Street Emission Ceiling (SEC) exercise

Phase 3 report on station pair data analysis, comparison with emissions estimates, street typology and guidance on how to use it

ETC/ACC Technical Paper 2006/7
April 2007

Steinar Larssen and Giorgos Mellios
Dick van den Hout, Evangelia Anna Kalognomou and Nicolas Moussiopoulos

European Topic Centre
on Air and Climate Change

The European Topic Centre on Air and Climate Change (ETC/ACC)
is a consortium of European institutes under contract of the European Environmental Agency
RIVM UBA-B UBA-V IIASA NILU AEAT AUTh CHMI DNMI NTUA ÖKO IEP TNO UEA

Cover photo:
Aerial photograph of the Runeberg Street in Helsinki (Finland) and the location of the air quality monitoring station (red dot) and the meteorological station (green dot).

DISCLAIMER

Foreword

This report presents the work performed within the task “Assessment of the local contribution to air pollution at urban hotspots” of the European Topic Centre on Air and Climate Change (ETC/ACC) 2006 workprogramme. The collaborating institutes are the Norwegian Institute for Air Research (NILU), the Aristotle University Thessaloniki (AUT) and the Institute of Environmental Sciences Energy Research and Process Innovation (TNO).

Authors

Chapter 1: Steinar Larssen (NILU), Giorgos Mellios (LAT/AUT)

Chapter 2: Dick van den Hout (TNO), Evangelia Kalognomou and Nicolas Moussiopoulos (LHTEE/AUT)

Acknowledgements

Grateful thanks are due to data providers: Christer Johansson (ITM Air Pollution Laboratory, Stockholm University) for the Hornsgatan test case, Martin Lutz (Senate department of Urban Development in Berlin) for the Frankfurter Allee case and David Green (King’s College London, Environmental Research Group) for the Marylebone Rd. case. Thanks are also due to Jaakko Kukkonen and Paivi Aarnio from the Finnish Meteorological Institute (FMI) and Ms. Tarja Koskentalo of the Helsinki Metropolitan Area Council who provided data for the Helsinki case study. The Oslo office of the Norwegian Road Administration funded the collection of the data for the RV4 study.

Table of Contents

Executive Summary

This report is the last one of the Street Emission Ceilings (SEC) study dealing with air pollution in European streets. It consists of two parts.

Station pair analysis

The analysis of air pollution monitoring data for new station pairs has given an added data base for testing of street scale air pollution dispersion models.

Together with the results from station pair analysis from previous subventions of the SEC project, the work under this subtask has resulted in a wider assessment of the contribution from road dust suspension to the fine and coarse fractions of PM_{10} at traffic hot spots. For streets where studded tyres are not used, the coarse fraction emission factor, which is dominated by road dust resuspension varies, for the locations included in the analysis, between 1 and 4 times the emission factor for fine particles (which is dominated by exhaust particle emissions), as an average for a winter or summer season. In Scandinavian streets where studded tyres are used in the winter, the coarse fraction emission factor is 3-10 times the fine fraction emission factor, as winter average. The fine fraction contribution from road dust suspension is also significant, while still not well quantified. In Hornsgatan in Stockholm, this contribution is about 1/3 of the exhaust particle contribution.

AirBase data supports the indication from UK and other studies that the NO_2 fraction of NO_X at street locations in Europe is increasing. This is consistent with the increased NO_2 fraction of NO_X emitted from diesel vehicles with oxidation catalyst and/or particle traps, which is being penetrated into the European vehicle fleet.

Street typology

It was attempted to develop a statistical overview of European roads based on the street typology developed earlier in the SEC study. A review of road data was conducted and a questionnaire was sent to municipalities in the EU. Information on building structure alongside streets was found to be hardly available. Estimates of road properties per street type were made based on the limited information found. For each street type emissions were calculated for a set of 20 European cities.

Before applying the CAR model to the various street types, a comparison was made with the more detailed OSPM model, which had been applied in an earlier phase of the SEC study. Although some differences between the model results were found, the agreement was satisfactory for the typology study. The model results were also found to be broadly consistent with an ensemble of street concentration increments that had been estimated from observations.

Based on the street typology, the report gives guidance on how to calculate nomograms for streets in a city. Explicit examples are given using the CAR model for Athens and Berlin.

The typology was then applied to all street types in 20 European cities, using the CAR model and background levels available from the previous phase of the SEC study. For all street types, the concentration ranges of NO_2 and PM_{10} are given for these 20 cities. When using these results, the limitations in the underlying data should be taken into account.

Chapter 1: Station pair data analysis and comparison with emissions estimates

1.1 Introduction

A main objective of the "Street Emission Ceilings" (SEC) project is to use existing monitoring data from selected high quality monitoring stations as a basis for estimating ratios of emission factors for various compounds, to provide data for testing street scale models as well as to test COPERT 3 emission factors for road vehicles.

The overriding objective of the Street Emission Ceilings (SEC) project is to develop a method for determining what local emission reductions in streets are needed to reach certain air quality thresholds, e.g. limit values.

The work in Sub-task 1 under the 2006 ETC/ACC Subvention includes to analyse data from further station pairs from cities in Europe in a similar way as under the 2004-2005 subventions. This analysis includes to calculate street level increments in concentrations above the urban background surrounding the street station of the pair, and calculating delta ratios relative to NO_X, to be used as basis for comparing ratios calculated from emission factor data bases and from the measurements. The analysis concentrates on PM and NO_2. For PM, both $PM_{2.5}$ and PM_{10} are considered, and this should result in estimates of emission factors for the fine and coarse particle fractions separately. The coarse fraction is most often dominated by the suspension of particles from the road. Particles from tyre and brake wear also contribute to the coarse fraction mass. These sources also contribute to the fine fraction emissions ($PM_{2.5}$), although this fraction is dominated by exhaust particles.

In 2006, new station pairs with sufficient data coverage were sought in many cities. The requirements were:

- a station pair where it was considered that the background station represented well the situation at the street station
- hourly measurements of $PM_{2.5}$, PM_{10}, NO_X and NO_2 at both stations, at least covering several months, preferably both summer and winter periods.
- hourly measurements also of meteorological and traffic parameters
- measurements to cover at least several months
- acceptable data quality procedures.

In 2006, data from the following station pairs were found to be good candidates for analysis:

- the RV4 station pair in Oslo: an urban highway, no street canyon
- the Runeberg Street/Kallio station pair in Helsinki: a street canyon
- the Vallila/Kallio station pair in Helsinki: no street canyon.

Candidate station pairs from cities like Prague turned out not yet to have the needed data coverage. The data quality issues of the Goettinger Strasse data from Hannover are still unresolved.

Results from similar analysis of station pair data carried out in the Air4EU project (AIR4EU, 2006; Keuken et. al., 2006) have also been included in this report.

Annex A presents the analysis of the data from the 3 new station pairs. In Annex B, emission calculations are presented for the RV4, Oslo and Runeberg, Helsinki cases. In Annex C, results of the data analysis from the previously analysed station pairs are presented (Moussiopoulos et. al., 2004).

Table 1.1 gives the metadata for the station pairs, including macrodata for the traffic flow. The heavy duty vehicles fraction may not be defined exactly the same way at all streets. Exact definitions of HDV fraction at the locations are not available to us. Also, they represent the total average fraction, not the fraction during the midday hours between rush hours.

Figures 1.3-1.8 show bar plots of the PM/NO_X and NO_2/NO_X ratios for all of the analysed station pairs (new and previous). The figures specify ratios for summer/winter/workday/weekend periods (for 6-hour long midday periods), where data are available.

1.2 Summary of results, PM

Table 1.2 summarises the results from the station pairs included in the 2006 subvention, together with previous SEC results as well as results extracted from the Air4EU project (Air4EU, 2006).

The measurements at the Helsinki station pairs were carried out by the city of Helsinki. The data were extracted from the OSCAR data base (OSCAR, 2004)

As part of the Air4EU project (ref), data from station pairs in Rotterdam, Rome and London (Marylebone Rd, data for 2004) has been made available, and were subjected to the same kind of data analysis as have been carried out in the SEC project (Keuken et.al., 2006).

The table has columns for:

- the ratio between PM and NO_X calculated from COPERT 3 emission factors, calculated for each location based upon the local vehicle fleet data
- the measured ratios between $PM_{2.5}$ and NO_X , workday conditions.
- the measured ratios between PM_{10} and NO_X , workday conditions.
- The measured ratios represent the average of 6 midday hours between rush hours (usually 10-15 or 11-16), to avoid rush hour effects on the emission factors and thus on the ratios.

Table 1.1: Overview of station pair metadata.

City	Year	Station pair		Street topography			Traffic			Meteorology (annual average)	
		Street	Background	Width m	Building height m	No. of traffic lanes	AADT veh/day	Aver. speed km/h	HDV fraction %	Wind speed m/s	Temp °C
2006 SEC subvention											
Oslo	2004	RV4	Aker Hospital	17	0	5	40,500	77	6.7	2.7	-1.0
	2004-5	RV4	Aker Hospital	17	0	5	40,500	67	6.7	3.1	+0.2
Helsinki	2003	Runeberg	Kallio	24	23	4	26,000	40	6.0	4.2	+5.2
	2004	Runeberg	Kallio	24	23	4	26,000	40	6.0	4.1	+5.4
Helsinki	2003	Vallila	Kallio	31	0	4	12,500	53	12.1	4.2	+5.2
Earlier SEC subventions, and Air4EU cases											
Stockholm	2000	Hornsgatan	Roof	22	20	4	34,800	47	5.0	3.5	+10.7
London	2000	Marylebone	Bloomsbury	35	22	6	85,500	40	10.3	5.2	+12.2
Oslo	2002	Skaarersletta	Nordby	19.4	0	4	35,900	91	6.0	1.2	+0.1
Berlin	2002	Frankfurter Allee	Neukoelln station	42	21	6	56,000	40	4.8	2.9	+9.8
Rome	2003	Magna Grecia	Villa Ada	N/A	15-20	N/A	38,000	Ca 40	7	N/A	N/A
Rotterdam	2005	Bentinckplein	Schiedam	N/A	10-15	N/A	28,500	N/A	3.5	N/A	N/A

The measured ratios are presented for summer and winter periods separately, where available. The main parameter creating differences in the ratios between summer and winter are the use of studded tyres during winter in some locations.

Also differing climatic conditions between summer and winter could affect the ratio to some extent, such as dominatingly the frequency of precipitation and the resulting occurrence of wet vs dry road surface. Dust would be suspended when the surface is dry. No attempt has been made so far in distinguishing between wet and dry hours/days. Rather, the average situation for each season has been calculated, given the actual precipitation regime at each location and each year. The meteorological temperature (winter vs summer) may also have a slight effect on the exhaust emission factors and thus on the ratio.

1.2.1 Comparison between calculated and measured PM/NO_X ratios

The $PM_{2.5}$ over NO_x emission ratios depend on both the fleet composition and the average speed. With regard to the fleet composition there are a number of parameters having an effect on the calculated ratios. These include the shares of the various vehicle categories (e.g. gasoline-fuel, passenger cars-HDVs, etc) and technologies (e.g. pre-Euro, Euro I, II, etc). In the absence of detailed data on the composition of the fleets of the various measuring sites we have assumed that they are in line with the respective national fleets. The differences in the observed emission ratios may thus be attributed mainly to the differences in the HDV share and the average speed of the vehicles. Since the $PM_{2.5}$ over NO_x emission ratio decreases with decreasing HDV share and increasing speed, this could explain the low ratio for RV4, Oslo (~7% HDV, 70-80 km/h) compared to e.g. Runeberg (~12% HDV, ~46 km/h). Hornsgatan in Stockholm has a fairly normal HDV fraction, but these consist to a large extent of gas-fueled buses with low PM emissions, explaining the low PM ratio there.

In general, the modelled $PM_{2.5}$ over NO_x emission ratios compare reasonably well with the measured delta ratios. The agreement is particularly good for the summer case in Hornsgatan in Stockholm. For Marylebone Road the modelled ratios are higher than measured while they are considerably lower than measured for the RV4 case in Oslo.

The winter case for Hornsgatan points to the important indication that road dust suspension also contributes significantly to $PM_{2.5}$. This is discussed further below (section 1.2.2.2).

In the framework of the DG TrEn project Artemis, it was found that emissions of Euro II heavy-duty vehicles are underestimated by the existing emission factor databases, a fact that affects especially NO_x emission levels. Consequently, NO_x emissions calculated with COPERT are expected to be underestimated. This contributes to an explanation of the Marylebone road difference model overestimation.

With regard to the modelled PM emissions it has to be noted that TRENDS covers solely tailpipe diesel PM, i.e. emissions from gasoline-fuelled vehicles. Non-tailpipe emissions (such as from brakes, tire wear, road wear and suspension of road dust) are not taken into account. While exhaust PM emissions from gasoline-fuelled vehicles are at least two orders of magnitude lower than diesel PM emissions, several studies indicate that non-tailpipe emissions constitute a significant fraction of the total road traffic PM emissions.

There are also several street-specific reasons that could explain – to a certain extent – the variations. These may include older technology vehicles, enhanced cold start effects, poorer than expected vehicle maintenance. The relative significance of the above phenomena is not known and may vary from site to site. More important, though, is the influence of the road dust suspension source, which is discussed in the following.

1.2.2 The road dust suspension source

The strength of the road dust suspension source can be estimated based upon the difference in ratios between $PM_{2.5}$ and PM_{10} relative to NO_X.

1.2.2.1 Non-studded-tyre streets

Marylebone Road in London (street canyon) is still the only non-studded-tyre street example where data for both $PM_{2.5}$ and PM_{10} are available, here for both summer and winter conditions. The analysis has been done for two years, for 2000 (as part of the previous SEC work) and for 2004 (results from the Air4EU project). Average speed is about 40 km/h and HDV fraction is about 10.5%.

For 2000 there was little difference between summer and winter ratios, both for $PM_{2.5}$ and PM_{10}, and thus also for the coarse fraction. This indicates that there was little difference in suspension conditions during summer and winter of 2000. The PM_{10} ratio was about two times the $PM_{2.5}$ ratio. The suspension source of coarse fraction PM can thus be estimated to be of about the same magnitude as the fine fraction source (exhaust/tyre wear/brake wear), i.e. about the same emission factor. The contribution from the suspension source to $PM_{2.5}$ cannot be judged from the available data. It is assumed that it is small. This estimate represents the average climatic conditions during each of the summer and winter seasons 2000 analysed.

The results of the analysis on the 2004 data deviates a bit from the 2000 analysis. The summer ratios are actually a bit higher (about 10% higher) than the winter ratios. Possible explanations for this must be sought in differences in traffic conditions and vehicle mix (including technology levels) between the two seasons, or differences in precipitation frequency and duration (apart from looking at possible data quality issues).

The data for PM_{10} from ***Frankfurter Allee in Berlin*** (street canyon) indicates that the suspension source is stronger here than in Marylebone Road, by about a factor of 2. However, the lack of $PM_{2.5}$ data prevents a definite estimate to be made here. Average speed is 40 km/h (as in Marylebone), while the HDV fraction is 4.8% (less than half of that in Marylebone). The lower HDV fraction should result in a lower PM_{10} ratio than in Marylebone, while the opposite is the case. Other factors must be looked at, such as street cleaning and precipitation frequencies.

The data from the pairs in ***Rome and Rotterdam*** (street canyons) include only PM_{10} ratios (Keuken et. al., 2006). These are rather high compared to Marylebone, of similar level as Frankfurter Allee. Magna Grecia in Rome has a high 2-wheeler fraction (15-20%). Also, the detailed analysis of the data (Keuken et.al., 2006) indicate that the urban background station used there may not be well representative for the traffic station, so the PM_{10} ratio from the Rome station pair should be regarded with caution.

The differences in the strength of the suspension source between Marylebone, Frankfurter and the Rome and Rotterdam locations indicate that the suspension source varies fairly much, from about equal to the exhaust/tyre/brake fine fraction source to 3-4 times that source. The variation could be due to different climate conditions (especially regarding precipitation events), to the street cleaning practices, and also to the differences in HDV fraction. Large vehicles in traffic have much stronger turbulence intensity around them, causing significantly more suspension of deposited particles from the road surface. However, the HDV fraction is very low in the inner-city street Bentinckplein in Rotterdam (3.5%) where the PM_{10} ratio is highest, while it is highest of these 4 streets in Marylebone, where the PM_{10} ratio is the lowest. Obviously, other factors than the HDV fraction seem to be more important for the PM suspension rate.

1.2.2.2 Studded tyre streets

For locations were studded tyres are used, the suspension source is much stronger. Data from four locations are available. ***Hornsgatan in Stockholm*** (street canyon) has the most complete data set. Average speed here is 47 km/h, and the HDV fraction is 5.0% (mostly gas-fueled buses). Occasional sanding.

The data for $PM_{2.5}$ indicate that the studded tyre road dust suspension source in winter contributes to $PM_{2.5}$ with a strength of about 1/3 of the exhaust/tyre/brake fine fraction source. For PM_{10}, the suspension source in Hornsgatan is large also during summer (no studded tyres used then), about 3 times the fine fraction source. In the winter, when studded tyres are used, the suspension source is close to 10 times the summer fine fraction source, and thus dominates completely. Again, this is the average over the entire season. With dry road surface during the winter, the suspension source is even much stronger than the average.

The data from the new station pair ***RV4 in Oslo*** (not street canyon) supports the Hornsgatan data. Data from two winters are available, but no summer data. The

speed limit was reduced from 80 km/h in 2004 to 60 km/h during the 2004-5 winter. The HDV fraction was 6.7%. No sanding, but occational application of road salt to melt ice and improve friction.

The average winter PM_{10} source strength in RV4 is 10 times higher than the winter $PM_{2.5}$ source strength. This is the case for both 2004 with 80 km/h speed limit (actual average speed: 77 km/h) and for the 2004/5 winter season with 60 km/h speed limit (actual average speed: 67 km/h). The suspension PM source strength is about 30% lower at 67 km/h than at 77 km/h. The much higher speed in RV4 than in Hornsgatan, as well as the higher HDV fraction increases the strength of the suspension source considerably, as can be expected.

At the Skaarersletta site near Oslo (not street canyon), the winter PM_{10} ratio is 240 (representing the full week, not just the workdays, as in all other cases). At the high traffic speed (over 90 km/h) one would expect a larger ratio than e.g. at RV4, while the measured ratio is actually lower.

The data from ***Runeberg Street in Helsinki*** (street canyon) do not fully support the findings from Stockholm and Oslo. The main reason for this is that there were building construction activities in the vicinity of the measurement site at Runeberg Street that influenced the measured concentrations of PM_{10}. Data are available there from two years (2003 and 2004), with data from 2004 being the most complete (both summer and winter). Traffic speed is 40 km/h and the HDV fraction is 6%. Occational sanding.

The PM_{10} ratios are only about 2-3 times the $PM_{2.5}$ ratios (similar to Marylebone Rd), and this is the case both for summer and winter periods. Actually the winter PM_{10} ratio for 2004 is even somewhat lower than the summer ratio.

Results of analysis of data from the ***Vallila-Kallio Station pair in Helsinki*** (not street canyon) are included in Annex A. Vallila is located fairly close to a highway, but it is not a curb station. Therefore, concentrations measured is very dependent upon the wind direction, and the distance to the road is large enough that the concentrations at the station are not always significantly higher than at the urban background. The figure in Annex A show that the $PM_{2.5}$ ratio is generally low and very variable, and the delta ratio relative to NO_X is negative in periods. Meaningful $PM_{2.5}$ delta ratios thus cannot be extracted from this station pair. For PM_{10}, the summer and winter midday workday ratio is about 150 and 400, respectively. The summer ratio is in line with the Runeberg street ratio, while the winter ration is much higher than for Runeberg, more in line with the RV4 Oslo ratio, as expected for a street where studded tyres are used.

So, also for the studded tyre locations the data show a large variation in the suspension source strength. This variation is much larger than for the non-studded situations, and the PM_{10} winter source strength is from 3 to 10 times the winter $PM_{2.5}$ source strength. The winter $PM_{2.5}$ in studded tyre locations also includes a suspended PM contribution, as indicated by the Hornsgatan results. That means that compared to the exhaust/tyre/brake source, the suspension source in studded tyre locations is even larger than 3-10 times that source. The

differing sanding and salting practices in Stockholm, Helsinki and Oslo may add to the variation in apparent coarse fraction source strength.

1.2.2.3 Summarizing

Table 1.2 includes data from 9 station pairs in different cities and countries. The analysis above shows that the variations between the locations are large. Data from even more station pairs should be included, when the data coverage complies with the requirements (in terms of time, compounds and quality).

A next step in the analysis of station pair data would be to include meteorological parameters in the analysis. When including wind direction and speed, delta ratios could be calculated specifically for the downwind direction (from street towards the side where the monitoring station is located) and for a narrower speed range, which would probably reduce the scatter in the delta ratio variations. This would especially improve the delta ratios for non-street canyon cases. When including precipitation data, delta ratios could be calculated for wet and dry conditions separately, enabling to characterize the suspension source more directly.

Table 1.2: Measured and calculated (from COPERT 3) ratios between PM and NO_X. The measured ratios represent the average over 6 mid-day hours during workdays.

Street/city/characteristic	Year	Emission ratio PM/NO_X COPERT3	Measured ratio $PM_{2.5}$ / NO_X		Measured ratio PM_{10} / NO_X	
			Summer	Winter	Summer	Winter
2006 SEC subvention						
RV4, Oslo * *77 km/h, 6.7% HDV*	2004	25		54		548
RV4, Oslo * *67 km/h, 6.7% HDV*	2004/5	27		38		309
Runeberg, Helsinki * *40.km/h, 6.0 % HDV*	2003	56	ca 60		ca 130	
Runeberg, Helsinki * *40km/h, 6.0 % HDV*	2004	57	ca 40	ca 40	ca 125	ca 100
Vallila, Helsinki * *53 km/h, 12.1 % HDV*	2003				150	400
Earlier SEC subventions, and Air4EU cases						
Marylebone Rd, London *40 km/h, 10.3 % HDV*	2000	50	41	39	75	78
Marylebone Rd, London *40 km/h, 10.5 % HDV*	2004	50	35	31	88	79
Frankfurter Allee, Berlin *40 km/h, 4.8 % HDV*	2002	50			160	180
Hornsgatan, Stockholm * *47 km/h, 5.0 % HDV*	2000	28	30	40	98	251
Skaarer, near Oslo * *91 km/h, 6.0 % HDV*	2002					240
Magna Grecia, Rome *20 km/h, 7 % HDV*	2003	50			ca 200	
Betinckplein, Rotterdam *xx.km/h, 3.5 % HDV*	2004	50			ca 120	
* locations where studded tyres are used in winter						

1.3 Summary of results, NO_2

Figures 1.3-1.8 show the delta ratios for NO_2/NO_X measured at the station pairs. These delta ratios do not just reflect the ratio in the emissions from the traffic, since fast NO-O_3 reactions take place in the street/road air, when the air coming towards the street contains ozone. This is normally the case, except in high pollution situation when the urban ozone may already be completely depleted by NO in the urban background air. Ozone data were not available for all the station pairs analysed, so it has not been possible to correct for this ozone effect in the present analysis.

Figures 1.3-1.8 show considerable variation in NO_2/NO_X ratios, which is partly due to the ozone effect described above, and partly to the varying HDV fractions between the locations.

Analysis of NO_2 and NO_X data in AirBase show a tendency towards increased fraction of NO_2 in vehicle exhaust in Europe. Figure 1.1 show the tendencies in NO_2 concentrations (annual average) measured at a number of rural, urban background and traffic stations since 1996. The figure is based on a total of 406 stations, which are all the stations with <70% data coverage each year 1996-2004. The tendency towards lower NO_2 concentrations is clear towards 2000-2001, both in rural, urban and traffic locations. Since then, the NO_2 concentrations have been stable as an average over the 406 stations, except for an increased NO_2 level in 2003, which might be explained by the meteorological conditions that year.

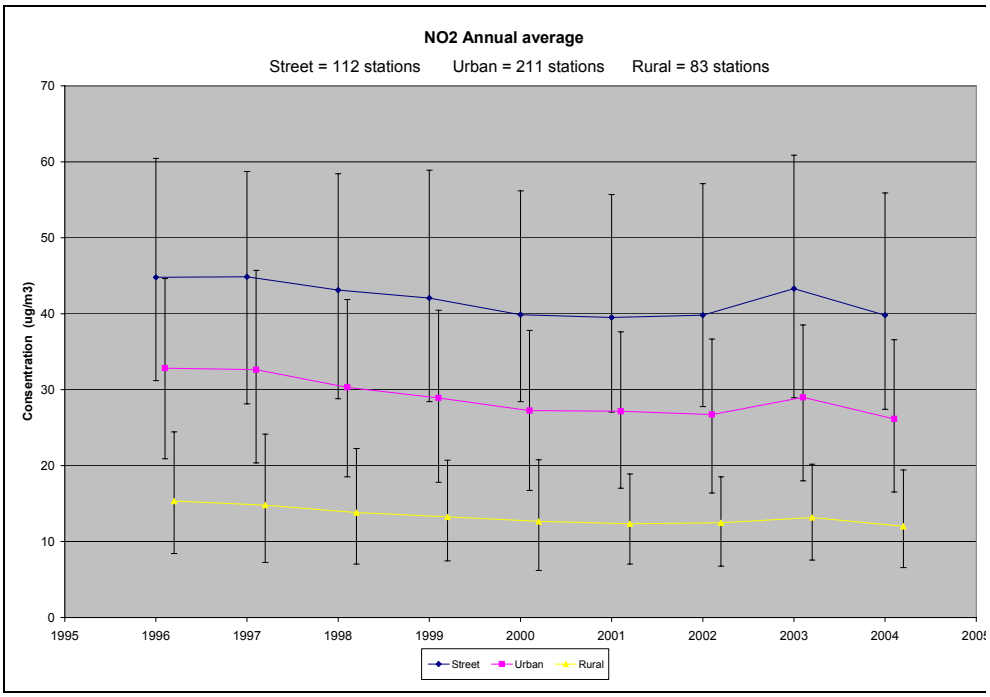


Figure 1.1: NO_2 data in AirBase from rural, urban background and traffic stations in Europe. (Larssen et. al., 2006).

In Figure 1.2, the NO_2 data have been combined with associated NO_X data, at about 115 rural stations, about 220 urban background stations and about 140 traffic stations with both NO_X and NO_2 data for at least 6 of the 7 years (de Leeuw, 2006).

The figure shows regarding the relative trend in NO_2 compared to NO_X, that:

- the relative trends are similar at the rural stations.
- NO_2 is reducing less than NO_X since 2000-2001 at urban background.
- the split between NO_2 and NO_X relative trends is even larger at traffic stations: NO_X is continuing downwards , while NO_2 at traffic stations is even increasing since 2000-2001.

As an average over all the traffic stations represented, the NO_2/NO_X ratio has increased by about 10-15% relative since 2000. This analysis is also affected by the same ozone effect as described above. If one subtracts the fraction of NO_2 at the traffic station which is due to the ozone effect, the relative increase in the average emission NO_2/NO_X ratio at these station would be larger than 10-15%.

It is well known that diesel vehicles with oxidation catalysts and/or catalytically regenerative particle traps (CRT) have a considerably higher fraction of NO_2 of their NO_X emissions, as e.g. presented and summarised at the “EU level workshop on direct NO_2 emissions from road vehicles” on 19 September in Brussels (URL1). E.g. for Euro III diesel vehicles, NO_2 fractions of 20-70% have been measured.

The UK has studied the current trends in direct NO_2 emissions from vehicles (DEFRA, 2006). Rather abrupt increases in NO_2 concentrations relative to NO_X has been observed at some UK monitoring sites, especially at the Marylebone Road site in London (URL2). Analysis of monitoring data from Marylebone Road in London results in an estimate of the average NO_2/NO_X fraction which has increased from about 7% in 1997 to higher than 15% in 2004 and 2005. The fraction has increased steadily since 1997, but a considerable step upwards in 2003 coincides with the introduction of buses with CRT in London.

This indicates that the primary NO_2 fraction of NO_X emissions from vehicles in Europe is on the increase. There is consistency between the trend in NO_2/NO_X ratio analysed from AirBase data above and the evidence from the UK study, although it is clear that the NO_2 fraction varies considerably between sites dependent upon the vehicle type and technology mix. At the same time, NO_X emissions from vehicles will continue to decrease with penetration of post-Euro 3/III vehicles. This decrease will counteract the increase in NO_2 fraction. The UK analysis indicates that the total result may be that NO_2 exceedances will be reduced by 2010, but this indication is uncertain because of the uncertainty in estimating the actual future emissions of NO_X and NO_2.

