3	43	17
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro IV - 2005 Standards	3	43	18

Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro V - 2008 Standards	3	43	19
Heavy Duty Trucks	Articulated 14 - 20 t	HD Euro VI	3	43	44
Heavy Duty Trucks	Articulated 20 - 28 t	Conventional	3	44	22
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	3	44	15
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	3	44	16
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro III - 2000 Standards	3	44	17
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro IV - 2005 Standards	3	44	18
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro V - 2008 Standards	3	44	19
Heavy Duty Trucks	Articulated 20 - 28 t	HD Euro VI	3	44	44
Heavy Duty Trucks	Articulated 28 - 34 t	Conventional	3	45	22
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	3	45	15
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	3	45	16
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro III - 2000 Standards	3	45	17
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro IV - 2005 Standards	3	45	18
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro V - 2008 Standards	3	45	19
Heavy Duty Trucks	Articulated 28 - 34 t	HD Euro VI	3	45	44
Heavy Duty Trucks	Articulated 34 - 40 t	Conventional	3	46	22
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro I - 91/542/EEC Stage I	3	46	15
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro II - 91/542/EEC Stage II	3	46	16
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro III - 2000 Standards	3	46	17
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro IV - 2005 Standards	3	46	18
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro V - 2008 Standards	3	46	19
Heavy Duty Trucks	Articulated 34 - 40 t	HD Euro VI	3	46	44
Heavy Duty Trucks	Articulated 40 - 50 t	Conventional	3	47	22
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro I - 91/542/EEC Stage I	3	47	15
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro II - 91/542/EEC Stage II	3	47	16
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro III - 2000 Standards	3	47	17
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro IV - 2005 Standards	3	47	18
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro V - 2008 Standards	3	47	19
Heavy Duty Trucks	Articulated 40 - 50 t	HD Euro VI	3	47	44
Heavy Duty Trucks	Articulated 50 - 60 t	Conventional	3	48	22
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro I - 91/542/EEC Stage I	3	48	15
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro II - 91/542/EEC Stage II	3	48	16
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro III - 2000 Standards	3	48	17
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro IV - 2005 Standards	3	48	18

Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro V - 2008 Standards	3	48	19
Heavy Duty Trucks	Articulated 50 - 60 t	HD Euro VI	3	48	44
Buses	Urban CNG Buses	HD Euro I - 91/542/EEC Stage I	4	49	15
Buses	Urban CNG Buses	HD Euro II - 91/542/EEC Stage II	4	49	16
Buses	Urban CNG Buses	HD Euro III - 2000 Standards	4	49	17
Buses	Urban CNG Buses	EEV	4	49	45
Buses	Urban Biodiesel Buses	Conventional	4	50	22
Buses	Urban Biodiesel Buses	HD Euro I - 91/542/EEC Stage I	4	50	15
Buses	Urban Biodiesel Buses	HD Euro II - 91/542/EEC Stage II	4	50	16
Buses	Urban Biodiesel Buses	HD Euro III - 2000 Standards	4	50	17
Buses	Urban Biodiesel Buses	HD Euro IV - 2005 Standards	4	50	18
Buses	Urban Biodiesel Buses	HD Euro V - 2008 Standards	4	50	19
Buses	Urban Biodiesel Buses	HD Euro VI	4	50	44
Buses	Urban Buses Midi <=15 t	Conventional	4	30	22
Buses	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	4	30	15
Buses	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	4	30	16
Buses	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	4	30	17
Buses	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	4	30	18
Buses	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	4	30	19
Buses	Urban Buses Midi <=15 t	HD Euro VI	4	30	44
Buses	Urban Buses Standard 15 - 18 t	Conventional	4	31	22
Buses	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	4	31	15
Buses	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	4	31	16
Buses	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	4	31	17
Buses	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	4	31	18
Buses	Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	4	31	19
Buses	Urban Buses Standard 15 - 18 t	HD Euro VI	4	31	44
Buses	Urban Buses Articulated >18 t	Conventional	4	32	22
Buses	Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	4	32	15
Buses	Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	4	32	16
Buses	Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	4	32	17
Buses	Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	4	32	18
Buses	Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	4	32	19
Buses	Urban Buses Articulated >18 t	HD Euro VI	4	32	44
Buses	Coaches Standard <=18 t	Conventional	4	33	22

Buses	Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	4	33	15
Buses	Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	4	33	16
Buses	Coaches Standard <=18 t	HD Euro III - 2000 Standards	4	33	17
Buses	Coaches Standard <=18 t	HD Euro IV - 2005 Standards	4	33	18
Buses	Coaches Standard <=18 t	HD Euro V - 2008 Standards	4	33	19
Buses	Coaches Standard <=18 t	HD Euro VI	4	33	44
Buses	Coaches Articulated >18 t	Conventional	4	34	22
Buses	Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	4	34	15
Buses	Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	4	34	16
Buses	Coaches Articulated >18 t	HD Euro III - 2000 Standards	4	34	17
Buses	Coaches Articulated >18 t	HD Euro IV - 2005 Standards	4	34	18
Buses	Coaches Articulated >18 t	HD Euro V - 2008 Standards	4	34	19
Buses	Coaches Articulated >18 t	HD Euro VI	4	34	44
Mopeds	<50 cm³	Conventional	5	21	22
Mopeds	<50 cm³	Mop - Euro I	5	21	20
Mopeds	<50 cm³	Mop - Euro II	5	21	21
Mopeds	<50 cm³	Mop - Euro III	5	21	38
Motorcycles	2-stroke >50 cm³	Conventional	6	22	22
Motorcycles	2-stroke >50 cm³	Mot - Euro I	6	22	27
Motorcycles	2-stroke >50 cm³	Mot - Euro II	6	22	39
Motorcycles	2-stroke >50 cm³	Mot - Euro III	6	22	40
Motorcycles	4-stroke <250 cm³	Conventional	6	23	22
Motorcycles	4-stroke <250 cm³	Mot - Euro I	6	23	27
Motorcycles	4-stroke <250 cm³	Mot - Euro II	6	23	39
Motorcycles	4-stroke <250 cm³	Mot - Euro III	6	23	40
Motorcycles	4-stroke 250 - 750 cm³	Conventional	6	24	22
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro I	6	24	27
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro II	6	24	39
Motorcycles	4-stroke 250 - 750 cm³	Mot - Euro III	6	24	40
Motorcycles	4-stroke >750 cm³	Conventional	6	25	22
Motorcycles	4-stroke >750 cm³	Mot - Euro I	6	25	27
Motorcycles	4-stroke >750 cm³	Mot - Euro II	6	25	39
Motorcycles	4-stroke >750 cm³	Mot - Euro III	6	25	40

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Abstract
This is the final report of a study on the characterization of the sensitivity and quantification of the uncertainty of road transport calculations performed with COPERT 4. Two case studies were examined: one referring to Italy which is considered as a country with very good knowledge of the operating vehicle stock and the total activity in its territory. The second situation refers to Poland, where some of the older vehicle technologies do not follow the European classification and this increases the uncertainty in the calculations. Other differences between the countries include the difference in ambient conditions and the much younger stock of the fleet in Italy compared to Poland. The report provides the uncertainty ranges of the COPERT 4 emission factors and modelling parameters. It also characterizes the uncertainty of the input data for Italy and Poland. The most influential variables were also identified, using a screening technique (Morris) and Monte Carlo simulations. Finally, the uncertainty of the calculations was quantified by performing over 6000 simulation runs per country. The results of the simulations have been also used to provide guidance for road transport inventory calculations, following the methods proposed in the EMEP/EEA Atmospheric Emission Inventory Guidebook.

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