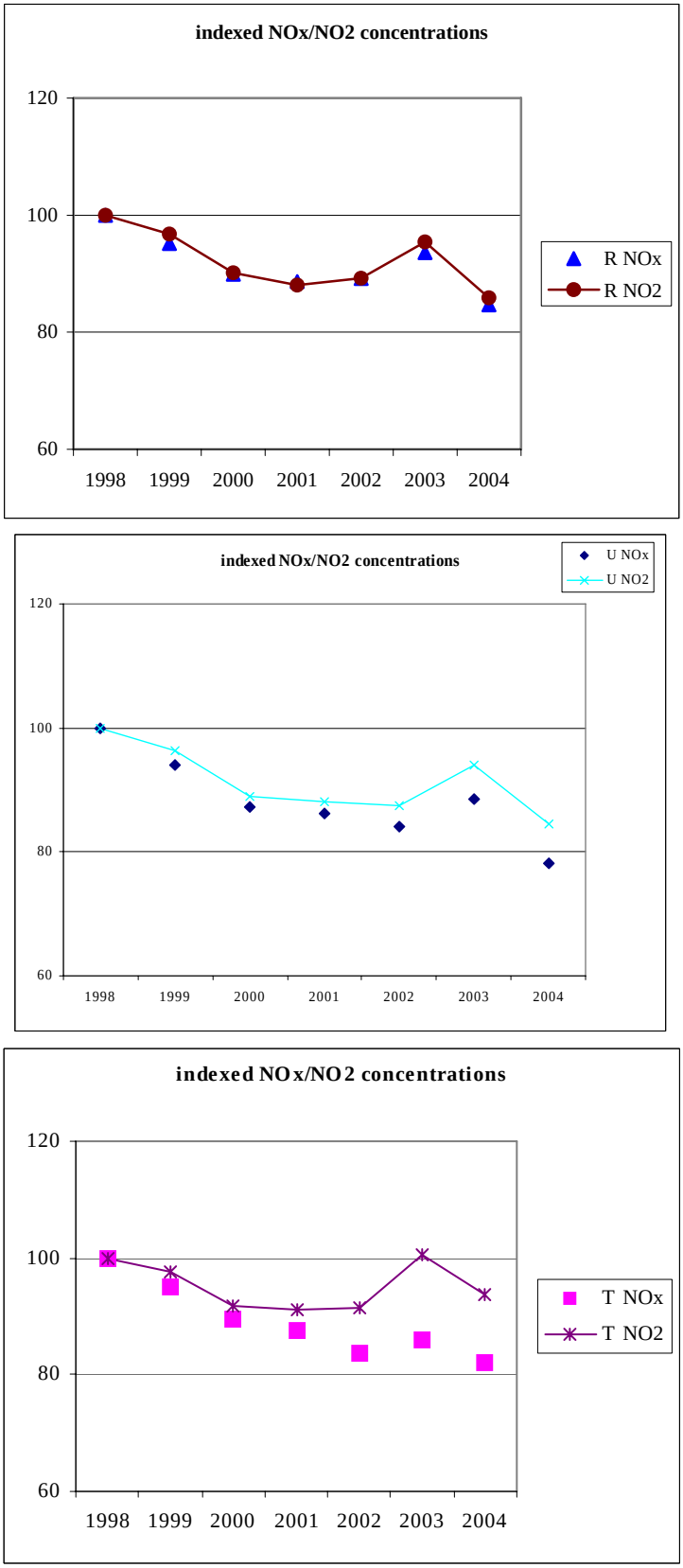


Figure 1.2: Development of NO_X and NO_2 concentrations at rural, urban background and traffic stations in Europe, 1998-2004. Reference: AirBase

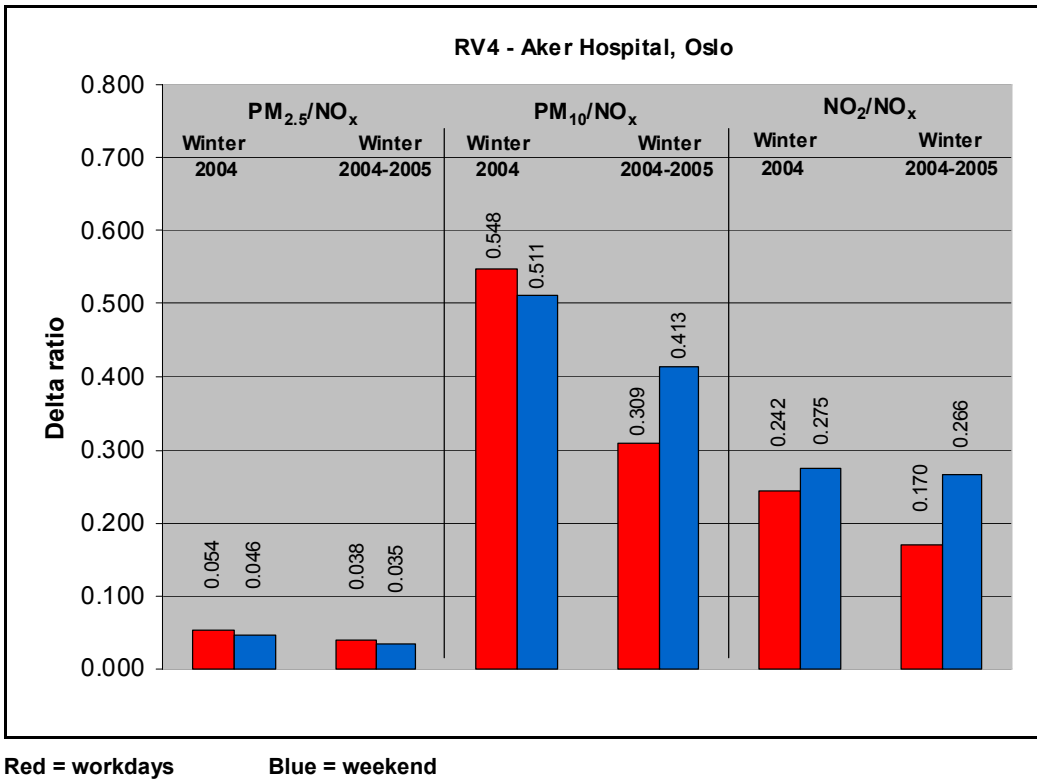


Figure 1.3:Delta ratios for the RV4 station pair in Oslo, winters 2004 and 2004-5.

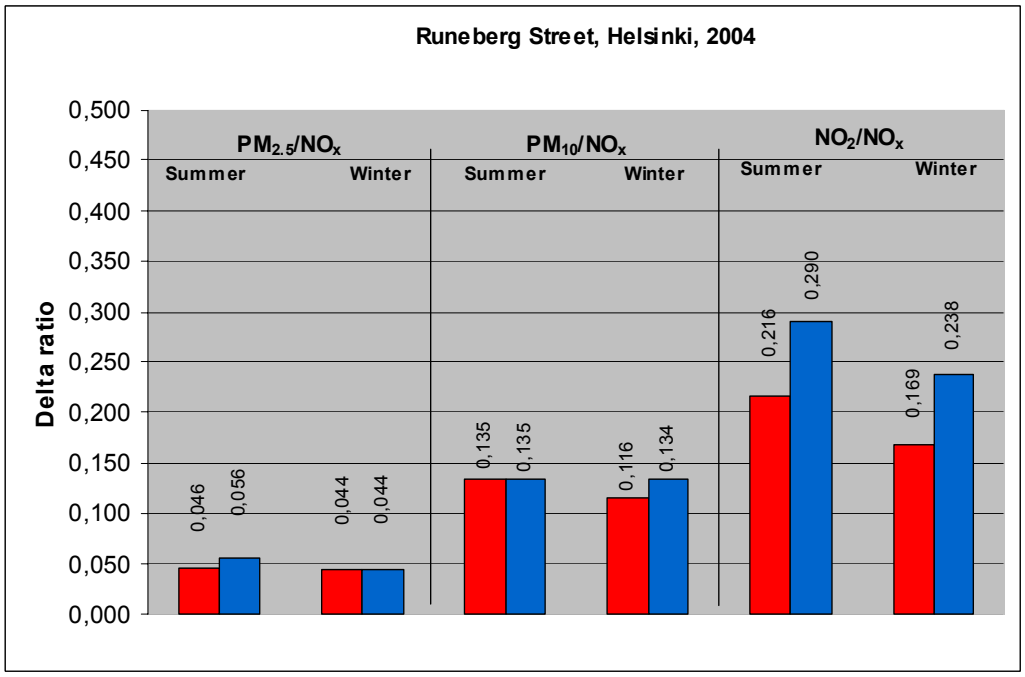


Figure 1.4: Delta ratios for the Runeberg street station pair in Helsinki, 2004.

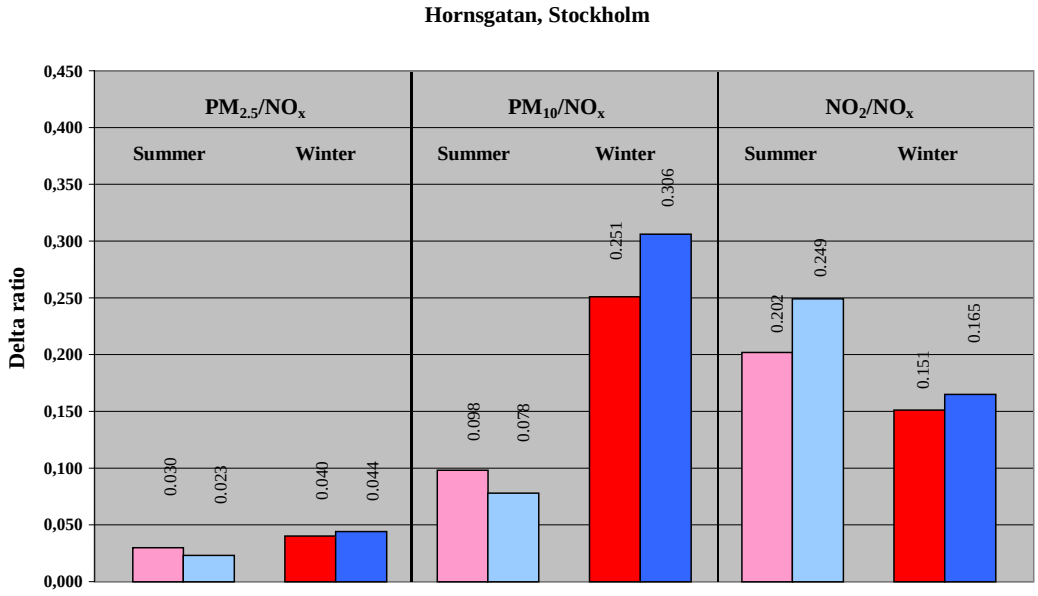


Figure 1.5: Delta ratios for the Hornsgatan station pair in Stockholm, 2000.

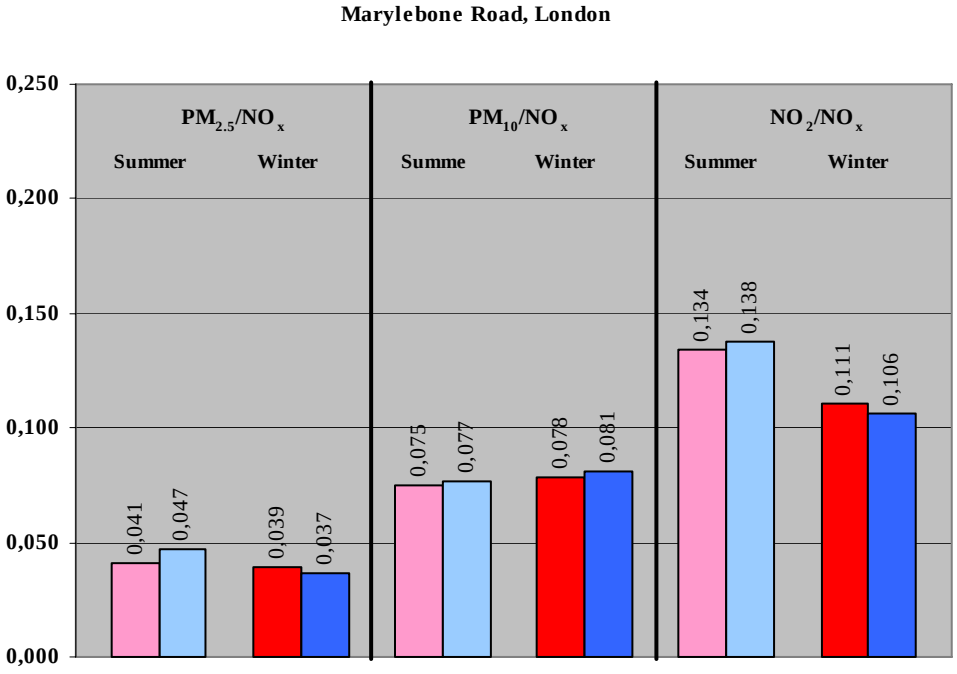


Figure 1.6: Delta ratios for the Marylebone Road station pair in London, 2000.

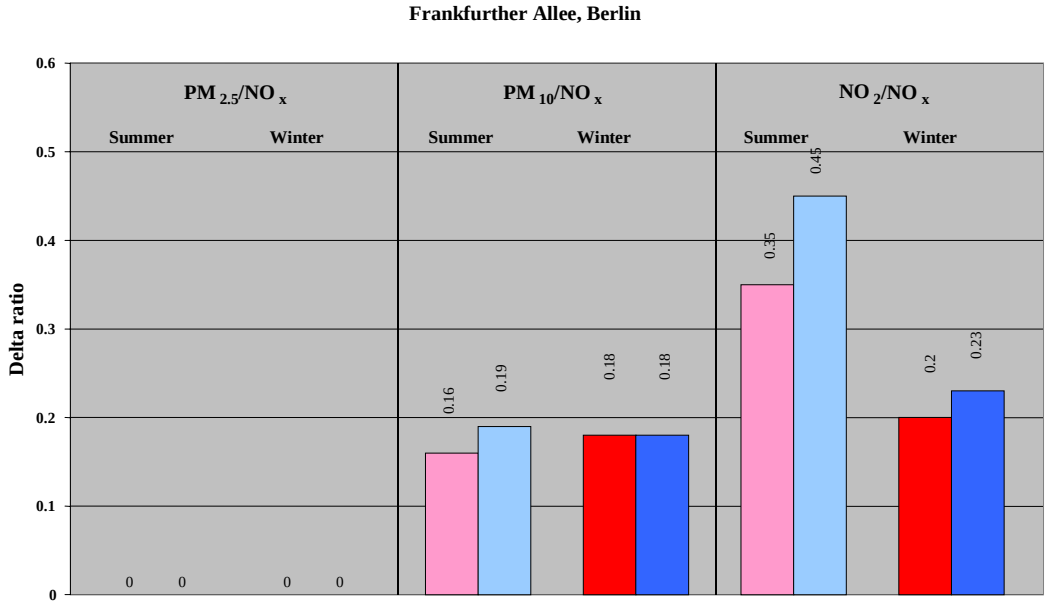
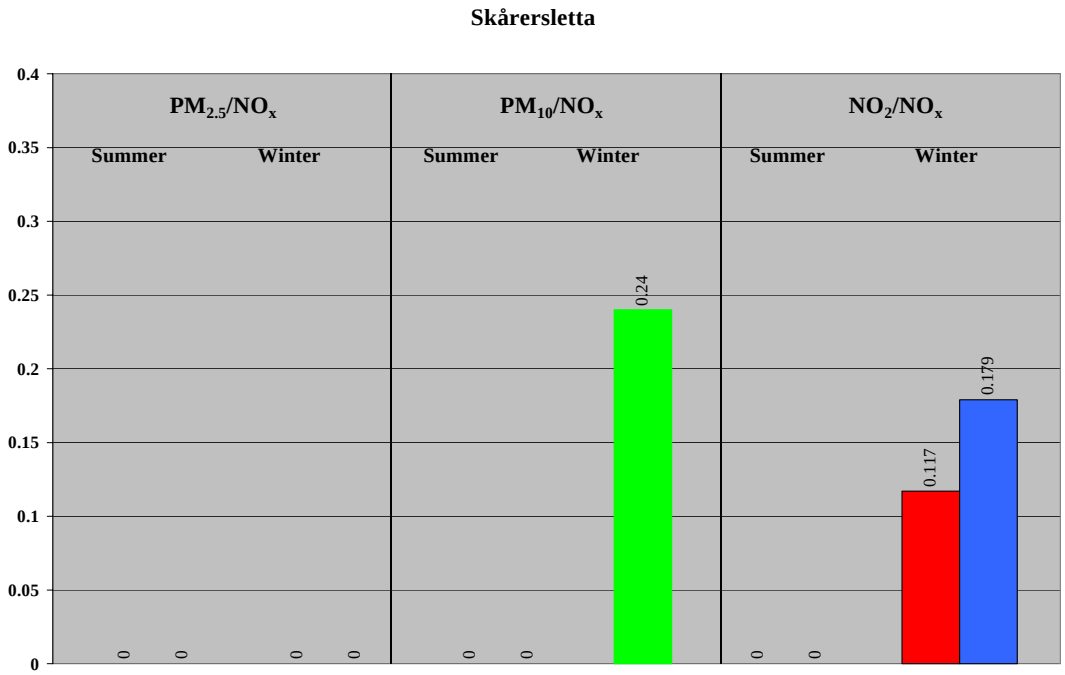


Figure 1.7: Delta ratios for the Frankfurter Allee station pair in Berlin,2002.



Note: Green bar is all weekdays

Figure 1.8: Delta ratios for the Skårersletta station pair near Oslo, winter 2002.

Chapter 2: Calculations of air quality in European streets

2.1 Introduction

Within the Street Emission Ceilings project, a typology of European streets has been developed (Moussiopoulos et al. 2005). In 2005 model calculations of air quality in street canyons in Europe were performed for current and future years. In phase 3 of the SEC project, the SEC methodology is applied in order to provide simple models for individual European cities and to develop a preliminary overview of air quality levels in EU street types.

2.2 Traffic intensities and prevalence of street types in EU

In order to develop an overview of air quality levels in European streets, a statistically representative set of European streets had to be defined. From the SEC phase 2 report (Moussiopoulos et al. 2005), a typology of streets was already available, but the traffic intensities and numbers or percentages of streets in the various typology classes in European regions were not known.

In phase 3 of the SEC project, European data sets on roads were sought. Several national and municipal databases were found to exist, but the division into roads turned out not to be suitable for the purpose of the SEC work. In particular, information on the physical structure of the roads was generally lacking: e.g. the data did not indicate whether streets were surrounded by dispersed buildings or enclosed by buildings as in street canyons. These limitations were consistent with earlier attempts to set up an inventory of streets relevant for air quality, such as described in (ENTEC, 2006[1]).

In a second step of the inventory work, 19 European cities were individually approached with the request to give information on street types in their cities. To enhance the chances of response, the contact was made with air pollution experts of municipalities that had personally collaborated with one of the participants of SEC in other projects. It was also decided to lower the threshold for responding by not requesting to supply the precise data that were directly needed in SEC, but to ask for related (possibly estimated) information that was more likely to be available. Annex D shows the information requested.

The very limited response to this questionnaire (incomplete replies and a database from Berlin) did give some useful information, but it also showed that hardly any cities have a street database that includes information on buildings along the road, useful for the purpose of the SEC study.

In the Netherlands, the routine application of the CAR model had stimulated the development of municipal databases that include data similar to those required by SEC. In this country also a simple expert system for estimating traffic

[1] ENTEC, 2006. Development of a methodology to assess population exposed to high levels of noise and air pollution close to major transport infrastructure. ENTEC, UK. Available at http://ec.europa.eu/environment/air/pdf/hot_spots/final_report_main.pdf .

intensities depending on road characteristics was found to be available for municipal authorities (VROM/DGM, 2006[2]).

The scattered information did not allow to systematically derive the statistics of traffic intensities and occurrence of street types in Europe. Instead, estimates were made on the basis of the information received: the estimated maximum traffic intensities per street type are given in Table 2.1. Typical high traffic intensities (i.e. intensities typical for busy streets) were set at 50% of the maximum intensities.

Table 2.1: Maximum traffic intensities assumed per street type. The other characteristics of the street types have been taken from Table 3 of Moussiopoulos et al. (2005).

Street type	Geometry parameter	% trucks	Canyon width	Driving pattern [2)]	Distance [3)]	Traffic intensity (veh/day)
Urban motorway 1	z_0=0.1m	7%/15%	-	100 km/h	25m	150 000
Urban motorway 2	z_0=0.1m	7%/15%	-	100 km/h	100m	150 000
Urban non-canyon street 1	z_0=1m	7%/15%	-	26km/h	10m	40 000
Urban non-canyon street 2	z_0=1m	7%/15%	-	26km/h	40m	80 000
Canyon 1	H=15m	7%/15%	15m	26km/h	5m	30 000
Canyon 2	H=15m	7%/15%	40m	26km/h	15m	60 000

In view of the limitations of the available information, it was not considered appropriate to attempt making estimates of the percentage of street types in European regions, which would e.g. be needed to make estimates of total street length with exceedance of limit values. Whereas the maximum intensities could to some extent be estimated from the number of traffic lanes, there did not seem to be a simple rule to estimate statistics of building configurations such as street canyons.

2.3 Emissions

During the work performed within the SEC project in support of the Clean Air For Europe (CAFE) programme, the emissions for the narrow street canyon, assuming a traffic intensity of 20 000 were calculated and analysed in detail (EEA 2006). Preliminary emissions calculations were also performed for traffic intensities of 30 000 and 60 000 veh/day corresponding to the traffic in square (height and width = 15 m) and wide (height = 15 m, width = 40 m) streets according to the typology methodology developed in phase 2 of the SEC project (see Table 2.1), which however were not analysed in full detail at the time.

[2] VROM/DGM, 2006. VI-Lucht. An instrument for estimating traffic intensities to be used in air quality calculations (in Dutch). Ministry of VROM, The Hague, Netherlands.Document nr VRO015/Kvw/0048. Available at http://www.infomil.nl/contents/pages/136862/vro0048kvw.pdf .

Within the work performed in phase 3, the emissions for the urban motorway types were calculated. The COPERT III emissions model was applied, in conjunction with vehicle fleet data from the TRENDS/TREMOVE models. In order to ensure full compatibility with previous emissions calculations, the methodology used was the same as that applied during the emission calculations performed in support of the CAFE programme and full details are reported in EEA (2006). It should however be noted that in the urban motorway case, it was assumed that all vehicle types are allowed to circulate, including heavy duty vehicles >16 tons, whereas in the canyon emissions calculations (i.e. emissions for street canyons located inside or close to the city centres) it was assumed that for heavy duty vehicles (HDV) only vehicles < 16 tons could circulate. Furthermore, it was assumed that mopeds <50cm^3 are not capable of acquiring a vehicle speed of 100 km/h, but rather they move at a maximum speed of ~30 km/h. All emissions were calculated assuming 7% of HDVs in the vehicle fleet. In order to see the differences with a larger percentage of HDVs than 7%, the emissions for selected cities (Athens, Berlin, Milano, Rome, Stuttgart and Thessaloniki) were also calculated assuming 15 % HDVs in street canyon types.

2.4 Calculations with the CAR model

The air quality modelling work in phase 3 of the SEC project involved the application of the CAR model (Eerens et al., 1993; Den Boeft et al., 1996). To investigate the consistency with the results of the OSPM model (Berkowicz 2000) presented and analysed in detail in EEA (2006), the CAR model was re-run for the streets considered in that study.

2.4.1 Comparison with OSPM calculations

In the work performed by the SEC project in support of CAFE, air pollutant concentrations had been calculated for assumed standard street canyons in 20 European cities. In addition to the narrow street canyon results presented in detail in EEA (2006), assuming a traffic intensity of 20 000 veh/day, the OSPM model was also used to study air quality in square and wide canyons with an assumed traffic intensity of 30,000 and 60,000 vehicles respectively. Due to time and budget constraints, these model results had not been elaborated in detail in EEA (2006). However, they were used for this report (phase 3 of the project) to compare with CAR model results, which was applied using the same input data[3].

Table 2.2 shows that for PM_{10} and NO_x in the 20 cities CAR and OSPM show a good agreement for a wide canyon. For narrow and square canyon OSPM gives almost the same values as for the wide canyon, while CAR gives 50% higher concentrations. It should be noted that exact correspondence is not be expected anyway, because of the division in street types that is used by CAR, which does not allow to enter the exact dimensions of the streets. The OPSM model on the

[3] For the wind speed a conversion was made, since the OSPM model uses the above-roof wind speed as input, while CAR uses the wind speed at a representative meteorological station (roughness length 0.03m, 10m height). Based on a logarithmic profile dependent on roughness length and height, the wind speed for CAR was estimated to be 25% higher than that used in the OSPM model calculations.

other hand does not allow to specify the receptor point distance from the centre of the street (which was set at 5 m in the CAR calculations), as the calculations are performed for points located relatively close to the building face, where the pavement is located. The very good correlation between the results of the two models found for the 20 cities – not tabulated – is trivial because the differences between the streets are mainly due to the differences in emissions, which were the same for the two models.

For NO_2 a significant difference is seen in the NO_2 fraction of NO_x: for the wide canyon NO_x concentrations agreed very well, while the CAR increments for NO_2 are on the average about 2/3 of than those by OSPM. This is due to the lower rate of NO_2 formation from reaction of NO and ozone in CAR: analysis of the results showed the amount of background ozone converted into NO_2 for CAR to be roughly 2/3 of the amount converted for OSPM. The table also shows that the concentration of NO_2 is sensitive to the fraction direct NO_2 emission assumed: when, consistent with recent evaluations,17% instead of the standard value of 5% is taken, the NO_2 increment calculated by CAR increases by roughly 50%.

Table 2.2: Comparison of concentration increments (µg/m^3) averaged over the standard streets in 20 European cities.

		OPSM narrow (10m)	OSPM square (15m)	CAR, narrow canyon		OSPM wide (40m)	CAR wide canyon
NO_x		118	113	191		128	126
NO_2 (5% direct NO_2)		35	33	30		37	24
NO_2 (17% direct NO_2)		-	-	52		-	38
PM_{10}		10	10	17		11	11

2.4.2 Crude comparison with observations

Model results and emission calculations were performed for the reference year 2000. The measurement data used in the analysis were taken from in Airbase (URL3). Due to lack of sufficient data for certain cities and certain pollutants, data from the years 2001, 2002 and in some cases 2003 were used (see Annex B of EEA (2006) for details) and were considered to represent the approximate level of the concentrations measured in 2000.

The measured street increments in the various cities considered were calculated from the maximum measured street and background concentrations in each city. This introduces an uncertainty since the increment depends critically on the location of the respective urban background and traffic stations, which are often not close to each other. Another important unknown is the street type and the traffic intensity at the monitoring site. It should be stressed that the comparison of modelled and measured increments is limited by these factors.

Table 2.3 shows the annual mean concentrations averaged over the 15 cities for which observational data were available. For NO_2 two choices for the fraction of

direct NO_2 emission (5 and 17%) were used in the CAR calculations. For recent years, percentages of around 17% have been deduced from measurements at traffic sites (see also Chapter 1 of this report), but the "standard" value of 5% from the eighties is still widely used, as also in the OSPM calculations in SEC2005. It can be concluded that, considering the very considerable uncertainties in the correspondence of the set of measured street and the model set, the results of both CAR and OSPM are broadly consistent with the observations.

Table 2.3: Crude comparison of concentrations calculated with CAR and OSPM with observations in streets in 15 cities (average over the cities, in µg/m^3).

	Observations	**CAR (narrow canyon)**	**CAR (wide canyon)**	**OSPM**
dNO_x	129	190	125	111
dNO_2	29	30 / 52 *)	24 / 37 *)	32
dPM_{10}	15	16	11	10

*) For fractions of direct emission of NO_2 of 5% and 17% respectively.

2.5 Nomograms for individual cities

The typology could be used for developing a simple method for estimating the concentrations in streets, taking city characteristics into account. This has not been elaborated in detail. However, the general approach including examples is described below for NO_2 and PM_{10}.

City-specific fleet compositions should be determined (monitored) and used to calculate emissions and annual mean urban background levels of NO_2, ozone and PM_{10} should first be collected. Here, the data for 20 European cities collected earlier in the SEC work described above are used. Using a model for air pollution in streets (CAR is taken here), nomograms for street types, relating concentrations to distance from the road axis, can then be calculated. In the examples this has been done for Athens and Berlin: Figure 2.1 shows the curves for the annual average concentrations of NO_x, NO_2 and PM_{10} for a traffic intensity of 10 000 vehicles per day.

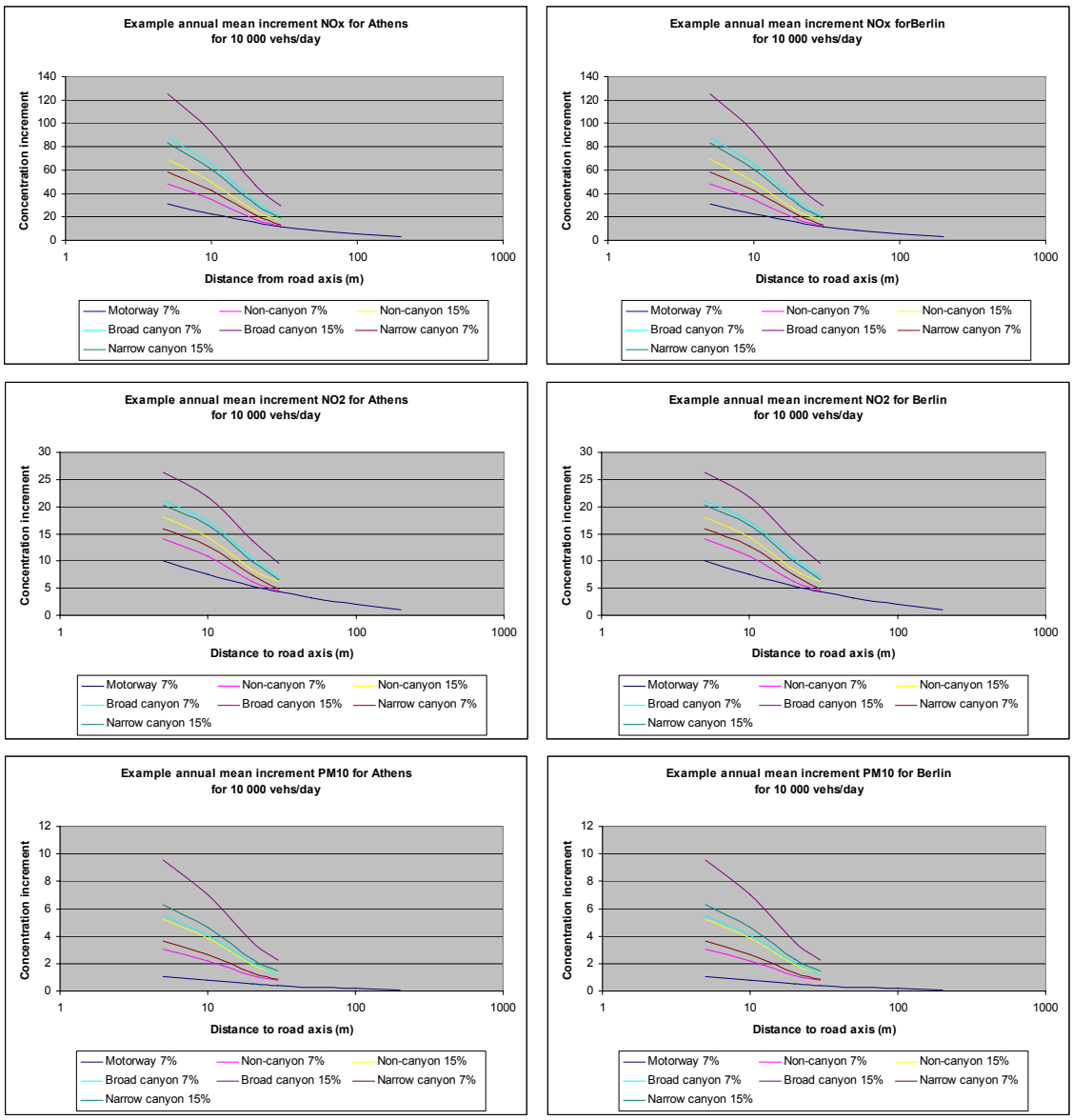


Figure 2.1: Nomograms for estimating the concentration increments of NO_2 and PM_{10} near urban roads in two example cities Athens and Berlin.

For NO_x and PM_{10}, the concentration increment is proportional to the traffic intensity, so it can be scaled to any traffic intensity. For NO_2, a nomogram as given above is not very useful because NO_2 relates non-linearly both to the distance from the road axis and to the street emission, and therefore the concentration cannot be scaled proportionally to the traffic intensity. A practical solution can be taken following the CAR model, in which a simple formula relating the annual mean concentrations of dNO_2 to dNO_x and $O_{3background}$ is used:

$$dNO_2 = fr_{direct} * dNO_x + O_{3background} * dNO_x / (dNO_x + constant),$$

where the prefix d indicates the incremental part of the concentration, fr_{direct} is the fraction of NO_x emitted directly as NO_2; the constant is about 100 µg/m^3.

For PM_{10}, not only the annual mean concentration is important to know, but even more so is the number of exceedances of the daily mean values of 50 µg/m^3,

relating to the most stringent limit value for PM_{10}. In phase 2 of the SEC project (Moussiopoulos et al. 2005), it has been shown that the 90.1 percentile of daily mean PM_{10}, which corresponds to this limit value, can be simply related to the annual mean concentration by:

[90.1 percentile of daily mean PM_{10}] = 1.52 x [annual mean of PM_{10}].

Considering the robustness of this empirical relationship (the relative standard deviation of the data was 10%), the uncertainty in the calculated percentile can be said to be more likely determined by the calculation of the annual mean PM_{10} concentration than by the conversion into the percentile.

2.6 Application to European street types

The SEC2005 gave a European overview of street level concentrations in narrow street canyons. Using the CAR model and the above mentioned additional emission data for motorways and for 15% Heavy Duty Vehicles, these calculations could be extended to all street types, using the parameters given in Table 2.1. Table 2.4 and Figure 2.2 show the results for the various street types in Europe (with 7% heavy duty vehicles), indicating for all street types the average and range over all 20 cities, distinguishing very busy and typically busy streets. For 15% HDV, the concentrations calculated are higher (including the background level up to some 20% for PM_{10} and 15% for NO_2; see also Figure 2.1), but because the emissions were only available for six cities in three countries, the averages and ranges are not well comparable to the more robust averages and ranges in Table 2.4 and Figure 2.2 and are therefore not tabulated.

According to these calculations, the highest concentrations are to be found near urban highways and in street canyons. It should, however, be borne in mind that these levels depend not only on the model performance, but also on the maximum traffic intensities assumed, which are speculative.

Table 2.4: Annual mean concentrations calculated for street types in Europe calculated with the CAR model, based on streets in 20 cities ($\mu g/m^3$) with 7% heavy duty vehicles. The range of results over the cities is given in parentheses.

Street type	NO_2		PM_{10}	
	Very busy	Busy	Very busy	Busy
Urban motorway 1	98 (71, 146)	76 (50, 114)	47 (37, 68)	42 (33, 63)
Urban motorway 2	69 (44, 105)	58 (32, 89)	41 (32, 62)	39 (30, 61)
Urban non-canyon street 1	88 (65, 126)	69 (46, 102)	51 (38, 73)	44 (33, 66)
Urban non-canyon street 2	91 (68, 130)	71 (48, 104)	52 (39, 74)	45 (34, 67)
Canyon 1	115 (92, 163)	86 (63, 123)	62 (45, 86)	50 (37, 72)
Canyon 2	98 (75, 139)	75 (52, 109)	55 (41, 77)	46 (35, 68)

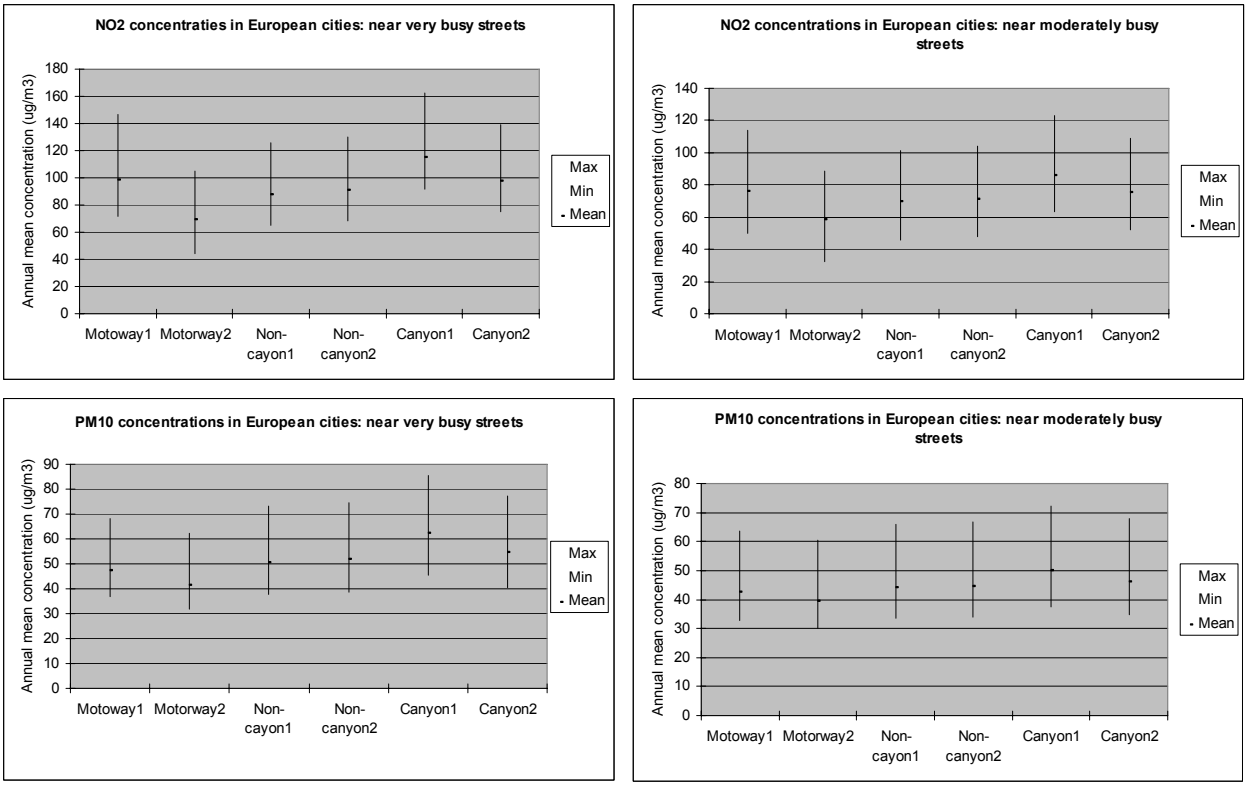


Figure 2.2: Annual mean concentrations in European street types calculated by the CAR model (7% heavy duty vehicles). The lines indicate the ranges of the street levels in the cities concerned; the mean represents the average over all city streets.

2.7 Conclusions

In this limited study, the typology developed in 2004 and the model input data collected in the SEC2005 study have been combined to develop a preliminary overview of air quality in street types in Europe. It was, however, not possible to systematically build a database of streets with data that are adequate for street level modelling. In particular, data on building geometry were generally lacking.

Using the CAR model, examples of nomograms of concentrations in two cities were constructed, allowing estimating local NO_x and PM_{10} concentration increments. To calculate NO_2 a simple formula is given relating NO_x increments to NO_2.

Based on scarce information, traffic intensities for the various street types were chosen in order to present a first overview of concentrations in European street types.

In view of the speculative nature of the estimated traffic data, the calculated concentrations and nomograms should be regarded as preliminary, serving as demonstrations of the feasibility of the approach rather than as definitive results.

References

Chapter 1

Air4EU (2006). EU FP6 Research Program project "Air Quality Assessment for Europe: from local to continental scale". 6th Framework Programme – Policy oriented Research Priority 8.1, Topic 1.5, Task 2.

DEFRA (2006). "Trends in Primary Nitrogen Oxide in the UK". Air Quality Expert Group. Department for Environment, Food and Rural Affairs, UK.

de Leeuw, Frank (2007). Personal communication, analysis of AirBase data. ETC/ACC - MNP, Bilthoven.

Keuken, Menno et. al. (2006). "Assessment of non-exhaust PM by road traffic in urban areas". Air4EU Case study report. Draft.

Kukkonen. J., Valkonen, E., Walden, J., Koskentalo, T., Aarnio, P., Karppinen, A., Berkowicz, R., Kartastenpaa, R. (2001). "A measurement campaign in a street canyon in Helsinki and comparison of results with predictions of the OSPM model". Atmos. Environ. 35 (2001), 231-243.

Larssen S. and Barrett K. (eds.), de Leeuw, F., Pulles T., Adams M., van Pul A., van het Bolscher M. (2007). Air Pollution in Europe 1990-2004.), in press.

Moussiopoulos N., Kalognomou E.-A., Larssen S., Gjerstad K. I., Mellios G., Samaras Z., van den Hout D., Teeuwisse S., van Aalst R., Vouitsis I., Papathanasiou A., Eleftheriadou S., Barmpas Ph. and Vlachokostas C. (2005). „"Street Emission Ceilings (SEC) exercise - Phase 2". ETC/ACC Technical Paper No 2004/5, European Topic Centre on Air and Climate Change, Copenhagen, Denmark.

OSCAR (2004). EU FP6 Research Program project "Optimised Expert System for Conducting Environmental Assessment of Urban Road Traffic – OSCAR". EU Contract N°: EVK4-CT-2002-00083 OSCAR.

URL1:http://forum.europa.eu.int/Public/irc/env/cafe_baseline/library?l=/cafe_ambient_quality/workshop_vehicles&vm=detailed&sb=Title

URL2:http://www.defra.gov.uk/corporate/consult/aqeg-nitrogendioxide/consultation.pdf

Chapter 2

Berkowicz R. (2000). 'OSPM - A parameterised street pollution model', Environ. Monit. Assess. 65, 1-2, 323-331.

Den Boeft J., Eerens H. C., den Tonkelaar W. A. M., Zandfeld P. Y. J. (1996). CAR International: A simple model to determine city street air quality. Sci. Total Environ. 190, 321-326.

Eerens H. C., Sliggers C. J. and Van den Hout K. D. (1993). The CAR Model: the Dutch method to determine city air quality. Atmos. Environ., 27B, 389-399.

European Environment Agency (2006). Air pollution at street level in European cities, Technical report No 1/2006, European Environment Agency, Copenhagen, Denmark.

Moussiopoulos N., Kalognomou E.-A., Larssen S., Gjerstad K. I., Mellios G., Samaras Z., van den Hout D., Teeuwisse S., van Aalst R., Vouitsis I., Papathanasiou A., Eleftheriadou S., Barmpas Ph. and Vlachokostas C. (2005). “Street Emission Ceilings (SEC) exercise - Phase 2”, ETC/ACC Technical Paper No 2004/5, European Topic Centre on Air and Climate Change, Copenhagen, Denmark.

URL3: http://etc-acc.eionet.eu.int/databases/airbase.html

Annex A

Analysis of concentration measurements at station pairs

A.1 Introduction

The objectives of the analysis of the measured concentrations are to:

- calculate the excess concentrations at the street station of the pair over and above what is present at the background station
- compare excess concentration ratios, using NO_X as a reference compound, with emission estimates.

The calculations are carried out in the same way as was done in the SEC project in 2005. In more detail:

The main result of the data calculation/analysis process is the calculation of "delta concentrations" (DeltaC) and "delta ratio" (DR) for each pair:

DeltaC: the street station minus the background station concentrations, for each hour of the year.

Delta ratio (DR): the ratio between the NO_2 and PM deltas on the one hand and the NO_x delta on the other hand, also this for each hour of the year.

NO_x is used as the "reference" compound because it is purely a primary composite pollutant and it is considered that the emission factor for NO_x from road vehicles is the one with the lowest uncertainty (among the compounds selected for this study).

The DeltaCs and DRs are presented as average values per hour of the day (thus as average daily variations), for four combinations of season and time of the week: Summer and winter workdays and weekend days.

In 2006, new station pairs with sufficient data coverage were sought in many cities. The requirements were:

- a station pair where it was considered that the background station represented well the situation at the street station
- hourly measurements of $PM_{2.5}$, PM_{10}, NO_X and NO_2 at both stations
- hourly measurements also of meteorological and traffic parameters
- measurements to cover at least several months
- acceptable data quality procedures.

In 2006, data from the following station pairs were found to be good candidates for analysis:

- the RV4 station pair in Oslo: an urban highway, no street canyon
- the Runeberg Street/Kallio station pair in Helsinki: a street canyon
- the Vallila/Kallio station pair in Helsinki: no street canyon.

The measurements at the Helsinki stations were carried out by the City of Helsinki, as part of the EU OSCAR research project (OSCAR, 2006)

Station pairs in other cities were also looked at, but did not comply with all the requirements above. Especially it was found that measurements of both $PM_{2.5}$ and PM_{10} are seldom available, together with meteo and traffic measurements.

A.2 The RV4 station pair in Oslo

The station pair and the measurements

The urban background station and the traffic station constituted a station pair for the main 5-lane highway 'Trondheim Road' (National road no. 4) entering Oslo from North-East (see Figure A.1). There are scattered buildings and open areas near the road (no street canyon). The stations are located within the urban area of Oslo. The traffic station is located about 6 meters from the nearest traffic lane of the highway. The urban background station was established especially for this study, about 200 m from the main roads, and is well representative as background for the traffic site. The traffic was counted hourly at the site, at each of 4 lanes separately, and each vehicle was characterised in terms of length and speed. The daily average traffic was about 40,500 vehicles per day during the study period, with a 6.7 % heavy duty fraction and very few 2-wheelers. Data on composition of the heavy duty fraction and on age distribution is available.

Measurements were carried out during 2 winter periods, with the traffic speed limit different for the two periods, as below:

- January-April 2004, speed limit 80 km/h
- October 2004-April 2005, speed limit 60 km/h

The measurements were carried out as part of a study of the effects of traffic speed on the PM_{10} concentrations. The results from this study has been reported by Hagen and Larssen (NILU report no. OR 41/2005).

Results

Figure A.2 shows the results of the analysis, in terms of:

- the average daily variation of DeltaC for $PM_{2.5}$, PM_{10}, NO_X and NO_2, separately for workdays and weekend days, for each of the two winter periods. (Note that the NO_X curves are divided by 10).
- the average daily variation of the Delta Ratio (DR) for $PM_{2.5}$, PM_{10} and NO_2 relative to NO_X.

The DeltaC curves indicate that the data are of good quality. The curves are smooth, and they tend towards zero at late night time, but stay above zero.

The DR curves are also smooth, and for the most part establish a fairly flat course during the middle of the day, when traffic parameter variation, as well as meteorological variation, is generally limited. A special exception is for PM_{10} on weekend days in winter 2004. The peak in DR at midday is not easily explained, but the number of weekend days is fairly small, so special suspension conditions during one or two of the days could dominate the curve.

The DR curves for PM_{10} and NO_2 differ during night time from their daytime course, the reasons being that for NO_2 the contribution to NO_2 from $NO\text{-}O_3$ reaction dominates at night, while for PM_{10}, the heavy duty fraction of vehicles is very low at night time, leading to less suspension of road dust.

Figure A.3 shows the average DRs for the midday 6 hours 12:00-17:00. Main signals from that figure are:

- The PM_{10} DRs are a factor of 10 higher that the $PM_{2.5}$ DRs, in line with what was established in the SEC project in 2005: the suspension of road dust in roads/streets were studded tyres are used completely dominates the PM_{10} concentration, and thus the PM emissions.
- The DRs from the second winter, where the speed limit was reduced from 80 km/h to 60 km/h, are considerably lower, both for $PM_{2.5}$ and PM_{10}. This shows the significance of traffic speed on the amount of suspension. It was shown (Hagen and Larssen, 2005) that the reduction in speed limit from 80 to 60 km/h resulted in a reduction of the actual speed from 82 km/h to 68 km/h. This actual speed reduction resulted in a reduction of net PM_{10} concentration at the street station of about 35 %. This is shown also in Figure A.2.
- PM DRs are generally lower on weekend days that on workdays, corresponding to the lower heavy duty vehicle fraction on weekend days. An exception to this, for PM_{10} during the winter 2004-2005, is not explained. However, the number of weekend days is limited in the material, and special conditions during some of the days may dominate the results.
- For NO_2, the reduction in workday DR with reduced traffic speed can also be sought explained by the effect of speed on the emission factors. The increased NO_2 fraction on weekend days should be explained by lower heavy duty fraction, while at the same time checking for possible differences in urban ozone concentrations.

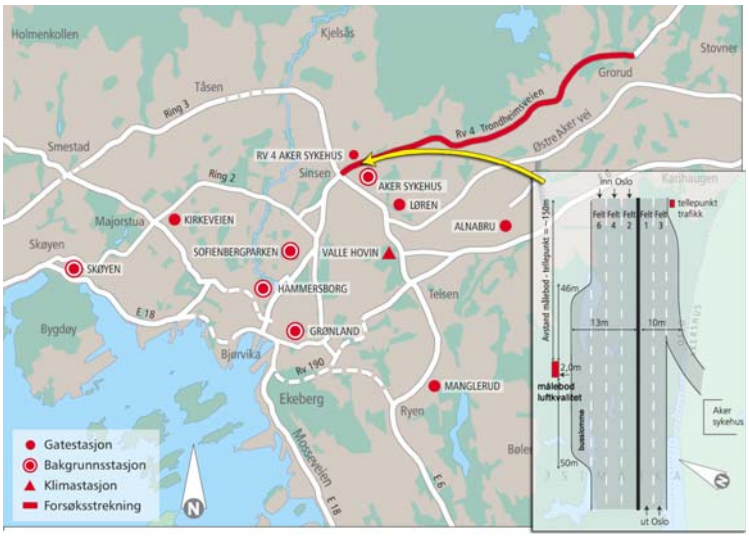


Figure A.1: Location of RV4 station pair.

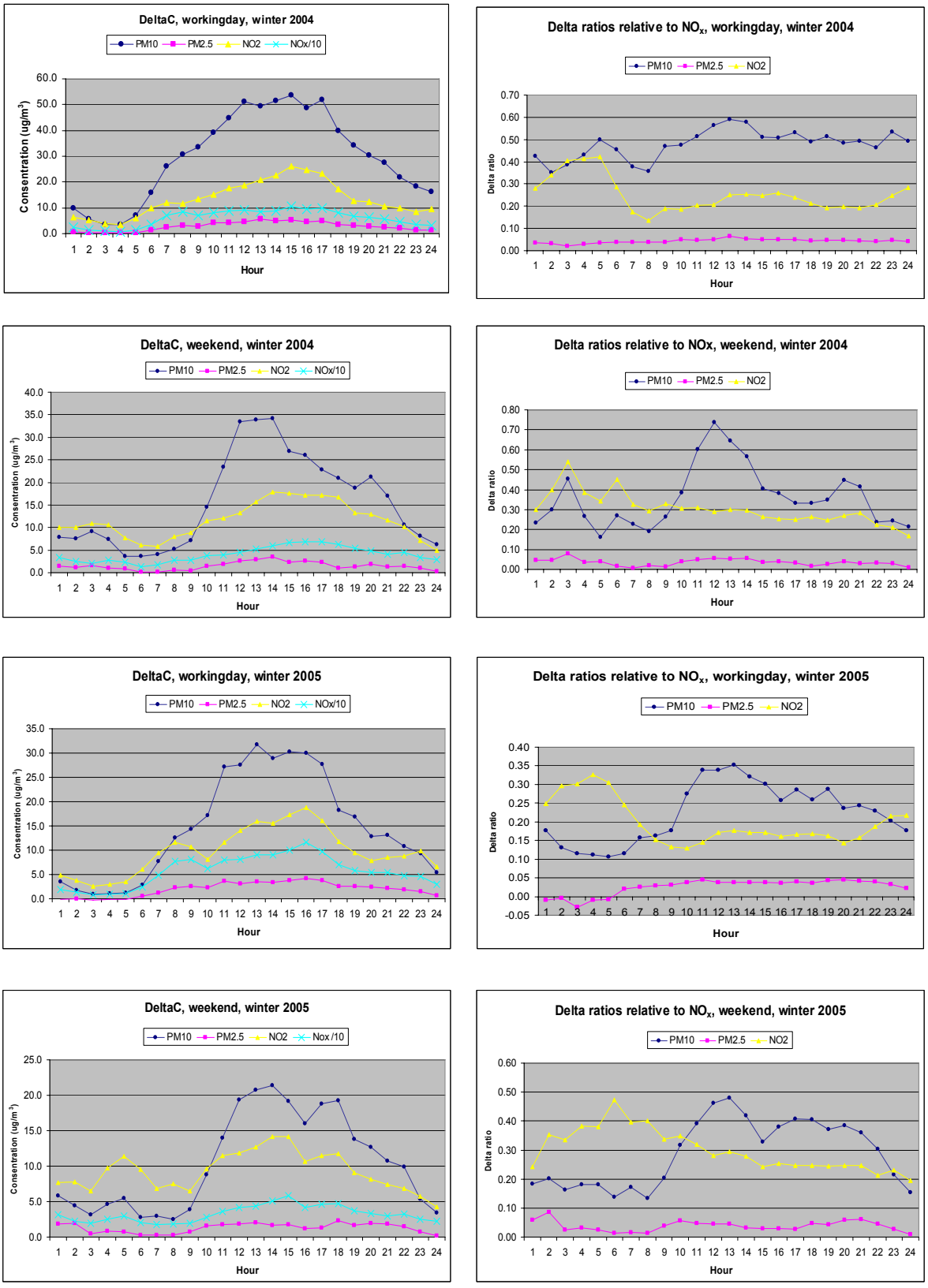
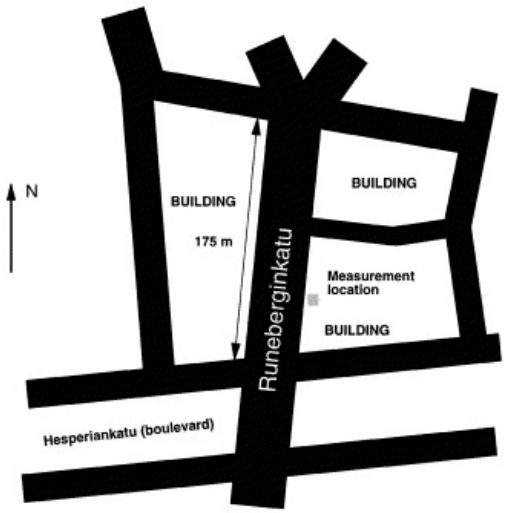


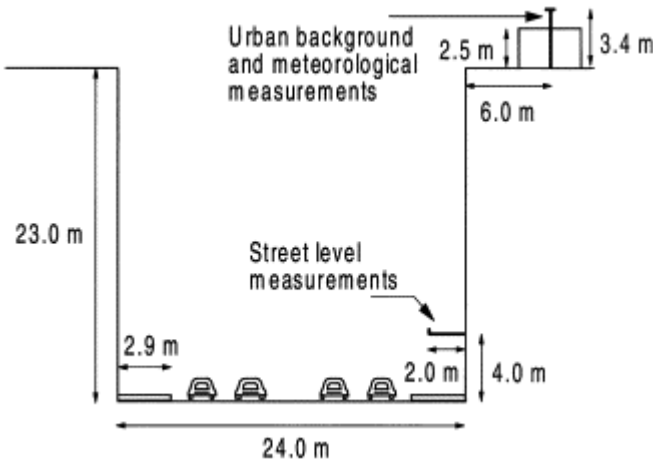
Figure A.2: The RV4 station pair, Oslo. DeltaC and DR curves.

A.3 The Runeberg/Kallio station pair in Helsinki

The station pair and measurements

The figures below show the street layout and the street canyon of Runeberg street (Kukkonen et. al., 2001).





The measurements were carried out by the City of Helsinki.

Results

Figure A.3 shows the average daily variations of DeltaC and Delta ratios (DR) for the summer of 2003 and for summer and winter 2004.

The DeltaC curves are less smooth as for the RV4 pair, and for some compounds the DeltaC values are negative for some hours at evening/night time. One

probable explanantion for the peculiar shapes of the DeltaC curves is that there were significant construction activities taking place near the site.

Runeberg street – Kallio 2003

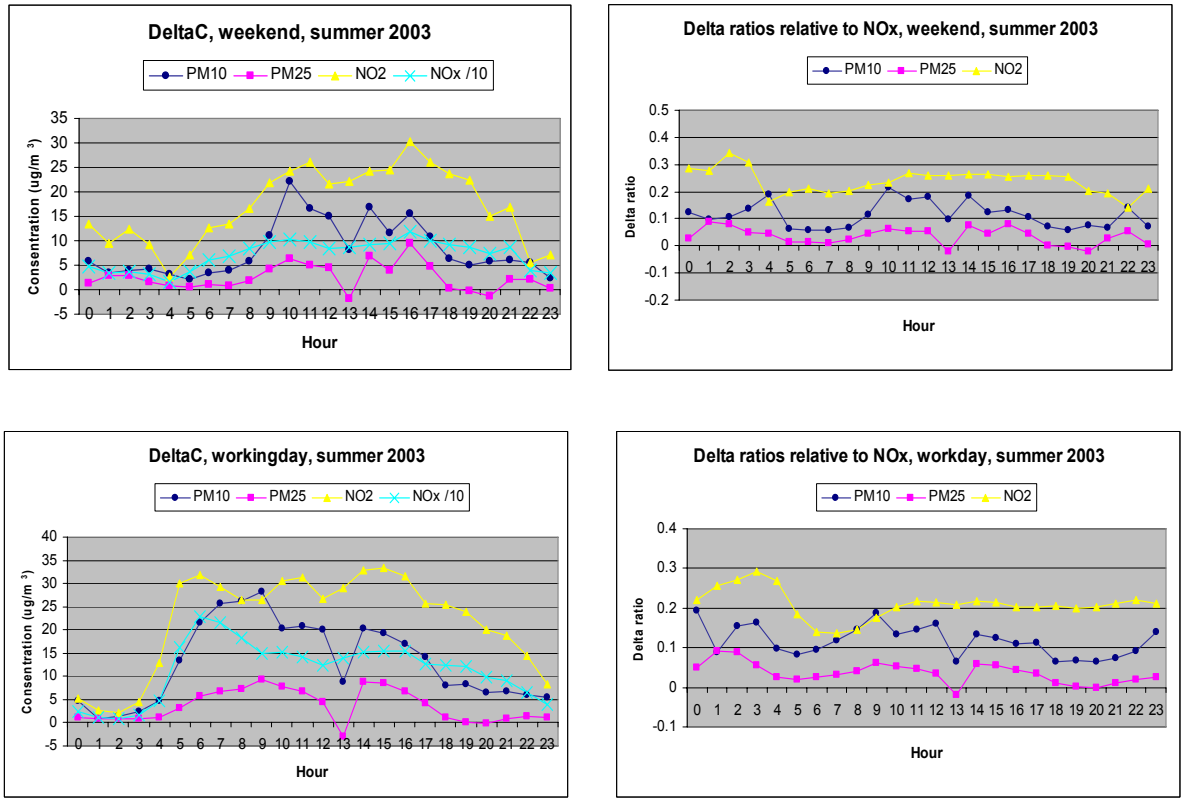
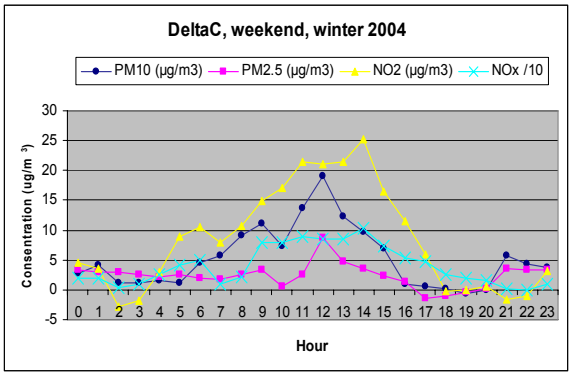
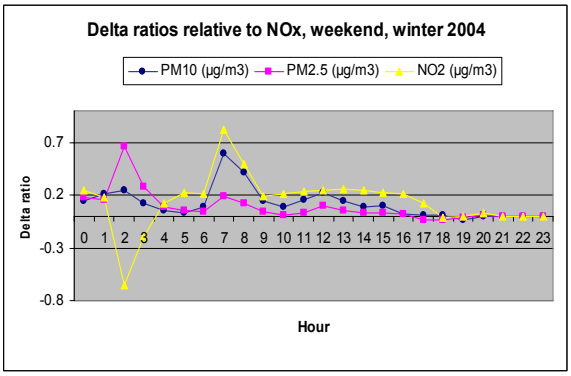
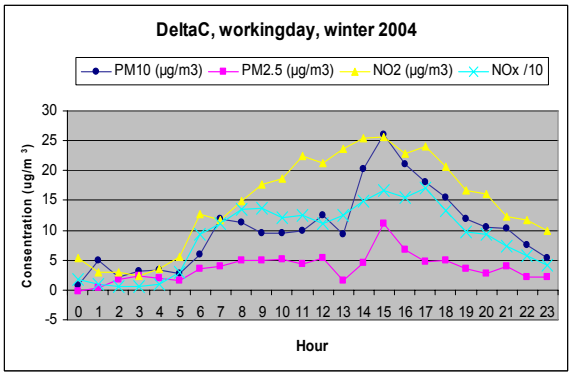


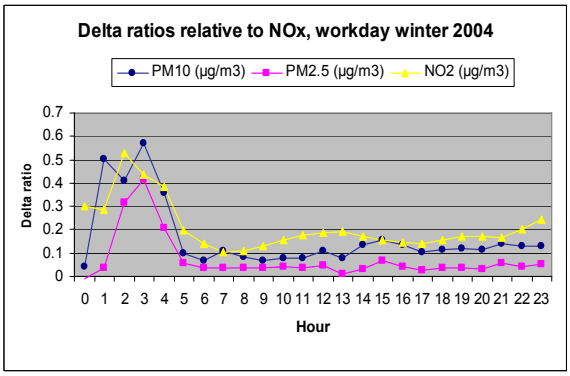
Figure A.3: The Runeberg-Kallio station pair in Helsinki. DeltaC and DR curves.

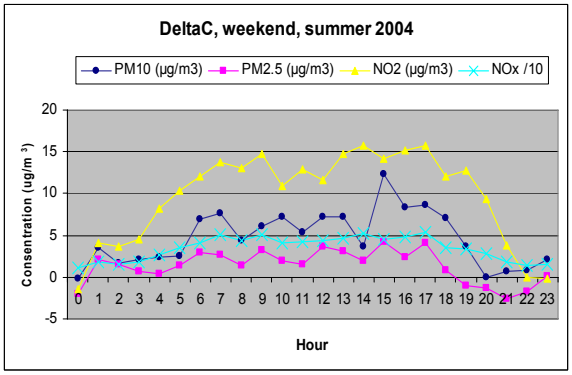
Runeberg street – Kallio 2004

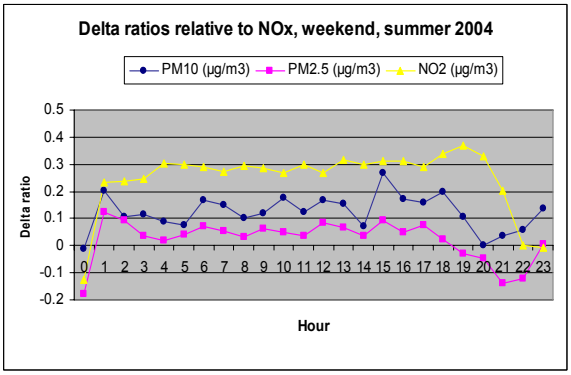


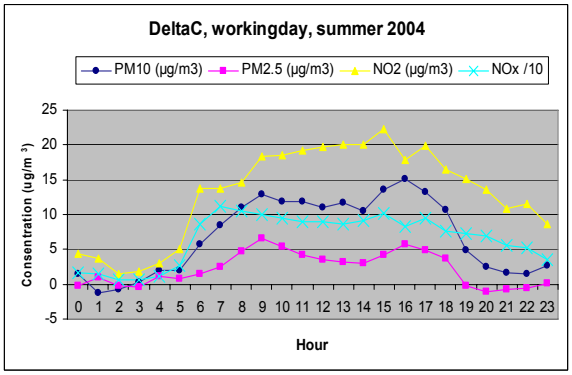












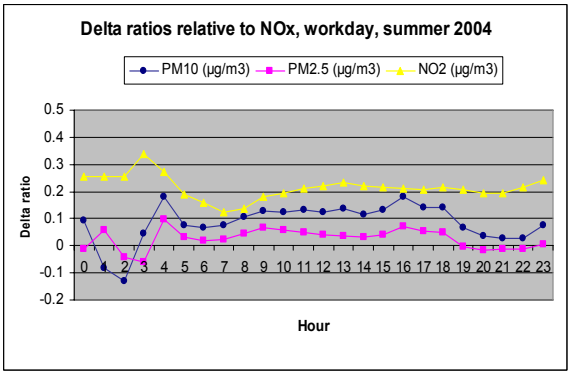


Figure A.3: (continued).

A.4 The Vallila-Kallio station pair in Helsinki

Vallila – Kallio 2003

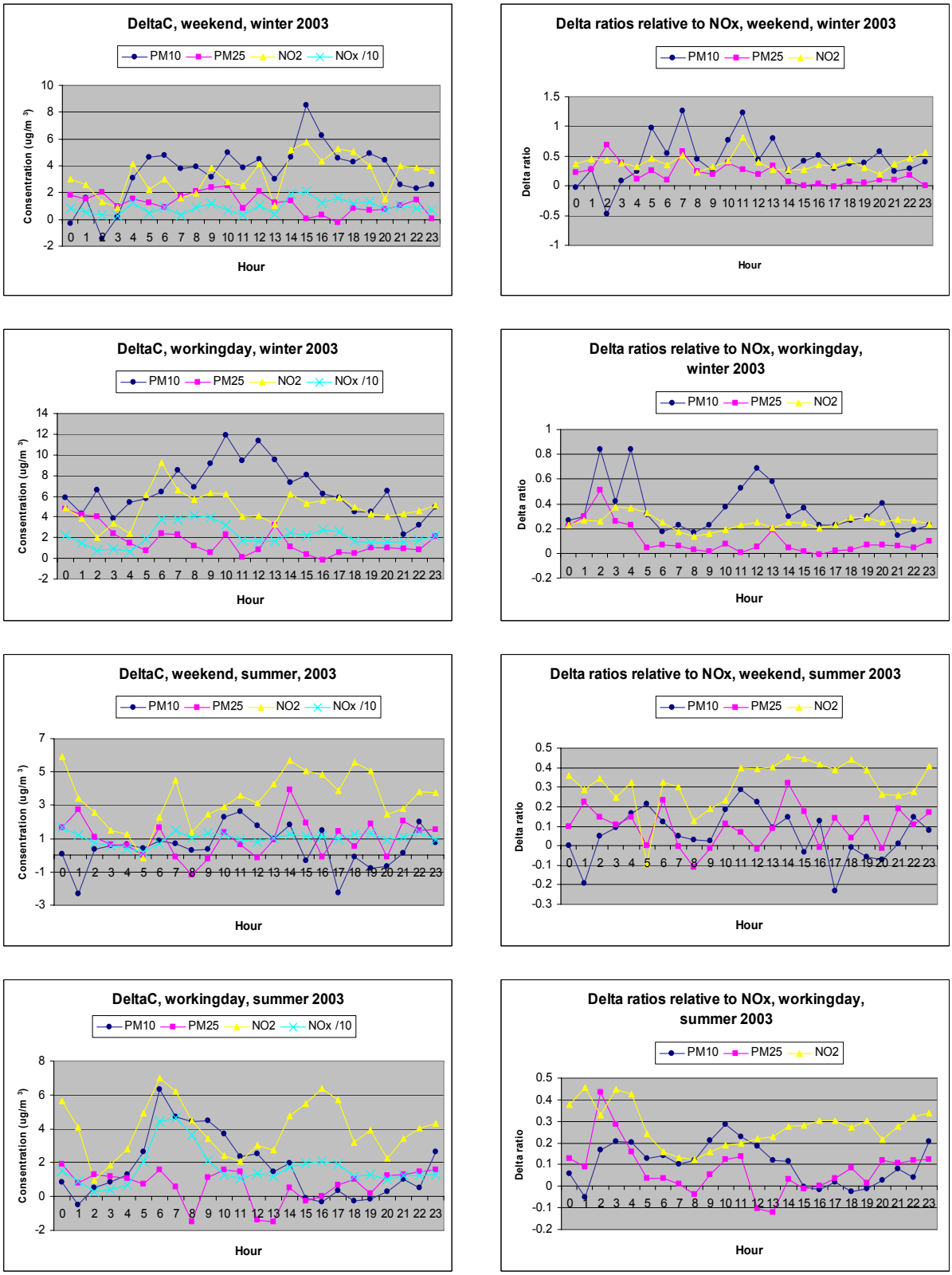


Figure A.4: The Vallila-Kallio station pair in Helsinki. DeltaC and DR curves.

Annex B

Local emission estimates

B.1 RV4, Oslo

The street has five traffic lanes in total (three downhill going towards Oslo centre and two uphill going out of Oslo), with different vehicle volumes. Using the composition of the Norwegian vehicle fleet for the years 2004 and 2005 extracted from the TREMOVE database, the share of each vehicle category is derived. From the traffic data monitored, average hourly data were derived for the number of passenger cars, the number of heavy duty vehicles and the average vehicle speed.

In total, four sets of runs were performed with COPERT, separately for workdays and weekends and for both years (2004 and 2005). From the monitored traffic data, average hourly data were derived for the number of passenger cars, the number of heavy duty vehicles and the average vehicle speed. For the calculations performed, the mileage of the vehicles was set equal to one kilometre and the gradient of the road (~4%) was taken into account. The detailed hourly distribution of traffic into the various vehicle categories is presented in Appendix I (Tables I.1 to I.8).

The calculated hourly vehicle emissions of CO, NO_x and $PM_{2.5}$ are presented in Table B.1 for working days and weekends of winter 2004. From the above emissions, $PM_{2.5}$ over NO_x and CO over NO_x ratios are derived, on an hourly basis and are also presented in the same table. In the same manner, Table B.2 shows the respective traffic emissions and the corresponding ratios for winter 2005.

Table B.1: Calculated hourly average traffic emissions (in kg) and associated emission ratios for working days and weekends in RV4, Oslo, 2004.

	Working days					Weekends				
Hour	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**
00:00	136.6	55.6	0.9	0.016	2.45	52.8	21.1	0.3	0.015	2.51
01:00	61.0	27.7	0.6	0.022	2.20	46.6	18.9	0.3	0.016	2.47
02:00	36.5	15.6	0.3	0.019	2.34	40.2	15.3	0.2	0.013	2.63
03:00	24.4	10.4	0.2	0.019	2.35	32.7	12.6	0.2	0.014	2.60
04:00	23.7	10.6	0.2	0.021	2.24	35.4	13.6	0.2	0.014	2.61
05:00	25.7	11.9	0.3	0.023	2.17	34.3	13.3	0.2	0.014	2.57
06:00	71.2	35.1	0.9	0.026	2.03	17.5	7.3	0.1	0.018	2.39
07:00	316.0	146.1	3.3	0.022	2.16	18.9	8.1	0.2	0.019	2.34
08:00	539.7	250.6	7.9	0.032	2.15	31.4	13.2	0.2	0.018	2.39
09:00	520.0	253.2	8.6	0.034	2.05	39.4	16.8	0.3	0.019	2.35
10:00	386.2	196.7	5.2	0.026	1.96	62.4	26.0	0.5	0.018	2.40
11:00	376.1	188.2	4.9	0.026	2.00	89.3	36.3	0.6	0.016	2.46
12:00	396.2	193.1	4.8	0.025	2.05	110.5	44.4	0.7	0.016	2.49
13:00	425.6	207.9	5.2	0.025	2.05	135.5	53.1	0.8	0.014	2.55
14:00	457.5	217.1	5.1	0.024	2.11	148.0	57.7	0.8	0.014	2.57
15:00	523.6	239.1	5.2	0.022	2.19	159.9	61.4	0.8	0.013	2.60
16:00	666.7	294.6	6.1	0.021	2.26	167.0	64.3	0.8	0.013	2.60
17:00	667.6	287.7	5.7	0.020	2.32	160.2	61.9	0.8	0.013	2.59
18:00	515.2	218.4	4.0	0.018	2.36	155.0	59.1	0.7	0.013	2.62
19:00	433.3	178.6	3.0	0.017	2.43	142.7	54.3	0.7	0.012	2.63
20:00	360.1	147.0	2.4	0.016	2.45	123.8	47.9	0.6	0.013	2.59
21:00	301.6	123.4	2.0	0.016	2.44	103.4	40.1	0.5	0.014	2.58
22:00	259.6	104.5	1.6	0.016	2.48	84.9	33.3	0.5	0.014	2.55
23:00	206.0	81.5	1.2	0.015	2.53	70.0	27.2	0.4	0.014	2.58
24:00	136.6	55.6	0.9	0.016	2.45	52.8	21.1	0.3	0.015	2.51

Table B.2: Calculated hourly average traffic emissions (in kg) and associated emission ratios for working days and weekends in RV4, Oslo, 2005.

	Working days					Weekends				
Hour	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**
00:00	82.1	33.9	0.6	0.019	2.42	35.2	14.0	0.2	0.017	2.52
01:00	37.5	18.0	0.4	0.025	2.08	31.5	12.9	0.2	0.018	2.43
02:00	22.3	9.7	0.2	0.020	2.29	26.1	10.1	0.1	0.014	2.60
03:00	14.7	6.7	0.2	0.022	2.19	21.5	8.5	0.1	0.015	2.53
04:00	14.6	7.1	0.2	0.025	2.05	21.6	8.7	0.1	0.016	2.48
05:00	18.0	10.0	0.3	0.030	1.80	17.3	6.8	0.1	0.015	2.55
06:00	53.3	28.6	0.8	0.030	1.86	11.0	4.9	0.1	0.021	2.26
07:00	228.7	109.4	3.1	0.028	2.09	12.5	5.7	0.1	0.022	2.21
08:00	443.8	183.9	6.0	0.033	2.41	21.8	8.9	0.2	0.018	2.44
09:00	382.0	173.2	5.3	0.031	2.21	26.7	11.5	0.2	0.020	2.32
10:00	264.9	135.3	3.9	0.029	1.96	41.3	17.4	0.3	0.020	2.37
11:00	248.7	130.0	3.8	0.029	1.91	60.9	24.7	0.5	0.018	2.47
12:00	263.7	134.5	3.8	0.029	1.96	78.7	31.4	0.6	0.018	2.51
13:00	280.9	142.6	4.1	0.028	1.97	96.1	37.3	0.6	0.017	2.58
14:00	305.8	147.4	3.9	0.027	2.08	103.3	39.9	0.7	0.017	2.59
15:00	366.6	168.7	4.3	0.025	2.17	113.5	42.6	0.7	0.015	2.67
16:00	485.8	208.7	5.1	0.024	2.33	120.5	45.3	0.7	0.016	2.66
17:00	484.4	197.5	4.5	0.023	2.45	115.9	44.0	0.7	0.016	2.63
18:00	352.2	145.0	3.1	0.021	2.43	112.3	41.7	0.6	0.015	2.70
19:00	293.6	118.1	2.3	0.020	2.49	98.2	36.5	0.6	0.015	2.69
20:00	241.4	97.5	1.9	0.019	2.48	84.2	31.7	0.5	0.015	2.66
21:00	203.9	82.0	1.6	0.019	2.49	70.1	26.9	0.4	0.016	2.61
22:00	169.2	67.2	1.2	0.018	2.52	56.0	21.6	0.3	0.016	2.59
23:00	134.2	52.2	0.9	0.017	2.57	46.5	17.9	0.3	0.016	2.60
24:00	82.1	33.9	0.6	0.019	2.42	35.2	14.0	0.2	0.017	2.52

In Figure B.1, the hourly variations over the day of the above emission ratios are plotted for working days and weekends for 2004, while Figure B.2 shows the same ratios for 2005. As expected, the CO over NO_x ratio is higher and the $PM_{2.5}$ over NO_x ratio is lower during the weekends, which is consistent with traffic having fewer heavy duty vehicles. This is also confirmed by the respective concentration ratio between the deltas of $PM_{2.5}$ and NO_x. When comparing the modelled emission ratio and the respective concentration ratio, there is a fair agreement as regards the general trend, although the modelled ratio is somewhat lower. This may be explained from the use of studded tyres as explained above in section 1.2.2.

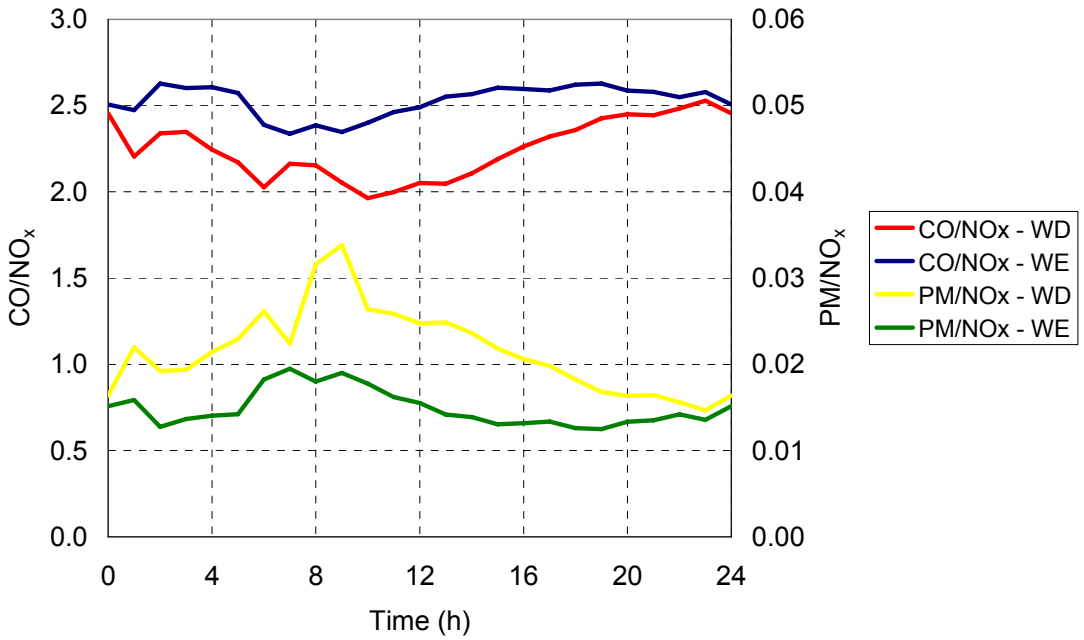


Figure B.1: Averaged diurnal variation of the CO over NO_x and $PM_{2.5}$ over NO_x ratios of traffic emissions for working days and weekends in RV4, Oslo, 2004.

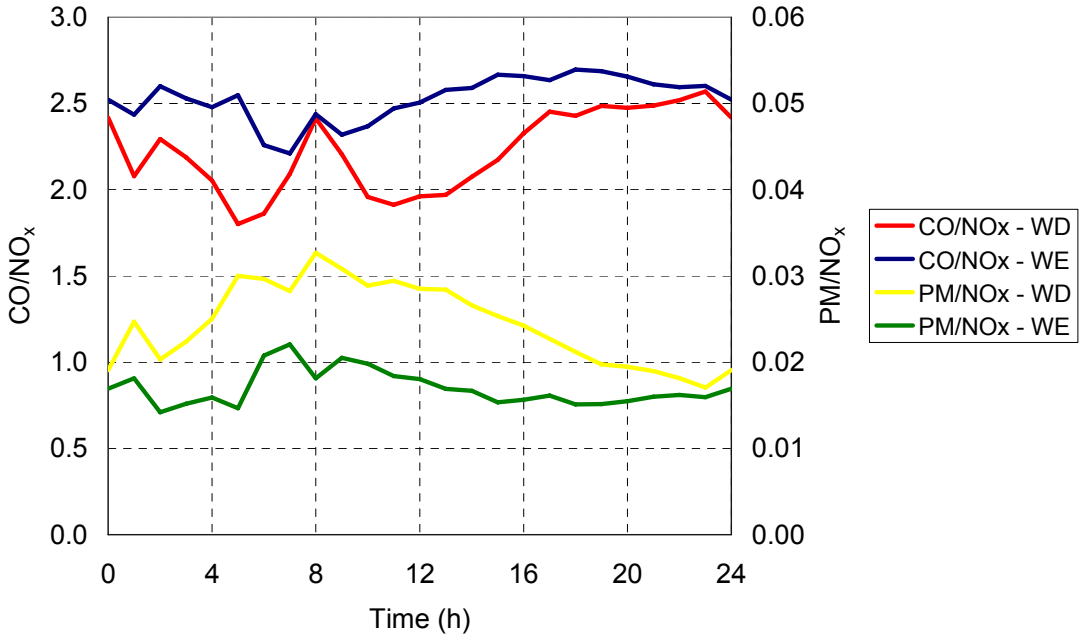


Figure B.2: Averaged diurnal variation of the CO over NO_x and $PM_{2.5}$ over NO_x ratios of traffic emissions for working days and weekends in RV4, Oslo, 2005.

B.2 Runeberg, Helsinki

Using the composition of the Finnish vehicle fleet for the years 2003 and 2004 extracted from the TRENDS database, the share of each vehicle category is derived. From the traffic data monitored, average hourly data were derived for the number of passenger cars, the number of heavy duty vehicles and the average vehicle speed.

In total, four sets of runs were performed with COPERT, separately for workdays and weekends and for both years (2003 and 2004). From the monitored traffic data, average hourly data were derived for the number of passenger cars, the number of heavy duty vehicles and the average vehicle speed. For the calculations performed, the mileage of the vehicles was set equal to one kilometre. The detailed hourly distribution of traffic into the various vehicle categories is presented in Appendix II (Tables II.1 to II.8).

The calculated hourly vehicle emissions of CO, NO_x and $PM_{2.5}$ are presented in Table B.3 for working days and weekends of winter 2004. From the above emissions, $PM_{2.5}$ over NO_x and CO over NO_x ratios are derived, on an hourly basis and are also presented in the same table. In the same manner, Table B.4 shows the respective traffic emissions and the corresponding ratios for winter 2005.

Table B.3: Calculated hourly average traffic emissions (in kg) and associated emission ratios for working days and weekends in Runeberg, Helsinki, 2003.

	Working days					Weekends				
Hour	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**
00:00	151.8	37.4	0.8	0.023	4.06	46.9	18.9	0.9	0.045	2.48
01:00	47.3	23.8	1.2	0.049	1.99	41.6	16.3	0.7	0.043	2.55
02:00	39.0	13.8	0.5	0.039	2.83	44.1	14.0	0.5	0.035	3.15
03:00	35.5	12.5	0.5	0.038	2.85	43.6	14.0	0.5	0.034	3.12
04:00	33.3	14.4	0.6	0.043	2.32	33.5	11.4	0.4	0.035	2.94
05:00	55.2	41.5	2.3	0.055	1.33	20.9	9.0	0.4	0.043	2.32
06:00	245.2	146.8	8.5	0.058	1.67	25.8	16.3	0.9	0.053	1.58
07:00	500.6	250.4	14.0	0.056	2.00	36.2	22.9	1.3	0.056	1.58
08:00	635.6	305.2	16.9	0.055	2.08	52.0	31.3	1.7	0.055	1.66
09:00	549.9	260.5	14.9	0.057	2.11	72.9	39.5	2.1	0.054	1.85
10:00	525.2	227.2	12.7	0.056	2.31	101.2	49.4	2.7	0.054	2.05
11:00	560.4	246.1	13.8	0.056	2.28	142.0	57.3	3.1	0.053	2.48
12:00	587.2	253.7	14.2	0.056	2.31	165.5	61.1	3.2	0.052	2.71
13:00	599.6	252.1	14.1	0.056	2.38	181.6	62.0	3.2	0.051	2.93
14:00	601.4	275.7	15.7	0.057	2.18	184.6	60.5	3.0	0.050	3.05
15:00	647.0	281.6	15.8	0.056	2.30	174.7	62.5	3.2	0.051	2.80
16:00	660.3	271.2	15.1	0.056	2.44	172.7	64.1	3.3	0.052	2.70
17:00	636.2	262.9	14.6	0.056	2.42	185.1	67.5	3.5	0.052	2.74
18:00	535.7	235.3	12.9	0.055	2.28	167.5	62.3	3.2	0.052	2.69
19:00	429.2	175.2	9.3	0.053	2.45	143.5	52.6	2.7	0.051	2.73
20:00	370.4	145.3	7.5	0.052	2.55	123.4	43.8	2.2	0.050	2.82
21:00	278.3	117.6	5.7	0.049	2.37	89.9	37.6	1.8	0.048	2.39
22:00	182.8	94.1	4.8	0.051	1.94	70.2	34.4	1.7	0.051	2.04
23:00	119.3	64.9	3.3	0.051	1.84	48.3	24.4	1.2	0.050	1.98
24:00	151.8	37.4	0.8	0.023	4.06	46.9	18.9	0.9	0.045	2.48

Table B.4: Calculated hourly average traffic emissions (in kg) and associated emission ratios for working days and weekends in Runeberg, Helsinki, 2004.

	Working days					Weekends				
Hour	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**	**CO**	**NO_x**	**$PM_{2.5}$**	**PM/NO_x**	**CO/NO_x**
00:00	86.1	45.3	2.3	0.051	1.90	42.1	19.4	1.0	0.049	2.16
01:00	50.8	26.8	1.4	0.051	1.90	50.9	20.0	0.9	0.045	2.54
02:00	42.9	15.7	0.7	0.042	2.74	53.6	17.6	0.7	0.038	3.04
03:00	36.8	13.6	0.6	0.041	2.71	53.1	16.9	0.6	0.036	3.14
04:00	37.2	17.6	0.8	0.047	2.12	40.6	15.0	0.6	0.040	2.71
05:00	67.0	52.8	3.0	0.057	1.27	24.3	10.7	0.5	0.045	2.27
06:00	293.9	176.3	10.4	0.059	1.67	27.9	18.7	1.0	0.055	1.49
07:00	606.3	306.6	17.5	0.057	1.98	42.1	27.3	1.6	0.057	1.54
08:00	772.9	374.2	21.2	0.057	2.07	62.4	38.3	2.2	0.057	1.63
09:00	668.1	298.8	17.2	0.058	2.24	82.7	53.5	3.1	0.057	1.55
10:00	624.2	274.4	15.7	0.057	2.27	116.6	63.2	3.6	0.056	1.84
11:00	648.9	301.7	17.3	0.057	2.15	166.6	71.2	3.9	0.055	2.34
12:00	682.0	308.7	17.7	0.057	2.21	201.2	80.3	4.4	0.055	2.50
13:00	703.4	305.9	17.4	0.057	2.30	222.9	76.9	4.0	0.053	2.90
14:00	722.1	337.8	19.6	0.058	2.14	224.6	78.5	4.1	0.053	2.86
15:00	784.5	351.9	20.3	0.058	2.23	212.7	83.5	4.5	0.054	2.55
16:00	801.8	341.4	19.5	0.057	2.35	201.1	91.3	5.1	0.055	2.20
17:00	768.5	335.8	19.2	0.057	2.29	214.8	98.9	5.5	0.056	2.17
18:00	628.3	312.2	17.9	0.057	2.01	200.1	86.3	4.7	0.055	2.32
19:00	484.2	239.6	13.5	0.056	2.02	171.8	71.7	3.9	0.054	2.40
20:00	423.2	191.0	10.6	0.055	2.22	150.9	62.7	3.4	0.054	2.41
21:00	320.0	146.8	7.6	0.052	2.18	98.8	48.3	2.5	0.052	2.04
22:00	202.9	114.6	6.2	0.054	1.77	76.7	40.5	2.1	0.053	1.89
23:00	129.2	77.0	4.1	0.054	1.68	55.6	30.5	1.6	0.053	1.83
24:00	86.1	45.3	2.3	0.051	1.90	42.1	19.4	1.0	0.049	2.16

In Figure B.3, the hourly variations over the day of the above emission ratios are plotted for working days and weekends for 2003, while Figure B.4 shows the same ratios for 2004. As expected, the CO over NO_x ratio is higher and the $PM_{2.5}$ over NO_x ratio is lower during the weekends, which is consistent with traffic having fewer heavy duty vehicles. The modelled $PM_{2.5}$ over NO_x emission ratios agree well with the respective concentration ratios.

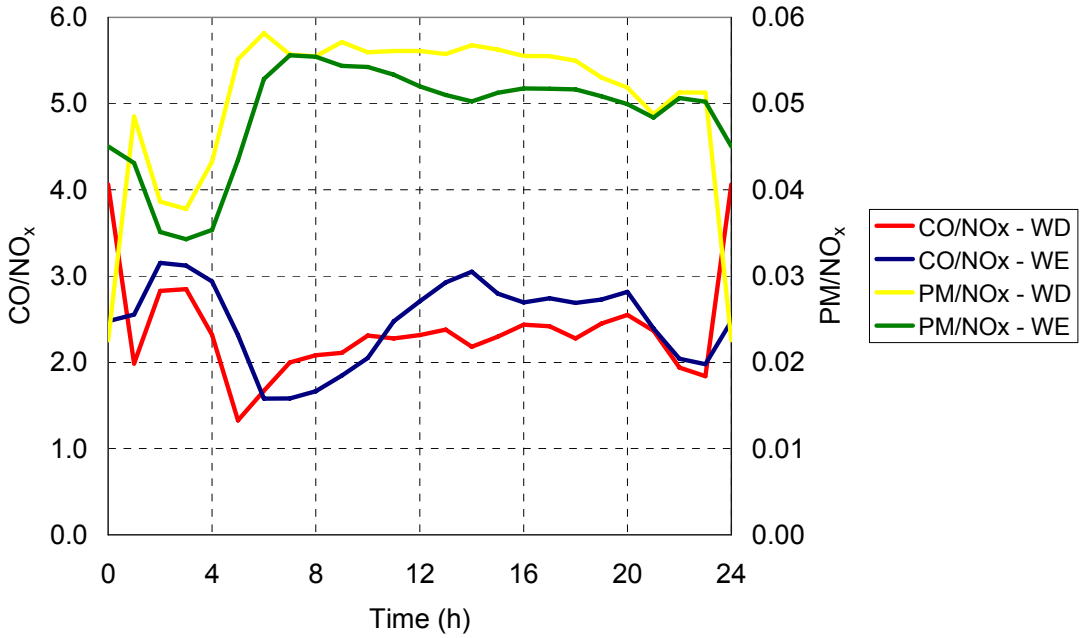


Figure B.3: Averaged diurnal variation of the CO over NO_x and $PM_{2.5}$ over NO_x ratios of traffic emissions for working days and weekends in Runeberg, Helsinki, 2003.

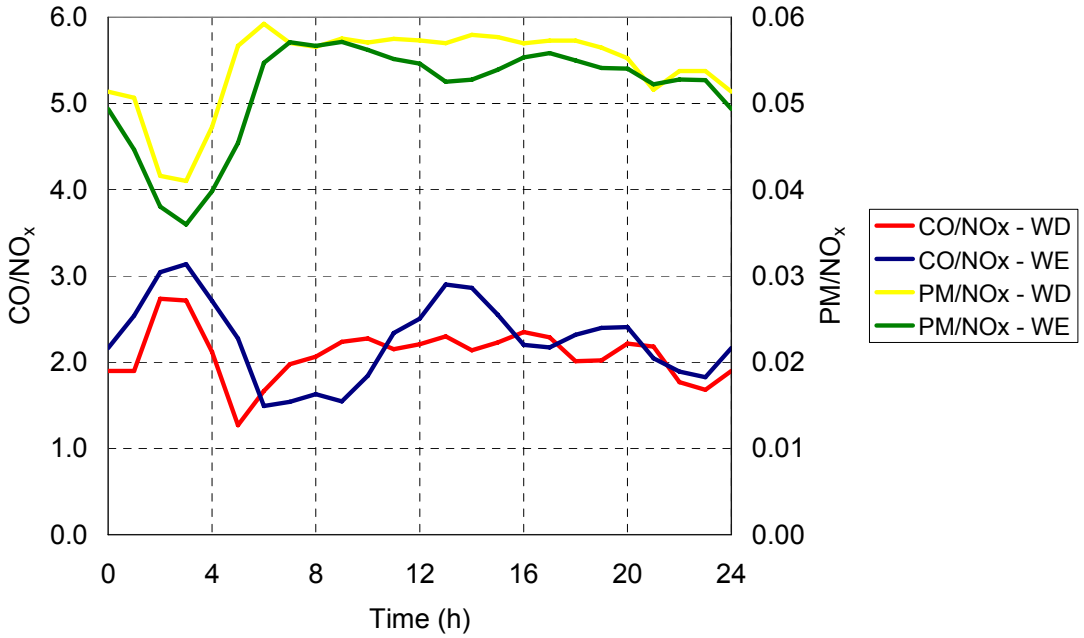


Figure B.4: Averaged diurnal variation of the CO over NO_x and $PM_{2.5}$ over NO_x ratios of traffic emissions for working days and weekends in Runeberg, Helsinki, 2004.

Appendix I

Table I.1: Hourly vehicle distribution in RV4, Oslo, working days, 2004, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	1	2	2	1	1	1
		ECE 15/03	163	100	65	62	67	169	886	1533	1448	1087	1004	1071
		ECE 15/04	1560	959	624	598	637	1614	8481	14676	13858	10403	9612	10255
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2189	1346	876	839	894	2265	11902	20595	19448	14599	13489	14391
		Euro II - 94/12/EC	2581	1587	1033	990	1054	2670	14033	24283	22930	17213	15905	16968
		Euro III - 98/69/EC Stage2000	950	584	380	364	388	983	5168	8942	8444	6339	5857	6249
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	1	2	2	2	2	2
		ECE 15/03	220	135	88	84	90	228	1197	2072	1956	1468	1357	1448
		ECE 15/04	2107	1296	843	808	860	2181	11460	19830	18725	14056	12988	13856
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2957	1819	1183	1134	1207	3060	16082	27829	26278	19726	18227	19445
		Euro II - 94/12/EC	3487	2145	1395	1337	1424	3608	18961	32811	30983	23258	21490	22927
		Euro III - 98/69/EC Stage2000	1284	790	514	492	524	1329	6983	12083	11410	8565	7914	8443
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	1	1	0	0	0
		ECE 15/03	54	33	21	21	22	56	292	506	477	358	331	353
		ECE 15/04	514	316	206	197	210	532	2797	4839	4570	3430	3170	3382
		Euro I - 91/441/EEC	722	444	289	277	295	747	3925	6791	6413	4814	4448	4746
		Euro II - 94/12/EC	851	523	341	326	347	881	4627	8007	7561	5676	5245	5595
		Euro III - 98/69/EC Stage2000	313	193	125	120	128	324	1704	2949	2785	2090	1931	2061
	Diesel <2,0 l	Conventional	167	103	67	64	68	173	908	1571	1484	1114	1029	1098
		Euro I - 91/441/EEC	111	68	44	43	45	115	604	1046	988	741	685	731
		Euro II - 94/12/EC	223	137	89	86	91	231	1215	2102	1985	1490	1377	1469
		Euro III - 98/69/EC Stage2000	105	64	42	40	43	108	569	984	930	698	645	688
	Diesel >2,0 l	Conventional	111	68	45	43	45	115	605	1048	989	743	686	732
		Euro I - 91/441/EEC	74	46	30	28	30	77	403	697	658	494	457	487
		Euro II - 94/12/EC	149	92	60	57	61	154	810	1402	1323	993	918	979
		Euro III - 98/69/EC Stage2000	70	43	28	27	28	72	379	656	620	465	430	459
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	583	358	233	224	238	603	3169	5484	5179	3888	3592	3832
		Euro I - 93/59/EEC	15	9	6	6	6	16	84	145	137	103	95	101
		Euro II - 96/69/EC	44	27	17	17	18	45	237	409	387	290	268	286
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	98	60	39	38	40	101	533	923	871	654	604	645
		Euro I - 93/59/EEC	77	47	31	29	31	80	418	723	683	513	474	505
		Euro II - 96/69/EC	387	238	155	149	158	401	2106	3645	3442	2584	2387	2547
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	263	121	82	97	121	439	1389	3032	3325	2325	2214	2135
		Euro I - 91/542/EEC Stage I	126	58	39	47	58	210	664	1449	1589	1112	1058	1021
		Euro II - 91/542/EEC Stage II	112	51	35	41	52	187	592	1291	1416	990	943	909
		Euro III - 2000 Standards	25	12	8	9	12	42	134	293	322	225	214	207
	Diesel 7,5 - 16 t	Conventional	289	133	90	107	133	482	1526	3331	3653	2555	2432	2346
		Euro I - 91/542/EEC Stage I	138	63	43	51	64	231	729	1592	1746	1221	1163	1121
		Euro II - 91/542/EEC Stage II	123	57	38	46	57	205	650	1419	1556	1088	1036	999
		Euro III - 2000 Standards	28	13	9	10	13	47	148	322	353	247	235	227
	Diesel 16 - 32 t	Conventional	342	157	106	127	157	571	1806	3942	4324	3024	2879	2776
		Euro I - 91/542/EEC Stage I	164	75	51	61	75	273	863	1884	2067	1445	1376	1327
		Euro II - 91/542/EEC Stage II	146	67	45	54	67	243	769	1679	1842	1288	1226	1182
		Euro III - 2000 Standards	33	15	10	12	15	55	175	381	418	292	278	269
	Diesel >32t	Conventional	5	2	2	2	2	8	26	57	62	43	41	40
		Euro I - 91/542/EEC Stage I	2	1	1	1	1	4	12	27	30	21	20	19
		Euro II - 91/542/EEC Stage II	2	1	1	1	1	3	11	24	26	18	18	17
		Euro III - 2000 Standards	0	0	0	0	0	1	3	5	6	4	4	4
Buses - Coaches	Urban Buses	Conventional	96	44	30	36	44	161	509	1111	1218	852	811	782
		Euro I - 91/542/EEC Stage I	10	5	3	4	5	17	55	120	131	92	87	84
		Euro II - 91/542/EEC Stage II	18	8	6	7	8	31	97	212	233	163	155	149
		Euro III - 2000 Standards	6	3	2	2	3	9	30	65	71	49	47	45
	Coaches	Conventional	24	11	7	9	11	40	127	278	305	213	203	196
		Euro I - 91/542/EEC Stage I	3	1	1	1	1	4	14	30	33	23	22	21
		Euro II - 91/542/EEC Stage II	5	2	1	2	2	8	24	53	58	41	39	37
		Euro III - 2000 Standards	1	1	0	1	1	2	7	16	18	12	12	11
Mopeds	<50 cm³	Conventional	499	307	200	192	204	517	2715	4699	4437	3331	3077	3283
		97/24/EC Stage I	91	56	36	35	37	94	496	858	810	608	562	600
		97/24/EC Stage II	189	116	76	72	77	196	1028	1779	1680	1261	1165	1243
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	138	85	55	53	56	143	750	1297	1225	919	850	906
		97/24/EC	77	48	31	30	32	80	421	728	687	516	477	509
	4-stroke 250 - 750 cm³	Conventional	138	85	55	53	56	143	750	1297	1225	919	850	906
		97/24/EC	77	48	31	30	32	80	421	728	687	516	477	509
	4-stroke >750 cm³	Conventional	138	85	55	53	56	143	750	1297	1225	919	850	906
		97/24/EC	77	48	31	30	32	80	421	728	687	516	477	509

Table I.2: Hourly vehicle distribution in RV4, Oslo, working days, 2004, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	1	2	2	2	2	2	2	1	1	1	1	0
		ECE 15/03	1149	1258	1487	2012	2044	1535	1289	1065	889	768	612	395
		ECE 15/04	11001	12039	14233	19261	19568	14697	12338	10193	8511	7354	5859	3782
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	15439	16895	19974	27030	27461	20626	17315	14304	11944	10321	8223	5308
		Euro II - 94/12/EC	18203	19920	23550	31869	32378	24319	20415	16865	14082	12169	9695	6258
		Euro III - 98/69/EC Stage2000	6703	7336	8673	11736	11924	8956	7518	6211	5186	4481	3570	2305
	Gasoline 1,4 - 2,0 l	ECE 15/02	2	2	2	3	3	2	2	2	1	1	1	1
		ECE 15/03	1553	1699	2009	2719	2762	2075	1742	1439	1201	1038	827	534
		ECE 15/04	14865	16267	19232	26025	26440	19859	16671	13772	11500	9937	7917	5110
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	20861	22829	26989	36523	37106	27870	23396	19327	16139	13945	11111	7172
		Euro II - 94/12/EC	24596	26916	31821	43062	43749	32860	27585	22788	19028	16442	13100	8456
		Euro III - 98/69/EC Stage2000	9058	9912	11719	15858	16111	12101	10158	8392	7007	6055	4824	3114
	Gasoline >2,0 l	ECE 15/02	0	0	1	1	1	1	1	0	0	0	0	0
		ECE 15/03	379	415	490	664	674	506	425	351	293	253	202	130
		ECE 15/04	3628	3970	4693	6351	6453	4847	4069	3361	2807	2425	1932	1247
		Euro I - 91/441/EEC	5091	5571	6587	8913	9056	6802	5710	4717	3939	3403	2712	1750
		Euro II - 94/12/EC	6003	6569	7766	10509	10677	8019	6732	5561	4644	4013	3197	2064
		Euro III - 98/69/EC Stage2000	2211	2419	2860	3870	3932	2953	2479	2048	1710	1478	1177	760
	Diesel <2,0 l	Conventional	1178	1289	1524	2062	2095	1574	1321	1091	911	787	627	405
		Euro I - 91/441/EEC	784	858	1014	1373	1395	1048	879	726	607	524	418	270
		Euro II - 94/12/EC	1576	1725	2039	2759	2803	2105	1767	1460	1219	1054	839	542
		Euro III - 98/69/EC Stage2000	738	808	955	1292	1313	986	828	684	571	493	393	254
	Diesel >2,0 l	Conventional	785	859	1016	1375	1397	1049	881	728	608	525	418	270
		Euro I - 91/441/EEC	523	572	676	915	930	698	586	484	404	349	278	180
		Euro II - 94/12/EC	1051	1150	1359	1839	1869	1404	1178	973	813	702	560	361
		Euro III - 98/69/EC Stage2000	492	538	636	861	875	657	552	456	381	329	262	169
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	4111	4499	5319	7198	7313	5492	4611	3809	3181	2748	2190	1413
		Euro I - 93/59/EEC	109	119	141	190	193	145	122	101	84	73	58	37
		Euro II - 96/69/EC	307	336	397	537	546	410	344	284	237	205	163	106
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	692	757	895	1211	1230	924	776	641	535	462	368	238
		Euro I - 93/59/EEC	542	593	701	949	964	724	608	502	419	362	289	186
		Euro II - 96/69/EC	2732	2990	3535	4784	4860	3650	3064	2531	2114	1826	1455	939
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	2314	2237	2173	2360	2140	1487	1071	845	720	558	389	325
		Euro I - 91/542/EEC Stage I	1106	1069	1039	1128	1023	711	512	404	344	267	186	156
		Euro II - 91/542/EEC Stage II	985	953	925	1005	911	633	456	360	307	238	166	139
		Euro III - 2000 Standards	224	216	210	228	207	144	104	82	70	54	38	31
	Diesel 7,5 - 16 t	Conventional	2542	2457	2387	2593	2351	1634	1176	928	791	613	428	357
		Euro I - 91/542/EEC Stage I	1215	1175	1141	1239	1124	781	562	444	378	293	204	171
		Euro II - 91/542/EEC Stage II	1083	1047	1017	1104	1001	696	501	395	337	261	182	152
		Euro III - 2000 Standards	246	238	231	251	227	158	114	90	77	59	41	35
	Diesel 16 - 32 t	Conventional	3009	2909	2826	3069	2782	1933	1392	1099	936	726	506	423
		Euro I - 91/542/EEC Stage I	1438	1390	1351	1467	1330	924	666	525	448	347	242	202
		Euro II - 91/542/EEC Stage II	1281	1239	1203	1307	1185	823	593	468	399	309	216	180
		Euro III - 2000 Standards	291	281	273	297	269	187	135	106	91	70	49	41
	Diesel >32t	Conventional	43	42	41	44	40	28	20	16	13	10	7	6
		Euro I - 91/542/EEC Stage I	21	20	19	21	19	13	10	8	6	5	3	3
		Euro II - 91/542/EEC Stage II	18	18	17	19	17	12	9	7	6	4	3	3
		Euro III - 2000 Standards	4	4	4	4	4	3	2	2	1	1	1	1
Buses - Coaches	Urban Buses	Conventional	848	820	796	865	784	545	392	310	264	205	143	119
		Euro I - 91/542/EEC Stage I	91	88	86	93	84	59	42	33	28	22	15	13
		Euro II - 91/542/EEC Stage II	162	156	152	165	150	104	75	59	50	39	27	23
		Euro III - 2000 Standards	49	48	46	50	46	32	23	18	15	12	8	7
	Coaches	Conventional	212	205	199	216	196	136	98	77	66	51	36	30
		Euro I - 91/542/EEC Stage I	23	22	21	23	21	15	11	8	7	6	4	3
		Euro II - 91/542/EEC Stage II	40	39	38	41	37	26	19	15	13	10	7	6
		Euro III - 2000 Standards	12	12	12	13	11	8	6	4	4	3	2	2
Mopeds	<50 cm³	Conventional	3522	3854	4557	6167	6265	4706	3950	3263	2725	2355	1876	1211
		97/24/EC Stage I	643	704	832	1126	1144	859	721	596	498	430	343	221
		97/24/EC Stage II	1333	1459	1725	2335	2372	1781	1495	1235	1032	891	710	458
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	972	1064	1258	1702	1729	1299	1090	901	752	650	518	334
		97/24/EC	546	597	706	955	971	729	612	506	422	365	291	188
	4-stroke 250 - 750 cm³	Conventional	972	1064	1258	1702	1729	1299	1090	901	752	650	518	334
		97/24/EC	546	597	706	955	971	729	612	506	422	365	291	188
	4-stroke >750 cm³	Conventional	972	1064	1258	1702	1729	1299	1090	901	752	650	518	334
		97/24/EC	546	597	706	955	971	729	612	506	422	365	291	188

Table I.3: Hourly vehicle distribution in RV4, Oslo, weekends, 2004, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	137	118	93	98	78	48	51	89	109	175	259	325
		ECE 15/04	1310	1132	894	942	745	460	488	848	1043	1677	2477	3110
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	1839	1589	1255	1322	1045	645	685	1190	1464	2353	3477	4365
		Euro II - 94/12/EC	2168	1873	1479	1558	1232	761	808	1403	1726	2775	4099	5146
		Euro III - 98/69/EC Stage2000	798	690	545	574	454	280	298	517	636	1022	1510	1895
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	1
		ECE 15/03	185	160	126	133	105	65	69	120	147	237	350	439
		ECE 15/04	1770	1530	1208	1273	1006	621	660	1146	1409	2266	3348	4203
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2484	2147	1695	1786	1412	872	926	1608	1978	3180	4698	5898
		Euro II - 94/12/EC	2929	2531	1999	2106	1665	1028	1092	1896	2332	3749	5539	6954
		Euro III - 98/69/EC Stage2000	1079	932	736	776	613	379	402	698	859	1381	2040	2561
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	45	39	31	32	26	16	17	29	36	58	85	107
		ECE 15/04	432	373	295	311	246	152	161	280	344	553	817	1026
		Euro I - 91/441/EEC	606	524	414	436	345	213	226	393	483	776	1146	1439
		Euro II - 94/12/EC	715	618	488	514	406	251	266	463	569	915	1352	1697
		Euro III - 98/69/EC Stage2000	263	227	180	189	150	92	98	170	210	337	498	625
	Diesel <2,0 l	Conventional	140	121	96	101	80	49	52	91	112	180	265	333
		Euro I - 91/441/EEC	93	81	64	67	53	33	35	60	74	120	177	222
		Euro II - 94/12/EC	188	162	128	135	107	66	70	122	149	240	355	446
		Euro III - 98/69/EC Stage2000	88	76	60	63	50	31	33	57	70	112	166	209
	Diesel >2,0 l	Conventional	94	81	64	67	53	33	35	61	74	120	177	222
		Euro I - 91/441/EEC	62	54	42	45	35	22	23	40	50	80	118	148
		Euro II - 94/12/EC	125	108	85	90	71	44	47	81	100	160	237	297
		Euro III - 98/69/EC Stage2000	59	51	40	42	33	21	22	38	47	75	111	139
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	490	423	334	352	278	172	183	317	390	627	926	1162
		Euro I - 93/59/EEC	13	11	9	9	7	5	5	8	10	17	24	31
		Euro II - 96/69/EC	37	32	25	26	21	13	14	24	29	47	69	87
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	82	71	56	59	47	29	31	53	66	105	156	196
		Euro I - 93/59/EEC	65	56	44	46	37	23	24	42	51	83	122	153
		Euro II - 96/69/EC	325	281	222	234	185	114	121	211	259	416	615	772
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	104	56	53	61	40	52	64	91	127	175	208	235
		Euro I - 91/542/EEC Stage I	50	27	26	29	19	25	31	43	61	84	100	112
		Euro II - 91/542/EEC Stage II	44	24	23	26	17	22	27	39	54	75	89	100
		Euro III - 2000 Standards	10	5	5	6	4	5	6	9	12	17	20	23
	Diesel 7,5 - 16 t	Conventional	115	62	59	67	44	57	70	100	140	193	229	258
		Euro I - 91/542/EEC Stage I	55	30	28	32	21	27	34	48	67	92	109	123
		Euro II - 91/542/EEC Stage II	49	26	25	29	19	24	30	42	60	82	97	110
		Euro III - 2000 Standards	11	6	6	7	4	5	7	10	14	19	22	25
	Diesel 16 - 32 t	Conventional	136	73	70	80	52	67	83	118	165	228	271	306
		Euro I - 91/542/EEC Stage I	65	35	33	38	25	32	40	56	79	109	129	146
		Euro II - 91/542/EEC Stage II	58	31	30	34	22	29	35	50	70	97	115	130
		Euro III - 2000 Standards	13	7	7	8	5	7	8	11	16	22	26	30
	Diesel >32t	Conventional	2	1	1	1	1	1	1	2	2	3	4	4
		Euro I - 91/542/EEC Stage I	1	1	0	1	0	0	1	1	1	2	2	2
		Euro II - 91/542/EEC Stage II	1	0	0	0	0	0	1	1	1	1	2	2
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	38	21	20	22	15	19	23	33	47	64	76	86
		Euro I - 91/542/EEC Stage I	4	2	2	2	2	2	3	4	5	7	8	9
		Euro II - 91/542/EEC Stage II	7	4	4	4	3	4	4	6	9	12	15	16
		Euro III - 2000 Standards	2	1	1	1	1	1	1	2	3	4	4	5
	Coaches	Conventional	10	5	5	6	4	5	6	8	12	16	19	22
		Euro I - 91/542/EEC Stage I	1	1	1	1	0	1	1	1	1	2	2	2
		Euro II - 91/542/EEC Stage II	2	1	1	1	1	1	1	2	2	3	4	4
		Euro III - 2000 Standards	1	0	0	0	0	0	0	0	1	1	1	1
Mopeds	<50 cm³	Conventional	419	362	286	302	238	147	156	272	334	537	793	996
		97/24/EC Stage I	77	66	52	55	44	27	29	50	61	98	145	182
		97/24/EC Stage II	159	137	108	114	90	56	59	103	126	203	300	377
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154
	4-stroke 250 - 750 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154
	4-stroke >750 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154

Table I.4: Hourly vehicle distribution in RV4, Oslo, weekends, 2004, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	0	1	1	1	1	1	1	0	0	0	0	0
		ECE 15/03	403	440	479	502	482	471	433	374	311	254	211	156
		ECE 15/04	3856	4210	4582	4803	4614	4512	4149	3582	2978	2434	2024	1493
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	5412	5907	6430	6741	6475	6332	5822	5026	4179	3416	2841	2095
		Euro II - 94/12/EC	6380	6965	7581	7948	7634	7465	6865	5926	4927	4028	3350	2471
		Euro III - 98/69/EC Stage2000	2350	2565	2792	2927	2811	2749	2528	2182	1814	1483	1234	910
	Gasoline 1,4 - 2,0 l	ECE 15/02	1	1	1	1	1	1	1	1	1	0	0	0
		ECE 15/03	544	594	647	678	651	637	586	506	420	344	286	211
		ECE 15/04	5210	5688	6191	6491	6234	6096	5606	4840	4023	3289	2735	2018
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	7312	7982	8688	9109	8749	8555	7867	6792	5646	4616	3839	2831
		Euro II - 94/12/EC	8621	9411	10243	10739	10315	10087	9276	8008	6657	5442	4526	3338
		Euro III - 98/69/EC Stage2000	3175	3466	3772	3955	3799	3715	3416	2949	2452	2004	1667	1229
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	133	145	158	165	159	155	143	123	103	84	70	51
		ECE 15/04	1272	1388	1511	1584	1521	1488	1368	1181	982	803	668	492
		Euro I - 91/441/EEC	1784	1948	2120	2223	2135	2088	1920	1658	1378	1127	937	691
		Euro II - 94/12/EC	2104	2297	2500	2621	2517	2462	2264	1954	1625	1328	1105	815
		Euro III - 98/69/EC Stage2000	775	846	921	965	927	907	834	720	598	489	407	300
	Diesel <2,0 l	Conventional	413	451	491	514	494	483	444	384	319	261	217	160
		Euro I - 91/441/EEC	275	300	327	342	329	322	296	255	212	173	144	106
		Euro II - 94/12/EC	552	603	656	688	661	646	594	513	427	349	290	214
		Euro III - 98/69/EC Stage2000	259	282	307	322	309	303	278	240	200	163	136	100
	Diesel >2,0 l	Conventional	275	300	327	343	329	322	296	256	213	174	145	107
		Euro I - 91/441/EEC	183	200	218	228	219	214	197	170	141	116	96	71
		Euro II - 94/12/EC	368	402	438	459	441	431	396	342	284	232	193	143
		Euro III - 98/69/EC Stage2000	172	188	205	215	206	202	186	160	133	109	91	67
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	1441	1573	1712	1795	1724	1686	1550	1338	1113	910	757	558
		Euro I - 93/59/EEC	38	42	45	47	46	45	41	35	29	24	20	15
		Euro II - 96/69/EC	108	117	128	134	129	126	116	100	83	68	56	42
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	242	265	288	302	290	284	261	225	187	153	127	94
		Euro I - 93/59/EEC	190	207	226	237	227	222	204	177	147	120	100	74
		Euro II - 96/69/EC	958	1045	1138	1193	1146	1121	1030	890	740	605	503	371
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	238	249	235	251	248	210	189	191	164	149	111	107
		Euro I - 91/542/EEC Stage I	114	119	112	120	118	100	90	91	79	71	53	51
		Euro II - 91/542/EEC Stage II	101	106	100	107	105	89	81	81	70	64	47	46
		Euro III - 2000 Standards	23	24	23	24	24	20	18	18	16	14	11	10
	Diesel 7,5 - 16 t	Conventional	262	274	258	276	272	231	208	210	180	164	122	117
		Euro I - 91/542/EEC Stage I	125	131	123	132	130	110	99	100	86	79	59	56
		Euro II - 91/542/EEC Stage II	111	116	110	117	116	98	88	89	77	70	52	50
		Euro III - 2000 Standards	25	26	25	27	26	22	20	20	17	16	12	11
	Diesel 16 - 32 t	Conventional	310	324	305	326	322	273	246	248	214	194	145	139
		Euro I - 91/542/EEC Stage I	148	155	146	156	154	131	118	119	102	93	69	66
		Euro II - 91/542/EEC Stage II	132	138	130	139	137	116	105	106	91	83	62	59
		Euro III - 2000 Standards	30	31	30	32	31	26	24	24	21	19	14	13
	Diesel >32t	Conventional	4	5	4	5	5	4	4	4	3	3	2	2
		Euro I - 91/542/EEC Stage I	2	2	2	2	2	2	2	2	1	1	1	1
		Euro II - 91/542/EEC Stage II	2	2	2	2	2	2	2	2	1	1	1	1
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	87	91	86	92	91	77	69	70	60	55	41	39
		Euro I - 91/542/EEC Stage I	9	10	9	10	10	8	7	8	6	6	4	4
		Euro II - 91/542/EEC Stage II	17	17	16	18	17	15	13	13	11	10	8	7
		Euro III - 2000 Standards	5	5	5	5	5	4	4	4	3	3	2	2
	Coaches	Conventional	22	23	22	23	23	19	17	17	15	14	10	10
		Euro I - 91/542/EEC Stage I	2	2	2	2	2	2	2	2	2	1	1	1
		Euro II - 91/542/EEC Stage II	4	4	4	4	4	4	3	3	3	3	2	2
		Euro III - 2000 Standards	1	1	1	1	1	1	1	1	1	1	1	1
Mopeds	<50 cm³	Conventional	1235	1348	1467	1538	1477	1445	1328	1147	953	779	648	478
		97/24/EC Stage I	225	246	268	281	270	264	243	209	174	142	118	87
		97/24/EC Stage II	467	510	555	582	559	547	503	434	361	295	245	181
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74
	4-stroke 250 - 750 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74
	4-stroke >750 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74

Table I.5: Hourly vehicle distribution in RV4, Oslo, working days, 2005, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	1	1	1	1	1	1
		ECE 15/03	113	69	44	43	50	155	680	1131	1078	788	735	784
		ECE 15/04	1079	658	424	411	481	1487	6513	10828	10321	7539	7036	7506
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	1514	924	595	576	675	2087	9140	15196	14484	10580	9874	10534
		Euro II - 94/12/EC	1786	1090	702	680	796	2461	10776	17917	17077	12474	11642	12420
		Euro III - 98/69/EC Stage2000	658	401	258	250	293	906	3969	6598	6289	4594	4287	4574
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	1	2	2	1	1	1
		ECE 15/03	152	93	60	58	68	210	919	1528	1457	1064	993	1060
		ECE 15/04	1458	890	573	555	650	2010	8800	14631	13946	10187	9507	10142
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2046	1249	804	779	912	2820	12350	20533	19571	14296	13342	14234
		Euro II - 94/12/EC	2413	1472	948	918	1075	3325	14561	24209	23075	16855	15731	16782
		Euro III - 98/69/EC Stage2000	888	542	349	338	396	1224	5362	8915	8498	6207	5793	6180
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	37	23	15	14	17	51	224	373	356	260	242	259
		ECE 15/04	356	217	140	135	159	490	2148	3571	3403	2486	2320	2475
		Euro I - 91/441/EEC	499	305	196	190	223	688	3014	5011	4776	3489	3256	3474
		Euro II - 94/12/EC	589	359	231	224	262	811	3554	5908	5631	4113	3839	4096
		Euro III - 98/69/EC Stage2000	217	132	85	83	97	299	1309	2176	2074	1515	1414	1508
	Diesel <2,0 l	Conventional	116	71	45	44	51	159	697	1159	1105	807	753	804
		Euro I - 91/441/EEC	77	47	30	29	34	106	464	772	736	537	501	535
		Euro II - 94/12/EC	155	94	61	59	69	213	933	1551	1478	1080	1008	1075
		Euro III - 98/69/EC Stage2000	72	44	28	28	32	100	437	726	692	506	472	503
	Diesel >2,0 l	Conventional	77	47	30	29	34	106	465	773	737	538	502	536
		Euro I - 91/441/EEC	51	31	20	20	23	71	309	514	490	358	334	357
		Euro II - 94/12/EC	103	63	41	39	46	142	622	1034	986	720	672	717
		Euro III - 98/69/EC Stage2000	48	29	19	18	22	67	291	484	462	337	315	336
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	403	246	159	154	180	556	2434	4047	3857	2817	2629	2805
		Euro I - 93/59/EEC	11	7	4	4	5	15	64	107	102	74	69	74
		Euro II - 96/69/EC	30	18	12	11	13	41	182	302	288	210	196	209
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	68	41	27	26	30	94	409	681	649	474	442	472
		Euro I - 93/59/EEC	53	32	21	20	24	73	321	534	509	372	347	370
		Euro II - 96/69/EC	268	164	105	102	119	369	1618	2689	2563	1872	1747	1864
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	185	75	60	75	138	372	1232	2168	2021	1638	1631	1613
		Euro I - 91/542/EEC Stage I	89	36	29	36	66	178	589	1036	966	783	780	771
		Euro II - 91/542/EEC Stage II	79	32	26	32	59	159	525	924	861	698	695	687
		Euro III - 2000 Standards	18	7	6	7	13	36	119	210	195	158	158	156
	Diesel 7,5 - 16 t	Conventional	204	83	66	83	151	409	1353	2382	2220	1800	1792	1773
		Euro I - 91/542/EEC Stage I	97	39	32	39	72	195	647	1139	1061	860	856	847
		Euro II - 91/542/EEC Stage II	87	35	28	35	64	174	576	1015	945	766	763	755
		Euro III - 2000 Standards	20	8	6	8	15	40	131	230	215	174	173	171
	Diesel 16 - 32 t	Conventional	241	98	78	98	179	484	1602	2820	2627	2130	2121	2098
		Euro I - 91/542/EEC Stage I	115	47	38	47	86	231	766	1348	1256	1018	1014	1003
		Euro II - 91/542/EEC Stage II	103	42	33	42	76	206	682	1201	1119	907	903	894
		Euro III - 2000 Standards	23	9	8	9	17	47	155	273	254	206	205	203
	Diesel >32t	Conventional	3	1	1	1	3	7	23	40	38	31	30	30
		Euro I - 91/542/EEC Stage I	2	1	1	1	1	3	11	19	18	15	15	14
		Euro II - 91/542/EEC Stage II	1	1	0	1	1	3	10	17	16	13	13	13
		Euro III - 2000 Standards	0	0	0	0	0	1	2	4	4	3	3	3
Buses - Coaches	Urban Buses	Conventional	68	28	22	28	50	136	451	795	740	600	598	591
		Euro I - 91/542/EEC Stage I	7	3	2	3	5	15	49	86	80	65	64	64
		Euro II - 91/542/EEC Stage II	13	5	4	5	10	26	86	152	141	115	114	113
		Euro III - 2000 Standards	4	2	1	2	3	8	26	46	43	35	35	34
	Coaches	Conventional	17	7	6	7	13	34	113	199	185	150	149	148
		Euro I - 91/542/EEC Stage I	2	1	1	1	1	4	12	21	20	16	16	16
		Euro II - 91/542/EEC Stage II	3	1	1	1	2	7	22	38	35	29	29	28
		Euro III - 2000 Standards	1	0	0	0	1	2	7	12	11	9	9	9
Mopeds	<50 cm³	Conventional	345	211	136	132	154	476	2085	3467	3304	2414	2253	2403
		97/24/EC Stage I	63	39	25	24	28	87	381	633	603	441	411	439
		97/24/EC Stage II	131	80	51	50	58	180	789	1312	1251	914	853	910
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	95	58	37	36	43	131	576	957	912	666	622	663
		97/24/EC	54	33	21	20	24	74	323	537	512	374	349	372
	4-stroke 250 - 750 cm³	Conventional	95	58	37	36	43	131	576	957	912	666	622	663
		97/24/EC	54	33	21	20	24	74	323	537	512	374	349	372
	4-stroke >750 cm³	Conventional	95	58	37	36	43	131	576	957	912	666	622	663
		97/24/EC	54	33	21	20	24	74	323	537	512	374	349	372

Table I.6: Hourly vehicle distribution in RV4, Oslo, working days, 2005, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	1	1	1	2	2	1	1	1	1	1	0	0
		ECE 15/03	836	920	1109	1460	1452	1076	902	744	630	524	417	254
		ECE 15/04	8002	8807	10614	13976	13895	10298	8634	7123	6031	5019	3993	2433
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	11230	12360	14895	19614	19500	14451	12117	9996	8463	7043	5603	3414
		Euro II - 94/12/EC	13241	14573	17562	23125	22992	17039	14286	11786	9978	8304	6607	4025
		Euro III - 98/69/EC Stage2000	4876	5367	6467	8516	8467	6275	5261	4340	3675	3058	2433	1482
	Gasoline 1,4 - 2,0 l	ECE 15/02	1	1	2	2	2	2	1	1	1	1	1	0
		ECE 15/03	1130	1243	1498	1973	1961	1454	1219	1005	851	708	564	343
		ECE 15/04	10813	11901	14342	18885	18775	13914	11666	9624	8149	6781	5395	3287
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	15174	16701	20126	26502	26349	19527	16372	13507	11435	9516	7571	4613
		Euro II - 94/12/EC	17891	19691	23730	31247	31066	23023	19303	15925	13483	11220	8927	5439
		Euro III - 98/69/EC Stage2000	6589	7251	8739	11507	11441	8478	7109	5865	4965	4132	3287	2003
	Gasoline >2,0 l	ECE 15/02	0	0	0	1	1	0	0	0	0	0	0	0
		ECE 15/03	276	303	366	481	479	355	297	245	208	173	138	84
		ECE 15/04	2639	2904	3500	4609	4582	3396	2847	2349	1989	1655	1317	802
		Euro I - 91/441/EEC	3703	4076	4912	6468	6430	4765	3996	3296	2791	2322	1848	1126
		Euro II - 94/12/EC	4366	4806	5791	7626	7582	5619	4711	3886	3290	2738	2179	1327
		Euro III - 98/69/EC Stage2000	1608	1770	2133	2808	2792	2069	1735	1431	1212	1008	802	489
	Diesel <2,0 l	Conventional	857	943	1136	1497	1488	1103	924	763	646	537	428	260
		Euro I - 91/441/EEC	570	628	756	996	990	734	615	508	430	358	285	173
		Euro II - 94/12/EC	1146	1262	1520	2002	1991	1475	1237	1020	864	719	572	348
		Euro III - 98/69/EC Stage2000	537	591	712	937	932	691	579	478	405	337	268	163
	Diesel >2,0 l	Conventional	571	629	758	998	992	735	616	508	430	358	285	174
		Euro I - 91/441/EEC	380	418	504	664	660	489	410	338	287	238	190	116
		Euro II - 94/12/EC	764	841	1014	1335	1327	983	825	680	576	479	381	232
		Euro III - 98/69/EC Stage2000	358	394	475	625	621	460	386	319	270	224	179	109
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	2990	3291	3966	5223	5193	3848	3227	2662	2254	1875	1492	909
		Euro I - 93/59/EEC	79	87	105	138	137	102	85	70	60	50	39	24
		Euro II - 96/69/EC	223	246	296	390	388	287	241	199	168	140	111	68
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	503	554	667	879	874	647	543	448	379	316	251	153
		Euro I - 93/59/EEC	394	434	523	689	685	507	426	351	297	247	197	120
		Euro II - 96/69/EC	1987	2187	2636	3471	3451	2557	2144	1769	1498	1246	992	604
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	1699	1593	1681	1885	1603	1101	812	662	537	413	291	230
		Euro I - 91/542/EEC Stage I	812	762	803	901	766	526	388	316	257	197	139	110
		Euro II - 91/542/EEC Stage II	724	679	716	803	683	469	346	282	229	176	124	98
		Euro III - 2000 Standards	164	154	163	182	155	106	79	64	52	40	28	22
	Diesel 7,5 - 16 t	Conventional	1867	1751	1847	2071	1761	1210	892	727	590	453	320	253
		Euro I - 91/542/EEC Stage I	892	837	883	990	842	578	426	347	282	217	153	121
		Euro II - 91/542/EEC Stage II	795	746	787	882	750	515	380	310	251	193	136	108
		Euro III - 2000 Standards	181	169	179	200	170	117	86	70	57	44	31	24
	Diesel 16 - 32 t	Conventional	2210	2072	2186	2451	2084	1432	1056	860	698	537	379	300
		Euro I - 91/542/EEC Stage I	1056	990	1045	1171	996	684	505	411	334	257	181	143
		Euro II - 91/542/EEC Stage II	941	882	931	1044	888	610	450	366	297	229	161	128
		Euro III - 2000 Standards	214	200	211	237	202	138	102	83	68	52	37	29
	Diesel >32t	Conventional	32	30	31	35	30	21	15	12	10	8	5	4
		Euro I - 91/542/EEC Stage I	15	14	15	17	14	10	7	6	5	4	3	2
		Euro II - 91/542/EEC Stage II	14	13	13	15	13	9	6	5	4	3	2	2
		Euro III - 2000 Standards	3	3	3	3	3	2	1	1	1	1	1	0
Buses - Coaches	Urban Buses	Conventional	623	584	616	691	587	403	298	242	197	151	107	84
		Euro I - 91/542/EEC Stage I	67	63	66	74	63	43	32	26	21	16	11	9
		Euro II - 91/542/EEC Stage II	119	111	118	132	112	77	57	46	38	29	20	16
		Euro III - 2000 Standards	36	34	36	40	34	23	17	14	11	9	6	5
	Coaches	Conventional	156	146	154	173	147	101	74	61	49	38	27	21
		Euro I - 91/542/EEC Stage I	17	16	17	19	16	11	8	7	5	4	3	2
		Euro II - 91/542/EEC Stage II	30	28	29	33	28	19	14	12	9	7	5	4
		Euro III - 2000 Standards	9	8	9	10	9	6	4	4	3	2	2	1
Mopeds	<50 cm³	Conventional	2562	2820	3398	4475	4449	3297	2764	2280	1931	1607	1278	779
		97/24/EC Stage I	468	515	621	817	812	602	505	416	353	293	233	142
		97/24/EC Stage II	970	1068	1286	1694	1684	1248	1046	863	731	608	484	295
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	707	778	938	1235	1228	910	763	630	533	444	353	215
		97/24/EC	397	437	526	693	689	511	428	353	299	249	198	121
	4-stroke 250 - 750 cm³	Conventional	707	778	938	1235	1228	910	763	630	533	444	353	215
		97/24/EC	397	437	526	693	689	511	428	353	299	249	198	121
	4-stroke >750 cm³	Conventional	707	778	938	1235	1228	910	763	630	533	444	353	215
		97/24/EC	397	437	526	693	689	511	428	353	299	249	198	121

Table I.7: Hourly vehicle distribution in RV4, Oslo, weekends, 2005, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	137	118	93	98	78	48	51	89	109	175	259	325
		ECE 15/04	1310	1132	894	942	745	460	488	848	1043	1677	2477	3110
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	1839	1589	1255	1322	1045	645	685	1190	1464	2353	3477	4365
		Euro II - 94/12/EC	2168	1873	1479	1558	1232	761	808	1403	1726	2775	4099	5146
		Euro III - 98/69/EC Stage2000	798	690	545	574	454	280	298	517	636	1022	1510	1895
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	1
		ECE 15/03	185	160	126	133	105	65	69	120	147	237	350	439
		ECE 15/04	1770	1530	1208	1273	1006	621	660	1146	1409	2266	3348	4203
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2484	2147	1695	1786	1412	872	926	1608	1978	3180	4698	5898
		Euro II - 94/12/EC	2929	2531	1999	2106	1665	1028	1092	1896	2332	3749	5539	6954
		Euro III - 98/69/EC Stage2000	1079	932	736	776	613	379	402	698	859	1381	2040	2561
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	45	39	31	32	26	16	17	29	36	58	85	107
		ECE 15/04	432	373	295	311	246	152	161	280	344	553	817	1026
		Euro I - 91/441/EEC	606	524	414	436	345	213	226	393	483	776	1146	1439
		Euro II - 94/12/EC	715	618	488	514	406	251	266	463	569	915	1352	1697
		Euro III - 98/69/EC Stage2000	263	227	180	189	150	92	98	170	210	337	498	625
	Diesel <2,0 l	Conventional	140	121	96	101	80	49	52	91	112	180	265	333
		Euro I - 91/441/EEC	93	81	64	67	53	33	35	60	74	120	177	222
		Euro II - 94/12/EC	188	162	128	135	107	66	70	122	149	240	355	446
		Euro III - 98/69/EC Stage2000	88	76	60	63	50	31	33	57	70	112	166	209
	Diesel >2,0 l	Conventional	94	81	64	67	53	33	35	61	74	120	177	222
		Euro I - 91/441/EEC	62	54	42	45	35	22	23	40	50	80	118	148
		Euro II - 94/12/EC	125	108	85	90	71	44	47	81	100	160	237	297
		Euro III - 98/69/EC Stage2000	59	51	40	42	33	21	22	38	47	75	111	139
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	490	423	334	352	278	172	183	317	390	627	926	1162
		Euro I - 93/59/EEC	13	11	9	9	7	5	5	8	10	17	24	31
		Euro II - 96/69/EC	37	32	25	26	21	13	14	24	29	47	69	87
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	82	71	56	59	47	29	31	53	66	105	156	196
		Euro I - 93/59/EEC	65	56	44	46	37	23	24	42	51	83	122	153
		Euro II - 96/69/EC	325	281	222	234	185	114	121	211	259	416	615	772
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	104	56	53	61	40	52	64	91	127	175	208	235
		Euro I - 91/542/EEC Stage I	50	27	26	29	19	25	31	43	61	84	100	112
		Euro II - 91/542/EEC Stage II	44	24	23	26	17	22	27	39	54	75	89	100
		Euro III - 2000 Standards	10	5	5	6	4	5	6	9	12	17	20	23
	Diesel 7,5 - 16 t	Conventional	115	62	59	67	44	57	70	100	140	193	229	258
		Euro I - 91/542/EEC Stage I	55	30	28	32	21	27	34	48	67	92	109	123
		Euro II - 91/542/EEC Stage II	49	26	25	29	19	24	30	42	60	82	97	110
		Euro III - 2000 Standards	11	6	6	7	4	5	7	10	14	19	22	25
	Diesel 16 - 32 t	Conventional	136	73	70	80	52	67	83	118	165	228	271	306
		Euro I - 91/542/EEC Stage I	65	35	33	38	25	32	40	56	79	109	129	146
		Euro II - 91/542/EEC Stage II	58	31	30	34	22	29	35	50	70	97	115	130
		Euro III - 2000 Standards	13	7	7	8	5	7	8	11	16	22	26	30
	Diesel >32t	Conventional	2	1	1	1	1	1	1	2	2	3	4	4
		Euro I - 91/542/EEC Stage I	1	1	0	1	0	0	1	1	1	2	2	2
		Euro II - 91/542/EEC Stage II	1	0	0	0	0	0	1	1	1	1	2	2
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	38	21	20	22	15	19	23	33	47	64	76	86
		Euro I - 91/542/EEC Stage I	4	2	2	2	2	2	3	4	5	7	8	9
		Euro II - 91/542/EEC Stage II	7	4	4	4	3	4	4	6	9	12	15	16
		Euro III - 2000 Standards	2	1	1	1	1	1	1	2	3	4	4	5
	Coaches	Conventional	10	5	5	6	4	5	6	8	12	16	19	22
		Euro I - 91/542/EEC Stage I	1	1	1	1	0	1	1	1	1	2	2	2
		Euro II - 91/542/EEC Stage II	2	1	1	1	1	1	1	2	2	3	4	4
		Euro III - 2000 Standards	1	0	0	0	0	0	0	0	1	1	1	1
Mopeds	<50 cm³	Conventional	419	362	286	302	238	147	156	272	334	537	793	996
		97/24/EC Stage I	77	66	52	55	44	27	29	50	61	98	145	182
		97/24/EC Stage II	159	137	108	114	90	56	59	103	126	203	300	377
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154
	4-stroke 250 - 750 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154
	4-stroke >750 cm³	Conventional	116	100	79	83	66	41	43	75	92	148	219	275
		97/24/EC	65	56	44	47	37	23	24	42	52	83	123	154

Table I.8: Hourly vehicle distribution in RV4, Oslo, weekends, 2005, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	0	1	1	1	1	1	1	0	0	0	0	0
		ECE 15/03	403	440	479	502	482	471	433	374	311	254	211	156
		ECE 15/04	3856	4210	4582	4803	4614	4512	4149	3582	2978	2434	2024	1493
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	5412	5907	6430	6741	6475	6332	5822	5026	4179	3416	2841	2095
		Euro II - 94/12/EC	6380	6965	7581	7948	7634	7465	6865	5926	4927	4028	3350	2471
		Euro III - 98/69/EC Stage2000	2350	2565	2792	2927	2811	2749	2528	2182	1814	1483	1234	910
	Gasoline 1,4 - 2,0 l	ECE 15/02	1	1	1	1	1	1	1	1	1	0	0	0
		ECE 15/03	544	594	647	678	651	637	586	506	420	344	286	211
		ECE 15/04	5210	5688	6191	6491	6234	6096	5606	4840	4023	3289	2735	2018
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	7312	7982	8688	9109	8749	8555	7867	6792	5646	4616	3839	2831
		Euro II - 94/12/EC	8621	9411	10243	10739	10315	10087	9276	8008	6657	5442	4526	3338
		Euro III - 98/69/EC Stage2000	3175	3466	3772	3955	3799	3715	3416	2949	2452	2004	1667	1229
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	133	145	158	165	159	155	143	123	103	84	70	51
		ECE 15/04	1272	1388	1511	1584	1521	1488	1368	1181	982	803	668	492
		Euro I - 91/441/EEC	1784	1948	2120	2223	2135	2088	1920	1658	1378	1127	937	691
		Euro II - 94/12/EC	2104	2297	2500	2621	2517	2462	2264	1954	1625	1328	1105	815
		Euro III - 98/69/EC Stage2000	775	846	921	965	927	907	834	720	598	489	407	300
	Diesel <2,0 l	Conventional	413	451	491	514	494	483	444	384	319	261	217	160
		Euro I - 91/441/EEC	275	300	327	342	329	322	296	255	212	173	144	106
		Euro II - 94/12/EC	552	603	656	688	661	646	594	513	427	349	290	214
		Euro III - 98/69/EC Stage2000	259	282	307	322	309	303	278	240	200	163	136	100
	Diesel >2,0 l	Conventional	275	300	327	343	329	322	296	256	213	174	145	107
		Euro I - 91/441/EEC	183	200	218	228	219	214	197	170	141	116	96	71
		Euro II - 94/12/EC	368	402	438	459	441	431	396	342	284	232	193	143
		Euro III - 98/69/EC Stage2000	172	188	205	215	206	202	186	160	133	109	91	67
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	1441	1573	1712	1795	1724	1686	1550	1338	1113	910	757	558
		Euro I - 93/59/EEC	38	42	45	47	46	45	41	35	29	24	20	15
		Euro II - 96/69/EC	108	117	128	134	129	126	116	100	83	68	56	42
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel <3,5 t	Conventional	242	265	288	302	290	284	261	225	187	153	127	94
		Euro I - 93/59/EEC	190	207	226	237	227	222	204	177	147	120	100	74
		Euro II - 96/69/EC	958	1045	1138	1193	1146	1121	1030	890	740	605	503	371
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	238	249	235	251	248	210	189	191	164	149	111	107
		Euro I - 91/542/EEC Stage I	114	119	112	120	118	100	90	91	79	71	53	51
		Euro II - 91/542/EEC Stage II	101	106	100	107	105	89	81	81	70	64	47	46
		Euro III - 2000 Standards	23	24	23	24	24	20	18	18	16	14	11	10
	Diesel 7,5 - 16 t	Conventional	262	274	258	276	272	231	208	210	180	164	122	117
		Euro I - 91/542/EEC Stage I	125	131	123	132	130	110	99	100	86	79	59	56
		Euro II - 91/542/EEC Stage II	111	116	110	117	116	98	88	89	77	70	52	50
		Euro III - 2000 Standards	25	26	25	27	26	22	20	20	17	16	12	11
	Diesel 16 - 32 t	Conventional	310	324	305	326	322	273	246	248	214	194	145	139
		Euro I - 91/542/EEC Stage I	148	155	146	156	154	131	118	119	102	93	69	66
		Euro II - 91/542/EEC Stage II	132	138	130	139	137	116	105	106	91	83	62	59
		Euro III - 2000 Standards	30	31	30	32	31	26	24	24	21	19	14	13
	Diesel >32t	Conventional	4	5	4	5	5	4	4	4	3	3	2	2
		Euro I - 91/542/EEC Stage I	2	2	2	2	2	2	2	2	1	1	1	1
		Euro II - 91/542/EEC Stage II	2	2	2	2	2	2	2	2	1	1	1	1
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	87	91	86	92	91	77	69	70	60	55	41	39
		Euro I - 91/542/EEC Stage I	9	10	9	10	10	8	7	8	6	6	4	4
		Euro II - 91/542/EEC Stage II	17	17	16	18	17	15	13	13	11	10	8	7
		Euro III - 2000 Standards	5	5	5	5	5	4	4	4	3	3	2	2
	Coaches	Conventional	22	23	22	23	23	19	17	17	15	14	10	10
		Euro I - 91/542/EEC Stage I	2	2	2	2	2	2	2	2	2	1	1	1
		Euro II - 91/542/EEC Stage II	4	4	4	4	4	4	3	3	3	3	2	2
		Euro III - 2000 Standards	1	1	1	1	1	1	1	1	1	1	1	1
Mopeds	<50 cm³	Conventional	1235	1348	1467	1538	1477	1445	1328	1147	953	779	648	478
		97/24/EC Stage I	225	246	268	281	270	264	243	209	174	142	118	87
		97/24/EC Stage II	467	510	555	582	559	547	503	434	361	295	245	181
Motorcycles	2-stroke >50 cm³	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		97/24/EC	0	0	0	0	0	0	0	0	0	0	0	0
	4-stroke <250 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74
	4-stroke 250 - 750 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74
	4-stroke >750 cm³	Conventional	341	372	405	425	408	399	367	317	263	215	179	132
		97/24/EC	191	209	227	238	229	224	206	178	148	121	100	74

Appendix II

Table II.1: Hourly vehicle distribution in Runeberg, Helsinki, working days, 2003, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	1	3	4	3	3	3	3
		ECE 15/03	256	217	199	189	303	975	1993	2482	1955	1851	1984	2053
		ECE 15/04	1726	1462	1342	1274	2044	6566	13430	16722	13172	12473	13368	13830
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	4084	3458	3175	3015	4837	15534	31775	39562	31164	29511	31627	32721
		Euro II - 94/12/EC	4048	3428	3148	2989	4795	15398	31498	39217	30892	29253	31351	32435
		Euro III - 98/69/EC Stage2000	2464	2087	1916	1820	2919	9374	19175	23875	18807	17809	19086	19746
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	1	1	2	1	1	1	2
		ECE 15/03	128	109	100	95	152	488	999	1244	980	928	994	1029
		ECE 15/04	865	732	673	639	1024	3290	6730	8379	6600	6250	6699	6930
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2046	1733	1591	1511	2424	7784	15923	19825	15616	14788	15848	16396
		Euro II - 94/12/EC	2028	1718	1577	1498	2403	7716	15783	19651	15480	14658	15710	16253
		Euro III - 98/69/EC Stage2000	1235	1046	960	912	1463	4697	9609	11964	9424	8924	9564	9895
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	17	14	13	13	20	65	132	165	130	123	132	136
		ECE 15/04	111	94	86	82	131	421	862	1073	846	801	858	888
		Euro I - 91/441/EEC	274	232	213	203	325	1044	2135	2658	2094	1983	2125	2199
		Euro II - 94/12/EC	268	227	209	198	318	1021	2088	2600	2048	1939	2079	2150
		Euro III - 98/69/EC Stage2000	163	138	127	121	194	622	1271	1583	1247	1181	1265	1309
	Diesel <2,0 l	Conventional	362	307	282	267	429	1378	2819	3510	2765	2618	2806	2903
		Euro I - 91/441/EEC	217	184	169	160	257	827	1691	2106	1659	1571	1683	1742
		Euro II - 94/12/EC	431	365	335	318	511	1640	3354	4176	3289	3115	3338	3454
		Euro III - 98/69/EC Stage2000	291	247	227	215	345	1109	2268	2824	2224	2106	2257	2335
	Diesel >2,0 l	Conventional	242	205	188	178	286	919	1879	2340	1843	1745	1870	1935
		Euro I - 91/441/EEC	145	123	113	107	172	551	1128	1404	1106	1047	1122	1161
		Euro II - 94/12/EC	287	243	223	212	340	1093	2236	2784	2193	2076	2225	2302
		Euro III - 98/69/EC Stage2000	194	165	151	143	230	739	1512	1882	1483	1404	1505	1557
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	257	218	200	190	305	979	2002	2493	1963	1859	1993	2062
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	11	9	8	8	13	41	84	104	82	78	83	86
		Euro III - 98/69/EC Stage2000	7	6	5	5	8	25	51	64	50	48	51	53
	Diesel <3,5 t	Conventional	706	598	549	521	836	2685	5492	6838	5386	5100	5466	5655
		Euro I - 93/59/EEC	216	183	168	160	256	822	1682	2094	1649	1562	1674	1732
		Euro II - 96/69/EC	688	582	535	508	815	2616	5351	6663	5248	4970	5326	5511
		Euro III - 98/69/EC Stage2000	123	104	95	91	145	466	954	1188	936	886	950	982
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	289	82	69	131	718	2255	3416	4050	3463	2829	3096	3158
		Euro I - 91/542/EEC Stage I	65	18	16	30	161	507	768	911	779	636	696	710
		Euro II - 91/542/EEC Stage II	119	34	29	54	297	934	1414	1677	1433	1171	1282	1307
		Euro III - 2000 Standards	54	15	13	25	135	423	641	760	650	531	581	593
	Diesel 7,5 - 16 t	Conventional	411	117	99	187	1022	3212	4866	5770	4933	4030	4410	4499
		Euro I - 91/542/EEC Stage I	92	26	22	42	230	722	1094	1297	1109	906	992	1011
		Euro II - 91/542/EEC Stage II	170	48	41	77	423	1330	2014	2388	2042	1668	1826	1862
		Euro III - 2000 Standards	77	22	18	35	192	603	913	1083	926	756	828	844
	Diesel 16 - 32 t	Conventional	492	140	118	224	1223	3844	5822	6904	5902	4822	5277	5383
		Euro I - 91/542/EEC Stage I	111	32	27	50	275	864	1309	1552	1327	1084	1187	1210
		Euro II - 91/542/EEC Stage II	204	58	49	93	506	1591	2410	2858	2443	1996	2184	2228
		Euro III - 2000 Standards	92	26	22	42	230	721	1093	1296	1108	905	990	1010
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	83	24	20	38	206	648	981	1164	995	813	890	907
		Euro I - 91/542/EEC Stage I	15	4	4	7	38	118	179	212	182	148	162	166
		Euro II - 91/542/EEC Stage II	23	6	5	10	56	177	269	319	272	223	244	249
		Euro III - 2000 Standards	11	3	3	5	28	87	131	156	133	109	119	121
	Coaches	Conventional	21	6	5	9	52	162	245	291	249	203	222	227
		Euro I - 91/542/EEC Stage I	4	1	1	2	9	30	45	53	45	37	41	41
		Euro II - 91/542/EEC Stage II	6	2	1	3	14	44	67	80	68	56	61	62
		Euro III - 2000 Standards	3	1	1	1	7	22	33	39	33	27	30	30
Mopeds	<50 cm³	Conventional	159	135	124	117	188	605	1237	1540	1213	1149	1231	1274
		97/24/EC Stage I	74	62	57	54	87	280	573	713	562	532	570	590
		97/24/EC Stage II	335	283	260	247	396	1272	2603	3241	2553	2417	2591	2680
Motorcycles	2-stroke >50 cm³	Conventional	58	49	45	43	68	219	448	558	439	416	446	461
		97/24/EC	148	125	115	109	175	562	1150	1432	1128	1068	1144	1184
	4-stroke <250 cm³	Conventional	19	16	15	14	23	73	149	186	146	139	149	154
		97/24/EC	49	42	38	36	58	187	383	477	376	356	381	395
	4-stroke 250 - 750 cm³	Conventional	19	16	15	14	23	73	149	186	146	139	149	154
		97/24/EC	49	42	38	36	58	187	383	477	376	356	381	395
	4-stroke >750 cm³	Conventional	19	16	15	14	23	73	149	186	146	139	149	154
		97/24/EC	49	42	38	36	58	187	383	477	376	356	381	395

Table II.2: Hourly vehicle distribution in Runeberg, Helsinki, working days, 2003, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	3	3	3	3	3	3	2	2	2	1	1	1
		ECE 15/03	2090	2125	2257	2284	2211	2004	1656	1455	1310	907	615	356
		ECE 15/04	14079	14316	15203	15386	14898	13502	11158	9799	8829	6111	4146	2398
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	33311	33872	35969	36403	35249	31944	26399	23185	20889	14458	9809	5674
		Euro II - 94/12/EC	33020	33576	35655	36085	34941	31665	26168	22982	20706	14332	9723	5624
		Euro III - 98/69/EC Stage2000	20102	20441	21706	21968	21272	19277	15931	13991	12606	8725	5919	3424
	Gasoline 1,4 - 2,0 l	ECE 15/02	2	2	2	2	2	1	1	1	1	1	0	0
		ECE 15/03	1047	1065	1131	1144	1108	1004	830	729	657	455	308	178
		ECE 15/04	7055	7174	7618	7710	7466	6766	5591	4910	4424	3062	2077	1202
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	16692	16973	18024	18241	17663	16007	13228	11618	10467	7245	4915	2843
		Euro II - 94/12/EC	16546	16825	17867	18082	17509	15867	13113	11516	10376	7182	4872	2818
		Euro III - 98/69/EC Stage2000	10073	10243	10877	11008	10659	9660	7983	7011	6317	4372	2966	1716
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	139	141	150	151	147	133	110	96	87	60	41	24
		ECE 15/04	904	919	976	988	956	867	716	629	567	392	266	154
		Euro I - 91/441/EEC	2238	2276	2417	2446	2368	2146	1774	1558	1404	971	659	381
		Euro II - 94/12/EC	2189	2226	2364	2392	2317	2099	1735	1524	1373	950	645	373
		Euro III - 98/69/EC Stage2000	1333	1355	1439	1457	1410	1278	1056	928	836	578	392	227
	Diesel <2,0 l	Conventional	2955	3005	3191	3229	3127	2834	2342	2057	1853	1283	870	503
		Euro I - 91/441/EEC	1773	1803	1915	1938	1876	1700	1405	1234	1112	770	522	302
		Euro II - 94/12/EC	3516	3575	3796	3842	3720	3372	2786	2447	2205	1526	1035	599
		Euro III - 98/69/EC Stage2000	2377	2417	2567	2598	2516	2280	1884	1655	1491	1032	700	405
	Diesel >2,0 l	Conventional	1970	2003	2127	2153	2085	1889	1561	1371	1235	855	580	336
		Euro I - 91/441/EEC	1182	1202	1276	1292	1251	1134	937	823	741	513	348	201
		Euro II - 94/12/EC	2344	2383	2531	2561	2480	2248	1858	1631	1470	1017	690	399
		Euro III - 98/69/EC Stage2000	1585	1612	1711	1732	1677	1520	1256	1103	994	688	467	270
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	2099	2134	2266	2294	2221	2013	1663	1461	1316	911	618	357
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	88	89	95	96	93	84	69	61	55	38	26	15
		Euro III - 98/69/EC Stage2000	54	55	58	59	57	52	43	37	34	23	16	9
	Diesel <3,5 t	Conventional	5757	5854	6217	6292	6092	5521	4563	4007	3610	2499	1695	981
		Euro I - 93/59/EEC	1763	1793	1904	1927	1866	1691	1397	1227	1106	765	519	300
		Euro II - 96/69/EC	5610	5704	6058	6131	5936	5380	4446	3905	3518	2435	1652	956
		Euro III - 98/69/EC Stage2000	1000	1017	1080	1093	1058	959	793	696	627	434	294	170
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	3075	3583	3527	3249	3163	2935	2032	1608	1278	1232	877	476
		Euro I - 91/542/EEC Stage I	691	806	793	730	711	660	457	361	287	277	197	107
		Euro II - 91/542/EEC Stage II	1273	1483	1460	1345	1309	1215	841	666	529	510	363	197
		Euro III - 2000 Standards	577	672	662	610	594	551	381	302	240	231	165	89
	Diesel 7,5 - 16 t	Conventional	4380	5104	5025	4628	4506	4181	2894	2290	1820	1755	1250	677
		Euro I - 91/542/EEC Stage I	985	1148	1130	1040	1013	940	651	515	409	395	281	152
		Euro II - 91/542/EEC Stage II	1813	2113	2080	1916	1865	1731	1198	948	753	727	517	280
		Euro III - 2000 Standards	822	958	943	868	846	785	543	430	342	329	235	127
	Diesel 16 - 32 t	Conventional	5241	6108	6012	5537	5392	5003	3463	2740	2178	2100	1495	811
		Euro I - 91/542/EEC Stage I	1178	1373	1352	1245	1212	1125	779	616	490	472	336	182
		Euro II - 91/542/EEC Stage II	2170	2528	2489	2292	2232	2071	1434	1134	902	869	619	336
		Euro III - 2000 Standards	984	1146	1128	1039	1012	939	650	514	409	394	281	152
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	883	1029	1013	933	909	843	584	462	367	354	252	137
		Euro I - 91/542/EEC Stage I	161	188	185	170	166	154	107	84	67	65	46	25
		Euro II - 91/542/EEC Stage II	242	282	278	256	249	231	160	127	101	97	69	37
		Euro III - 2000 Standards	118	138	135	125	121	113	78	62	49	47	34	18
	Coaches	Conventional	221	257	253	233	227	211	146	115	92	89	63	34
		Euro I - 91/542/EEC Stage I	40	47	46	43	41	38	27	21	17	16	11	6
		Euro II - 91/542/EEC Stage II	60	70	69	64	62	58	40	32	25	24	17	9
		Euro III - 2000 Standards	30	34	34	31	30	28	20	15	12	12	8	5
Mopeds	<50 cm³	Conventional	1297	1319	1400	1417	1372	1244	1028	903	813	563	382	221
		97/24/EC Stage I	600	610	648	656	635	576	476	418	376	261	177	102
		97/24/EC Stage II	2729	2775	2946	2982	2887	2617	2162	1899	1711	1184	803	465
Motorcycles	2-stroke >50 cm³	Conventional	470	477	507	513	497	450	372	327	294	204	138	80
		97/24/EC	1205	1226	1301	1317	1275	1156	955	839	756	523	355	205
	4-stroke <250 cm³	Conventional	157	159	169	171	166	150	124	109	98	68	46	27
		97/24/EC	402	409	434	439	425	385	318	280	252	174	118	68
	4-stroke 250 - 750 cm³	Conventional	157	159	169	171	166	150	124	109	98	68	46	27
		97/24/EC	402	409	434	439	425	385	318	280	252	174	118	68
	4-stroke >750 cm³	Conventional	157	159	169	171	166	150	124	109	98	68	46	27
		97/24/EC	402	409	434	439	425	385	318	280	252	174	118	68

Table II.3: Hourly vehicle distribution in Runeberg, Helsinki, weekends, 2003, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	1	1	1
		ECE 15/03	222	243	247	195	118	138	172	241	330	424	535	616
		ECE 15/04	1495	1640	1666	1312	794	929	1160	1624	2223	2856	3606	4148
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	3537	3881	3942	3103	1878	2198	2745	3842	5259	6756	8531	9815
		Euro II - 94/12/EC	3506	3847	3908	3076	1862	2179	2721	3808	5213	6697	8456	9729
		Euro III - 98/69/EC Stage2000	2135	2342	2379	1873	1134	1326	1656	2318	3174	4077	5148	5923
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	111	122	124	98	59	69	86	121	165	212	268	309
		ECE 15/04	749	822	835	657	398	466	581	814	1114	1431	1807	2079
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	1773	1945	1976	1555	941	1101	1375	1925	2635	3385	4275	4918
		Euro II - 94/12/EC	1757	1928	1958	1541	933	1092	1363	1908	2612	3356	4238	4875
		Euro III - 98/69/EC Stage2000	1070	1174	1192	938	568	665	830	1162	1590	2043	2580	2968
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	15	16	16	13	8	9	11	16	22	28	35	41
		ECE 15/04	96	105	107	84	51	60	74	104	143	183	231	266
		Euro I - 91/441/EEC	238	261	265	209	126	148	184	258	353	454	573	659
		Euro II - 94/12/EC	232	255	259	204	123	144	180	252	346	444	561	645
		Euro III - 98/69/EC Stage2000	142	155	158	124	75	88	110	154	210	270	341	393
	Diesel <2,0 l	Conventional	314	344	350	275	167	195	243	341	467	599	757	871
		Euro I - 91/441/EEC	188	207	210	165	100	117	146	204	280	360	454	522
		Euro II - 94/12/EC	373	410	416	328	198	232	290	405	555	713	900	1036
		Euro III - 98/69/EC Stage2000	252	277	281	221	134	157	196	274	375	482	609	700
	Diesel >2,0 l	Conventional	209	230	233	184	111	130	162	227	311	400	505	580
		Euro I - 91/441/EEC	126	138	140	110	67	78	97	136	187	240	303	348
		Euro II - 94/12/EC	249	273	277	218	132	155	193	270	370	475	600	691
		Euro III - 98/69/EC Stage2000	168	185	188	148	89	105	131	183	250	321	406	467
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	223	245	248	196	118	138	173	242	331	426	537	618
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	9	10	10	8	5	6	7	10	14	18	22	26
		Euro III - 98/69/EC Stage2000	6	6	6	5	3	4	4	6	8	11	14	16
	Diesel <3,5 t	Conventional	611	671	681	536	325	380	474	664	909	1168	1474	1696
		Euro I - 93/59/EEC	187	205	209	164	99	116	145	203	278	358	452	519
		Euro II - 96/69/EC	596	654	664	523	316	370	462	647	886	1138	1437	1653
		Euro III - 98/69/EC Stage2000	106	117	118	93	56	66	82	115	158	203	256	295
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	137	53	48	49	83	249	360	476	558	653	663	650
		Euro I - 91/542/EEC Stage I	31	12	11	11	19	56	81	107	126	147	149	146
		Euro II - 91/542/EEC Stage II	57	22	20	20	34	103	149	197	231	270	274	269
		Euro III - 2000 Standards	26	10	9	9	16	47	68	89	105	123	124	122
	Diesel 7,5 - 16 t	Conventional	195	76	69	70	118	354	512	677	795	930	944	926
		Euro I - 91/542/EEC Stage I	44	17	15	16	27	80	115	152	179	209	212	208
		Euro II - 91/542/EEC Stage II	81	31	28	29	49	147	212	280	329	385	391	383
		Euro III - 2000 Standards	37	14	13	13	22	66	96	127	149	175	177	174
	Diesel 16 - 32 t	Conventional	234	91	82	83	142	424	613	811	952	1113	1130	1108
		Euro I - 91/542/EEC Stage I	53	20	19	19	32	95	138	182	214	250	254	249
		Euro II - 91/542/EEC Stage II	97	38	34	34	59	175	254	336	394	461	468	459
		Euro III - 2000 Standards	44	17	15	16	27	79	115	152	179	209	212	208
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	39	15	14	14	24	71	103	137	160	188	190	187
		Euro I - 91/542/EEC Stage I	7	3	3	3	4	13	19	25	29	34	35	34
		Euro II - 91/542/EEC Stage II	11	4	4	4	7	20	28	37	44	51	52	51
		Euro III - 2000 Standards	5	2	2	2	3	10	14	18	21	25	25	25
	Coaches	Conventional	10	4	3	4	6	18	26	34	40	47	48	47
		Euro I - 91/542/EEC Stage I	2	1	1	1	1	3	5	6	7	9	9	9
		Euro II - 91/542/EEC Stage II	3	1	1	1	2	5	7	9	11	13	13	13
		Euro III - 2000 Standards	1	1	0	0	1	2	3	5	5	6	6	6
Mopeds	<50 cm³	Conventional	138	151	153	121	73	86	107	150	205	263	332	382
		97/24/EC Stage I	64	70	71	56	34	40	49	69	95	122	154	177
		97/24/EC Stage II	290	318	323	254	154	180	225	315	431	553	699	804
Motorcycles	2-stroke >50 cm³	Conventional	50	55	56	44	26	31	39	54	74	95	120	138
		97/24/EC	128	140	143	112	68	80	99	139	190	244	309	355
	4-stroke <250 cm³	Conventional	17	18	19	15	9	10	13	18	25	32	40	46
		97/24/EC	43	47	48	37	23	27	33	46	63	81	103	118
	4-stroke 250 - 750 cm³	Conventional	17	18	19	15	9	10	13	18	25	32	40	46
		97/24/EC	43	47	48	37	23	27	33	46	63	81	103	118
	4-stroke >750 cm³	Conventional	17	18	19	15	9	10	13	18	25	32	40	46
		97/24/EC	43	47	48	37	23	27	33	46	63	81	103	118

Table II.4: Hourly vehicle distribution in Runeberg, Helsinki, weekends, 2003, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	1	1	1	1	1	1	1	1	1	1	0	0
		ECE 15/03	660	668	653	651	690	636	556	482	426	345	246	241
		ECE 15/04	4447	4500	4398	4389	4646	4283	3745	3249	2868	2322	1658	1623
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	10522	10648	10405	10384	10991	10133	8861	7688	6786	5494	3924	3841
		Euro II - 94/12/EC	10430	10555	10314	10293	10895	10044	8783	7621	6726	5446	3889	3807
		Euro III - 98/69/EC Stage2000	6350	6426	6279	6266	6633	6115	5347	4639	4095	3315	2368	2318
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	1	0	0	0	0	0	0	0
		ECE 15/03	331	335	327	326	346	319	279	242	213	173	123	121
		ECE 15/04	2229	2255	2204	2199	2328	2146	1877	1628	1437	1164	831	814
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	5273	5336	5214	5203	5508	5078	4440	3852	3400	2753	1966	1925
		Euro II - 94/12/EC	5227	5289	5168	5158	5460	5033	4401	3819	3371	2729	1949	1908
		Euro III - 98/69/EC Stage2000	3182	3220	3147	3140	3324	3064	2680	2325	2052	1661	1186	1162
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	44	44	43	43	46	42	37	32	28	23	16	16
		ECE 15/04	285	289	282	282	298	275	240	209	184	149	106	104
		Euro I - 91/441/EEC	707	715	699	698	739	681	595	517	456	369	264	258
		Euro II - 94/12/EC	692	700	684	682	722	666	582	505	446	361	258	252
		Euro III - 98/69/EC Stage2000	421	426	416	415	440	405	355	308	271	220	157	154
	Diesel <2,0 l	Conventional	933	945	923	921	975	899	786	682	602	487	348	341
		Euro I - 91/441/EEC	560	567	554	553	585	539	472	409	361	292	209	204
		Euro II - 94/12/EC	1111	1124	1098	1096	1160	1069	935	811	716	580	414	405
		Euro III - 98/69/EC Stage2000	751	760	743	741	784	723	632	549	484	392	280	274
	Diesel >2,0 l	Conventional	622	630	615	614	650	599	524	455	401	325	232	227
		Euro I - 91/441/EEC	373	378	369	368	390	360	314	273	241	195	139	136
		Euro II - 94/12/EC	740	749	732	731	773	713	623	541	477	387	276	270
		Euro III - 98/69/EC Stage2000	501	507	495	494	523	482	422	366	323	261	187	183
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	663	671	656	654	693	638	558	484	428	346	247	242
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	28	28	27	27	29	27	23	20	18	14	10	10
		Euro III - 98/69/EC Stage2000	17	17	17	17	18	16	14	12	11	9	6	6
	Diesel <3,5 t	Conventional	1819	1840	1798	1795	1900	1751	1531	1329	1173	949	678	664
		Euro I - 93/59/EEC	557	564	551	550	582	536	469	407	359	291	208	203
		Euro II - 96/69/EC	1772	1793	1752	1749	1851	1707	1492	1295	1143	925	661	647
		Euro III - 98/69/EC Stage2000	316	320	312	312	330	304	266	231	204	165	118	115
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	611	568	640	681	707	661	543	433	402	430	309	177
		Euro I - 91/542/EEC Stage I	137	128	144	153	159	149	122	97	90	97	69	40
		Euro II - 91/542/EEC Stage II	253	235	265	282	292	274	225	179	166	178	128	73
		Euro III - 2000 Standards	115	107	120	128	133	124	102	81	75	81	58	33
	Diesel 7,5 - 16 t	Conventional	870	809	912	970	1006	942	774	617	572	613	440	252
		Euro I - 91/542/EEC Stage I	196	182	205	218	226	212	174	139	129	138	99	57
		Euro II - 91/542/EEC Stage II	360	335	377	401	417	390	320	255	237	254	182	104
		Euro III - 2000 Standards	163	152	171	182	189	177	145	116	107	115	82	47
	Diesel 16 - 32 t	Conventional	1041	968	1091	1160	1204	1127	926	738	685	733	526	302
		Euro I - 91/542/EEC Stage I	234	218	245	261	271	253	208	166	154	165	118	68
		Euro II - 91/542/EEC Stage II	431	401	451	480	499	466	383	306	283	304	218	125
		Euro III - 2000 Standards	195	182	205	218	226	211	174	139	129	138	99	57
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	175	163	184	196	203	190	156	124	115	124	89	51
		Euro I - 91/542/EEC Stage I	32	30	34	36	37	35	28	23	21	23	16	9
		Euro II - 91/542/EEC Stage II	48	45	50	54	56	52	43	34	32	34	24	14
		Euro III - 2000 Standards	23	22	25	26	27	25	21	17	15	17	12	7
	Coaches	Conventional	44	41	46	49	51	47	39	31	29	31	22	13
		Euro I - 91/542/EEC Stage I	8	7	8	9	9	9	7	6	5	6	4	2
		Euro II - 91/542/EEC Stage II	12	11	13	13	14	13	11	9	8	8	6	3
		Euro III - 2000 Standards	6	5	6	7	7	6	5	4	4	4	3	2
Mopeds	<50 cm³	Conventional	410	415	405	404	428	394	345	299	264	214	153	150
		97/24/EC Stage I	190	192	188	187	198	183	160	139	122	99	71	69
		97/24/EC Stage II	862	872	852	851	900	830	726	630	556	450	321	315
Motorcycles	2-stroke >50 cm³	Conventional	148	150	147	146	155	143	125	108	96	77	55	54
		97/24/EC	381	385	376	376	398	367	321	278	246	199	142	139
	4-stroke <250 cm³	Conventional	49	50	49	49	52	48	42	36	32	26	18	18
		97/24/EC	127	128	125	125	133	122	107	93	82	66	47	46
	4-stroke 250 - 750 cm³	Conventional	49	50	49	49	52	48	42	36	32	26	18	18
		97/24/EC	127	128	125	125	133	122	107	93	82	66	47	46
	4-stroke >750 cm³	Conventional	49	50	49	49	52	48	42	36	32	26	18	18
		97/24/EC	127	128	125	125	133	122	107	93	82	66	47	46

Appendix II

Table II.5: Hourly vehicle distribution in Runeberg, Helsinki, working days, 2004, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	122	105	92	93	160	501	1040	1314	1013	956	1014	1056
		ECE 15/04	1682	1448	1271	1286	2205	6905	14324	18103	13958	13176	13973	14545
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	4852	4176	3665	3708	6359	19915	41314	52213	40257	38003	40303	41952
		Euro II - 94/12/EC	4918	4233	3714	3758	6445	20184	41872	52918	40801	38516	40847	42518
		Euro III - 98/69/EC Stage2000	3965	3413	2995	3030	5196	16274	33760	42665	32896	31054	32934	34281
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	61	53	46	47	80	251	521	658	508	479	508	529
		ECE 15/04	843	726	637	644	1105	3460	7178	9071	6994	6602	7002	7289
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2431	2093	1836	1858	3187	9980	20702	26164	20173	19043	20196	21022
		Euro II - 94/12/EC	2464	2121	1861	1883	3230	10114	20982	26517	20445	19300	20468	21306
		Euro III - 98/69/EC Stage2000	1987	1710	1501	1518	2604	8155	16917	21379	16484	15561	16503	17178
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	8	7	6	6	11	33	69	87	67	63	67	70
		ECE 15/04	107	92	81	82	141	441	914	1155	891	841	892	928
		Euro I - 91/441/EEC	326	281	246	249	427	1338	2775	3507	2704	2552	2707	2818
		Euro II - 94/12/EC	326	281	246	249	427	1338	2776	3508	2705	2554	2708	2819
		Euro III - 98/69/EC Stage2000	263	226	199	201	345	1079	2238	2829	2181	2059	2184	2273
	Diesel <2,0 l	Conventional	383	330	289	293	502	1572	3261	4122	3178	3000	3182	3312
		Euro I - 91/441/EEC	262	226	198	201	344	1077	2235	2824	2177	2056	2180	2269
		Euro II - 94/12/EC	524	451	395	400	686	2149	4458	5635	4344	4101	4349	4527
		Euro III - 98/69/EC Stage2000	479	412	361	366	627	1964	4075	5150	3970	3748	3975	4138
	Diesel >2,0 l	Conventional	255	220	193	195	335	1048	2174	2748	2119	2000	2121	2208
		Euro I - 91/441/EEC	175	151	132	134	229	718	1490	1883	1452	1370	1453	1513
		Euro II - 94/12/EC	349	300	264	267	457	1433	2972	3756	2896	2734	2900	3018
		Euro III - 98/69/EC Stage2000	319	275	241	244	418	1309	2716	3433	2647	2499	2650	2758
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	286	246	216	218	374	1172	2432	3073	2370	2237	2372	2469
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	13	11	10	10	17	54	111	140	108	102	108	113
		Euro III - 98/69/EC Stage2000	18	15	13	14	23	73	151	191	147	139	147	153
	Diesel <3,5 t	Conventional	794	683	600	607	1040	3258	6759	8542	6586	6217	6593	6863
		Euro I - 93/59/EEC	262	225	198	200	343	1074	2228	2815	2171	2049	2173	2262
		Euro II - 96/69/EC	835	719	631	638	1095	3429	7113	8989	6931	6543	6939	7222
		Euro III - 98/69/EC Stage2000	301	259	227	230	395	1236	2564	3240	2498	2358	2501	2603
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	323	98	82	178	891	2581	4018	4755	3631	3289	3762	3779
		Euro I - 91/542/EEC Stage I	76	23	19	42	209	606	943	1116	852	772	883	887
		Euro II - 91/542/EEC Stage II	140	43	36	77	387	1120	1744	2064	1576	1428	1633	1640
		Euro III - 2000 Standards	98	30	25	54	269	780	1214	1437	1097	994	1137	1142
	Diesel 7,5 - 16 t	Conventional	461	140	117	254	1269	3677	5723	6773	5172	4685	5359	5383
		Euro I - 91/542/EEC Stage I	108	33	27	60	298	863	1344	1590	1214	1100	1258	1264
		Euro II - 91/542/EEC Stage II	200	61	51	110	551	1596	2484	2940	2245	2034	2326	2337
		Euro III - 2000 Standards	139	42	35	77	383	1111	1729	2046	1563	1416	1619	1626
	Diesel 16 - 32 t	Conventional	551	167	140	304	1518	4399	6848	8105	6189	5607	6412	6441
		Euro I - 91/542/EEC Stage I	129	39	33	71	356	1033	1608	1903	1453	1316	1505	1512
		Euro II - 91/542/EEC Stage II	239	73	61	132	659	1910	2972	3518	2686	2434	2783	2796
		Euro III - 2000 Standards	167	51	42	92	459	1329	2069	2449	1870	1694	1937	1946
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	90	27	23	50	249	720	1121	1327	1013	918	1050	1055
		Euro I - 91/542/EEC Stage I	18	5	4	10	49	141	220	260	199	180	206	207
		Euro II - 91/542/EEC Stage II	27	8	7	15	73	213	332	392	300	271	310	312
		Euro III - 2000 Standards	20	6	5	11	56	162	252	298	228	206	236	237
	Coaches	Conventional	23	7	6	12	62	180	280	332	253	229	262	264
		Euro I - 91/542/EEC Stage I	4	1	1	2	12	35	55	65	50	45	51	52
		Euro II - 91/542/EEC Stage II	7	2	2	4	18	53	83	98	75	68	78	78
		Euro III - 2000 Standards	5	2	1	3	14	40	63	75	57	52	59	59
Mopeds	<50 cm³	Conventional	118	101	89	90	154	484	1003	1268	977	923	978	1019
		97/24/EC Stage I	89	77	67	68	117	367	761	962	741	700	742	773
		97/24/EC Stage II	454	391	343	347	595	1864	3867	4887	3768	3557	3773	3927
Motorcycles	2-stroke >50 cm³	Conventional	43	37	32	33	56	175	363	459	354	334	354	369
		97/24/EC	197	169	149	150	258	808	1676	2118	1633	1541	1635	1702
	4-stroke <250 cm³	Conventional	14	12	11	11	19	58	121	153	118	111	118	123
		97/24/EC	66	56	50	50	86	269	559	706	544	514	545	567
	4-stroke 250 - 750 cm³	Conventional	14	12	11	11	19	58	121	153	118	111	118	123
		97/24/EC	66	56	50	50	86	269	559	706	544	514	545	567
	4-stroke >750 cm³	Conventional	14	12	11	11	19	58	121	153	118	111	118	123
		97/24/EC	66	56	50	50	86	269	559	706	544	514	545	567

Appendix II

Table II.6: Hourly vehicle distribution in Runeberg, Helsinki, working days, 2004, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	1073	1105	1179	1204	1159	1047	841	729	667	450	298	202
		ECE 15/04	14782	15226	16243	16590	15963	14429	11592	10046	9184	6204	4103	2783
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	42635	43917	46848	47850	46040	41617	33435	28974	26490	17894	11834	8026
		Euro II - 94/12/EC	43210	44509	47480	48496	46662	42178	33886	29365	26847	18135	11994	8135
		Euro III - 98/69/EC Stage2000	34839	35886	38282	39101	37621	34007	27321	23676	21646	14622	9670	6559
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	538	554	591	603	581	525	422	365	334	226	149	101
		ECE 15/04	7407	7630	8139	8313	7999	7230	5809	5034	4602	3109	2056	1394
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	21364	22006	23475	23978	23071	20854	16754	14519	13274	8967	5930	4022
		Euro II - 94/12/EC	21652	22304	23792	24301	23382	21135	16980	14715	13453	9088	6010	4076
		Euro III - 98/69/EC Stage2000	17458	17982	19183	19593	18852	17041	13690	11864	10847	7327	4846	3286
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	71	73	78	80	77	69	56	48	44	30	20	13
		ECE 15/04	943	972	1036	1059	1019	921	740	641	586	396	262	178
		Euro I - 91/441/EEC	2864	2950	3147	3214	3092	2795	2246	1946	1779	1202	795	539
		Euro II - 94/12/EC	2865	2951	3148	3215	3094	2796	2247	1947	1780	1202	795	539
		Euro III - 98/69/EC Stage2000	2310	2379	2538	2592	2494	2255	1811	1570	1435	969	641	435
	Diesel <2,0 l	Conventional	3366	3467	3698	3777	3635	3285	2639	2287	2091	1413	934	634
		Euro I - 91/441/EEC	2306	2375	2534	2588	2490	2251	1808	1567	1433	968	640	434
		Euro II - 94/12/EC	4601	4739	5056	5164	4968	4491	3608	3127	2859	1931	1277	866
		Euro III - 98/69/EC Stage2000	4205	4331	4621	4719	4541	4105	3298	2858	2613	1765	1167	792
	Diesel >2,0 l	Conventional	2244	2311	2466	2518	2423	2190	1760	1525	1394	942	623	422
		Euro I - 91/441/EEC	1537	1584	1689	1725	1660	1501	1206	1045	955	645	427	289
		Euro II - 94/12/EC	3067	3159	3370	3443	3312	2994	2405	2084	1906	1287	851	577
		Euro III - 98/69/EC Stage2000	2803	2888	3080	3146	3027	2736	2198	1905	1742	1177	778	528
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	2509	2585	2757	2816	2710	2450	1968	1705	1559	1053	697	472
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	115	118	126	129	124	112	90	78	71	48	32	22
		Euro III - 98/69/EC Stage2000	156	160	171	175	168	152	122	106	97	65	43	29
	Diesel <3,5 t	Conventional	6975	7184	7664	7828	7532	6808	5470	4740	4333	2927	1936	1313
		Euro I - 93/59/EEC	2299	2368	2526	2580	2482	2244	1803	1562	1428	965	638	433
		Euro II - 96/69/EC	7340	7561	8065	8238	7926	7165	5756	4988	4560	3081	2037	1382
		Euro III - 98/69/EC Stage2000	2646	2725	2907	2969	2857	2582	2075	1798	1644	1110	734	498
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	3640	4236	4290	4004	4014	4053	3083	2289	1663	1542	1068	557
		Euro I - 91/542/EEC Stage I	854	994	1007	940	942	951	724	537	390	362	251	131
		Euro II - 91/542/EEC Stage II	1580	1839	1862	1738	1742	1759	1338	994	722	669	464	242
		Euro III - 2000 Standards	1100	1280	1296	1210	1213	1224	931	692	502	466	323	168
	Diesel 7,5 - 16 t	Conventional	5185	6034	6111	5703	5719	5773	4392	3261	2369	2196	1522	793
		Euro I - 91/542/EEC Stage I	1217	1417	1435	1339	1342	1355	1031	765	556	516	357	186
		Euro II - 91/542/EEC Stage II	2250	2619	2653	2476	2482	2506	1906	1415	1028	953	661	344
		Euro III - 2000 Standards	1566	1823	1846	1723	1728	1744	1327	985	716	663	460	240
	Diesel 16 - 32 t	Conventional	6204	7221	7313	6825	6843	6908	5255	3902	2835	2628	1821	949
		Euro I - 91/542/EEC Stage I	1456	1695	1717	1602	1606	1622	1234	916	665	617	428	223
		Euro II - 91/542/EEC Stage II	2693	3134	3174	2962	2970	2999	2281	1694	1230	1141	790	412
		Euro III - 2000 Standards	1874	2181	2209	2062	2067	2087	1588	1179	856	794	550	287
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	1016	1182	1197	1117	1120	1131	860	639	464	430	298	155
		Euro I - 91/542/EEC Stage I	199	232	235	219	220	222	169	125	91	84	58	30
		Euro II - 91/542/EEC Stage II	300	350	354	330	331	334	254	189	137	127	88	46
		Euro III - 2000 Standards	228	266	269	251	252	254	193	144	104	97	67	35
	Coaches	Conventional	254	296	299	279	280	283	215	160	116	108	75	39
		Euro I - 91/542/EEC Stage I	50	58	59	55	55	55	42	31	23	21	15	8
		Euro II - 91/542/EEC Stage II	75	87	89	83	83	84	64	47	34	32	22	11
		Euro III - 2000 Standards	57	66	67	63	63	64	48	36	26	24	17	9
Mopeds	<50 cm³	Conventional	1035	1066	1137	1162	1118	1010	812	703	643	434	287	195
		97/24/EC Stage I	785	809	863	881	848	766	616	534	488	330	218	148
		97/24/EC Stage II	3991	4111	4385	4479	4310	3896	3130	2712	2480	1675	1108	751
Motorcycles	2-stroke >50 cm³	Conventional	375	386	412	421	405	366	294	255	233	157	104	71
		97/24/EC	1729	1781	1900	1941	1867	1688	1356	1175	1074	726	480	326
	4-stroke <250 cm³	Conventional	125	129	137	140	135	122	98	85	78	52	35	24
		97/24/EC	576	594	633	647	622	563	452	392	358	242	160	109
	4-stroke 250 - 750 cm³	Conventional	125	129	137	140	135	122	98	85	78	52	35	24
		97/24/EC	576	594	633	647	622	563	452	392	358	242	160	109
	4-stroke >750 cm³	Conventional	125	129	137	140	135	122	98	85	78	52	35	24
		97/24/EC	576	594	633	647	622	563	452	392	358	242	160	109

Appendix II

Table II.7: Hourly vehicle distribution in Runeberg, Helsinki, weekends, 2004, 01:00 – 12:00.

Type	Class	Legislation	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	121	133	135	105	61	67	87	127	170	222	276	324
		ECE 15/04	1666	1829	1860	1450	846	917	1199	1751	2347	3064	3805	4462
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	4804	5274	5364	4181	2439	2646	3458	5049	6770	8838	10974	12870
		Euro II - 94/12/EC	4869	5346	5436	4238	2472	2682	3504	5117	6862	8957	11122	13043
		Euro III - 98/69/EC Stage2000	3926	4310	4383	3417	1993	2162	2826	4126	5532	7222	8968	10516
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	61	67	68	53	31	33	44	64	85	111	138	162
		ECE 15/04	835	916	932	726	424	460	601	877	1176	1535	1907	2236
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	2407	2643	2688	2095	1222	1326	1733	2530	3393	4429	5499	6449
		Euro II - 94/12/EC	2440	2679	2724	2124	1239	1344	1756	2564	3438	4488	5573	6536
		Euro III - 98/69/EC Stage2000	1967	2160	2196	1712	999	1084	1416	2068	2772	3619	4494	5270
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	8	9	9	7	4	4	6	8	11	15	18	21
		ECE 15/04	106	117	119	93	54	59	76	112	150	196	243	285
		Euro I - 91/441/EEC	323	354	360	281	164	178	232	339	455	594	737	864
		Euro II - 94/12/EC	323	354	360	281	164	178	232	339	455	594	737	865
		Euro III - 98/69/EC Stage2000	260	286	291	227	132	143	187	274	367	479	595	697
	Diesel <2,0 l	Conventional	379	416	423	330	193	209	273	399	534	698	866	1016
		Euro I - 91/441/EEC	260	285	290	226	132	143	187	273	366	478	594	696
		Euro II - 94/12/EC	518	569	579	451	263	286	373	545	731	954	1184	1389
		Euro III - 98/69/EC Stage2000	474	520	529	412	241	261	341	498	668	872	1082	1269
	Diesel >2,0 l	Conventional	253	278	282	220	128	139	182	266	356	465	578	677
		Euro I - 91/441/EEC	173	190	193	151	88	95	125	182	244	319	396	464
		Euro II - 94/12/EC	346	379	386	301	175	190	249	363	487	636	790	926
		Euro III - 98/69/EC Stage2000	316	347	353	275	160	174	227	332	445	581	722	846
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	283	310	316	246	144	156	204	297	399	520	646	758
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	13	14	14	11	7	7	9	14	18	24	30	35
		Euro III - 98/69/EC Stage2000	18	19	20	15	9	10	13	18	25	32	40	47
	Diesel <3,5 t	Conventional	786	863	877	684	399	433	566	826	1108	1446	1795	2105
		Euro I - 93/59/EEC	259	284	289	225	132	143	186	272	365	477	592	694
		Euro II - 96/69/EC	827	908	923	720	420	456	595	869	1166	1522	1889	2216
		Euro III - 98/69/EC Stage2000	298	327	333	259	151	164	215	313	420	548	681	799
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	160	72	50	83	96	281	415	561	811	860	823	880
		Euro I - 91/542/EEC Stage I	37	17	12	19	22	66	97	132	190	202	193	206
		Euro II - 91/542/EEC Stage II	69	31	22	36	41	122	180	244	352	373	357	382
		Euro III - 2000 Standards	48	22	15	25	29	85	125	170	245	260	249	266
	Diesel 7,5 - 16 t	Conventional	227	103	71	118	136	401	591	800	1155	1224	1172	1253
		Euro I - 91/542/EEC Stage I	53	24	17	28	32	94	139	188	271	287	275	294
		Euro II - 91/542/EEC Stage II	99	45	31	51	59	174	257	347	501	531	509	544
		Euro III - 2000 Standards	69	31	22	36	41	121	179	242	349	370	354	379
	Diesel 16 - 32 t	Conventional	272	123	85	141	163	480	707	957	1382	1465	1402	1499
		Euro I - 91/542/EEC Stage I	64	29	20	33	38	113	166	225	325	344	329	352
		Euro II - 91/542/EEC Stage II	118	54	37	61	71	208	307	415	600	636	609	651
		Euro III - 2000 Standards	82	37	26	42	49	145	214	289	418	443	424	453
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	45	20	14	23	27	79	116	157	226	240	230	245
		Euro I - 91/542/EEC Stage I	9	4	3	5	5	15	23	31	44	47	45	48
		Euro II - 91/542/EEC Stage II	13	6	4	7	8	23	34	46	67	71	68	73
		Euro III - 2000 Standards	10	5	3	5	6	18	26	35	51	54	52	55
	Coaches	Conventional	11	5	3	6	7	20	29	39	57	60	57	61
		Euro I - 91/542/EEC Stage I	2	1	1	1	1	4	6	8	11	12	11	12
		Euro II - 91/542/EEC Stage II	3	1	1	2	2	6	9	12	17	18	17	18
		Euro III - 2000 Standards	3	1	1	1	1	4	7	9	13	13	13	14
Mopeds	<50 cm³	Conventional	117	128	130	102	59	64	84	123	164	215	266	312
		97/24/EC Stage I	88	97	99	77	45	49	64	93	125	163	202	237
		97/24/EC Stage II	450	494	502	391	228	248	324	473	634	827	1027	1205
Motorcycles	2-stroke >50 cm³	Conventional	42	46	47	37	21	23	30	44	60	78	96	113
		97/24/EC	195	214	218	170	99	107	140	205	275	358	445	522
	4-stroke <250 cm³	Conventional	14	15	16	12	7	8	10	15	20	26	32	38
		97/24/EC	65	71	73	57	33	36	47	68	92	119	148	174
	4-stroke 250 - 750 cm³	Conventional	14	15	16	12	7	8	10	15	20	26	32	38
		97/24/EC	65	71	73	57	33	36	47	68	92	119	148	174
	4-stroke >750 cm³	Conventional	14	15	16	12	7	8	10	15	20	26	32	38
		97/24/EC	65	71	73	57	33	36	47	68	92	119	148	174

Appendix II

Table II.8: Hourly vehicle distribution in Runeberg, Helsinki, weekends, 2004, 13:00 – 24:00.

Type	Class	Legislation	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Gasoline <1,4 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	350	353	350	347	365	337	294	258	211	169	126	97
		ECE 15/04	4828	4864	4816	4775	5026	4642	4048	3558	2903	2331	1742	1333
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	13926	14030	13892	13773	14496	13390	11676	10262	8373	6722	5023	3845
		Euro II - 94/12/EC	14114	14219	14079	13959	14691	13571	11834	10400	8486	6813	5091	3896
		Euro III - 98/69/EC Stage2000	11380	11464	11352	11255	11845	10942	9541	8385	6842	5493	4104	3142
	Gasoline 1,4 - 2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	176	177	175	174	183	169	147	129	106	85	63	48
		ECE 15/04	2419	2437	2414	2393	2518	2326	2029	1783	1455	1168	873	668
		Improved Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Open Loop	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	6978	7030	6961	6902	7264	6710	5851	5142	4196	3368	2517	1927
		Euro II - 94/12/EC	7073	7125	7055	6995	7362	6800	5930	5212	4253	3414	2551	1953
		Euro III - 98/69/EC Stage2000	5702	5745	5688	5640	5935	5483	4781	4202	3429	2752	2057	1574
	Gasoline >2,0 l	ECE 15/02	0	0	0	0	0	0	0	0	0	0	0	0
		ECE 15/03	23	23	23	23	24	22	19	17	14	11	8	6
		ECE 15/04	308	310	307	305	321	296	258	227	185	149	111	85
		Euro I - 91/441/EEC	935	942	933	925	974	899	784	689	562	451	337	258
		Euro II - 94/12/EC	936	943	933	926	974	900	785	690	563	452	338	258
		Euro III - 98/69/EC Stage2000	754	760	753	746	785	725	633	556	454	364	272	208
	Diesel <2,0 l	Conventional	1099	1108	1097	1087	1144	1057	922	810	661	531	397	304
		Euro I - 91/441/EEC	753	759	751	745	784	724	632	555	453	364	272	208
		Euro II - 94/12/EC	1503	1514	1499	1486	1564	1445	1260	1107	904	725	542	415
		Euro III - 98/69/EC Stage2000	1373	1384	1370	1358	1430	1321	1152	1012	826	663	495	379
	Diesel >2,0 l	Conventional	733	738	731	725	763	705	615	540	441	354	264	202
		Euro I - 91/441/EEC	502	506	501	497	523	483	421	370	302	242	181	139
		Euro II - 94/12/EC	1002	1009	999	991	1043	963	840	738	602	484	361	277
		Euro III - 98/69/EC Stage2000	916	922	913	906	953	880	768	675	551	442	330	253
	LPG	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 98/69/EC Stage2000	0	0	0	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3,5t	Conventional	820	826	818	811	853	788	687	604	493	396	296	226
		Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 96/69/EC	37	38	37	37	39	36	31	28	23	18	14	10
		Euro III - 98/69/EC Stage2000	51	51	51	50	53	49	43	37	31	25	18	14
	Diesel <3,5 t	Conventional	2278	2295	2273	2253	2371	2191	1910	1679	1370	1100	822	629
		Euro I - 93/59/EEC	751	756	749	743	782	722	630	553	451	362	271	207
		Euro II - 96/69/EC	2398	2415	2392	2371	2496	2305	2010	1767	1442	1157	865	662
		Euro III - 98/69/EC Stage2000	864	871	862	855	899	831	725	637	520	417	312	239
Heavy Duty Vehicles	Gasoline >3,5 t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
	Diesel 3,5 - 7,5 t	Conventional	730	756	893	1100	1209	1001	802	699	578	514	395	208
		Euro I - 91/542/EEC Stage I	171	177	210	258	284	235	188	164	136	121	93	49
		Euro II - 91/542/EEC Stage II	317	328	388	477	525	434	348	303	251	223	171	90
		Euro III - 2000 Standards	220	228	270	332	365	302	242	211	175	155	119	63
	Diesel 7,5 - 16 t	Conventional	1040	1076	1272	1567	1723	1426	1143	996	824	733	562	297
		Euro I - 91/542/EEC Stage I	244	253	299	368	404	335	268	234	193	172	132	70
		Euro II - 91/542/EEC Stage II	451	467	552	680	748	619	496	432	357	318	244	129
		Euro III - 2000 Standards	314	325	384	473	520	431	345	301	249	221	170	90
	Diesel 16 - 32 t	Conventional	1244	1288	1522	1875	2061	1706	1368	1192	985	877	673	355
		Euro I - 91/542/EEC Stage I	292	302	357	440	484	401	321	280	231	206	158	83
		Euro II - 91/542/EEC Stage II	540	559	661	814	895	741	594	517	428	381	292	154
		Euro III - 2000 Standards	376	389	460	566	623	515	413	360	298	265	203	107
	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0	0	0	0
		Euro I - 91/542/EEC Stage I	0	0	0	0	0	0	0	0	0	0	0	0
		Euro II - 91/542/EEC Stage II	0	0	0	0	0	0	0	0	0	0	0	0
		Euro III - 2000 Standards	0	0	0	0	0	0	0	0	0	0	0	0
Buses - Coaches	Urban Buses	Conventional	204	211	249	307	337	279	224	195	161	144	110	58
		Euro I - 91/542/EEC Stage I	40	41	49	60	66	55	44	38	32	28	22	11
		Euro II - 91/542/EEC Stage II	60	62	74	91	100	83	66	58	48	42	33	17
		Euro III - 2000 Standards	46	47	56	69	76	63	50	44	36	32	25	13
	Coaches	Conventional	51	53	62	77	84	70	56	49	40	36	28	15
		Euro I - 91/542/EEC Stage I	10	10	12	15	17	14	11	10	8	7	5	3
		Euro II - 91/542/EEC Stage II	15	16	18	23	25	21	17	14	12	11	8	4
		Euro III - 2000 Standards	11	12	14	17	19	16	13	11	9	8	6	3
Mopeds	<50 cm³	Conventional	338	341	337	334	352	325	283	249	203	163	122	93
		97/24/EC Stage I	256	258	256	254	267	247	215	189	154	124	93	71
		97/24/EC Stage II	1304	1313	1300	1289	1357	1253	1093	961	784	629	470	360
Motorcycles	2-stroke >50 cm³	Conventional	122	123	122	121	127	118	103	90	74	59	44	34
		97/24/EC	565	569	563	559	588	543	474	416	340	273	204	156
	4-stroke <250 cm³	Conventional	41	41	41	40	42	39	34	30	25	20	15	11
		97/24/EC	188	190	188	186	196	181	158	139	113	91	68	52
	4-stroke 250 - 750 cm³	Conventional	41	41	41	40	42	39	34	30	25	20	15	11
		97/24/EC	188	190	188	186	196	181	158	139	113	91	68	52
	4-stroke >750 cm³	Conventional	41	41	41	40	42	39	34	30	25	20	15	11
		97/24/EC	188	190	188	186	196	181	158	139	113	91	68	52

Annex C

Results from station pairs analysed under previously SEC subventions

Annex C: Results from station pairs analysed under previously SEC subventions

Hornsgatan, Stockholm

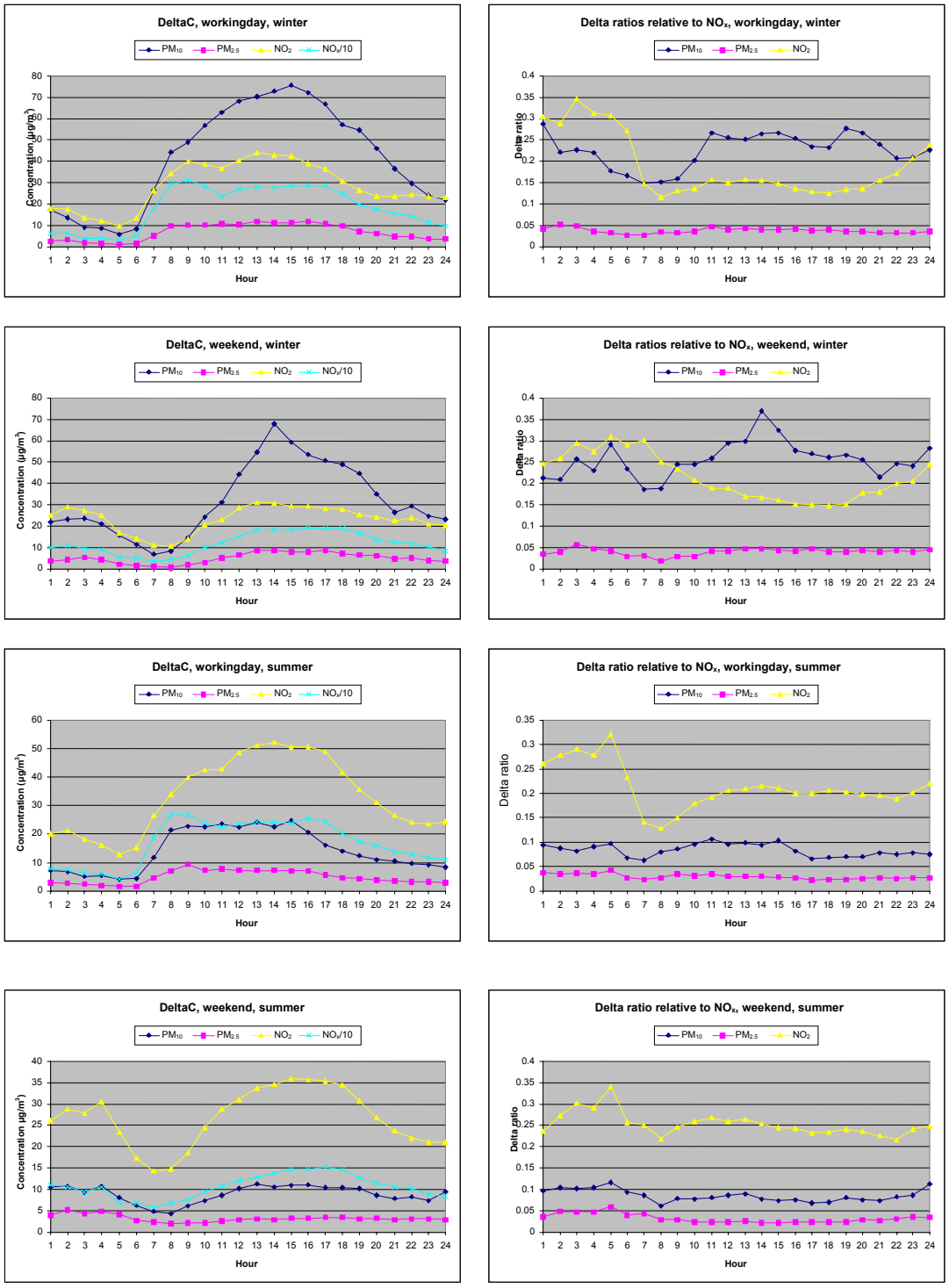


Figure C.1: Average concentration variation over the day, Hornsgatan, Stockholm, DeltaC and delta ratio (DR) relative to NO_x.

Annex C: Results from station pairs analysed under previously SEC subventions

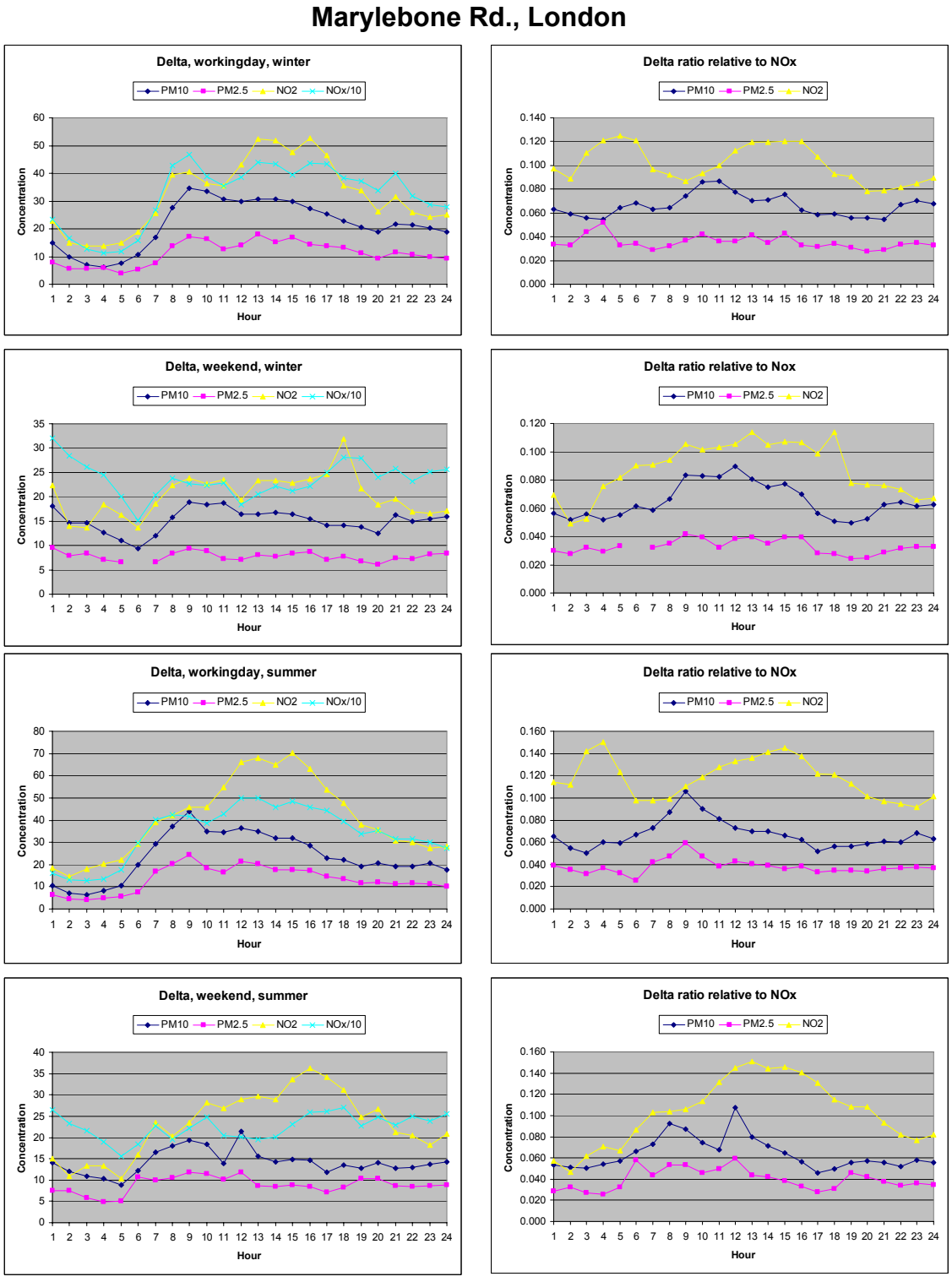


Figure C.2: Average concentration variation over the day, Marylebone Rd., London, DeltaC and delta ratio relative to NO_x.

Frankfurter Allee, Berlin

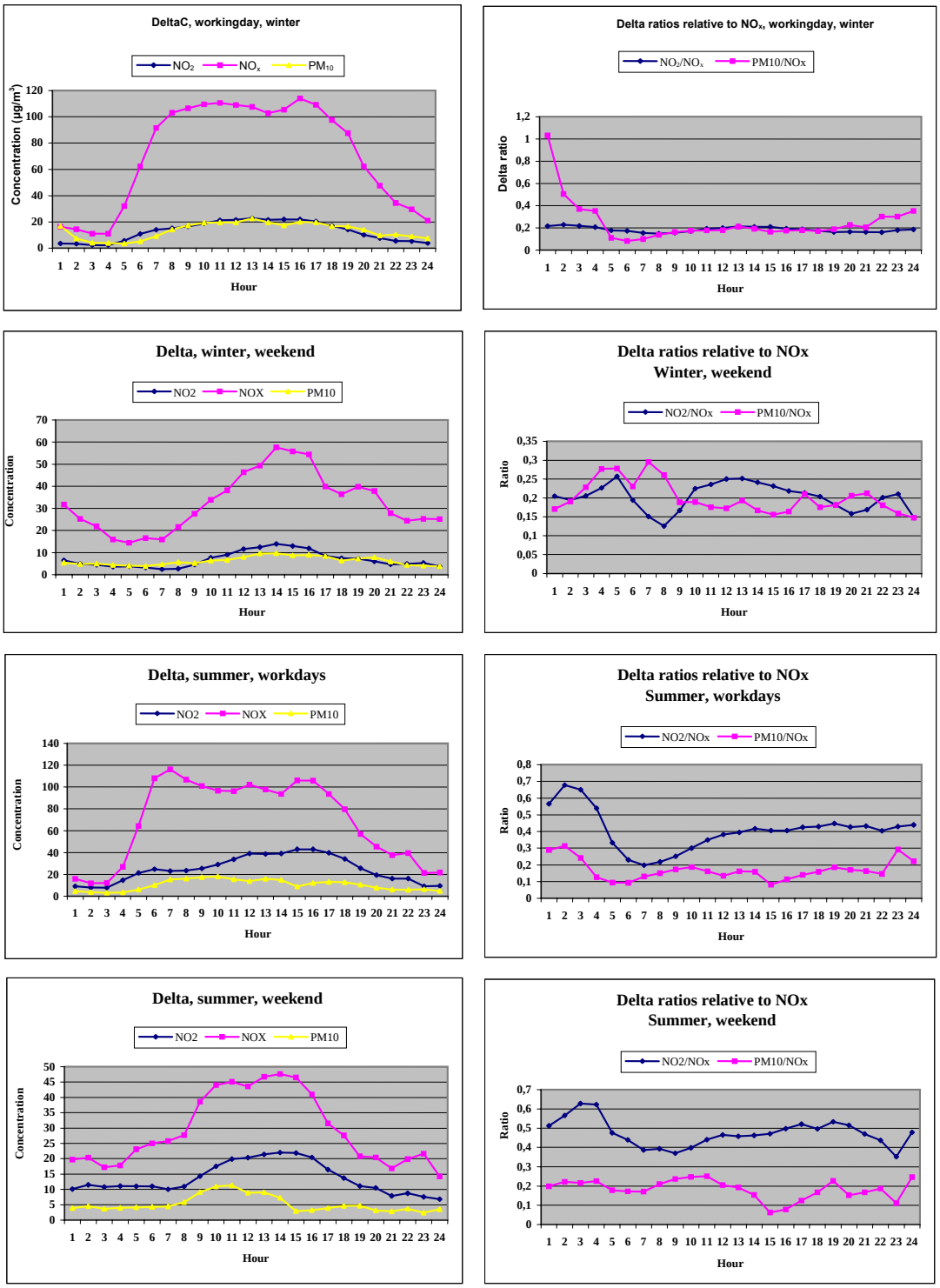


Figure C.3: Average concentration variation over the day, Frankfurter Allee, Berlin, DeltaC and delta ratio relative to NO_x.

Annex C: Results from station pairs analysed under previously SEC subventions

Skaarersletta, Oslo

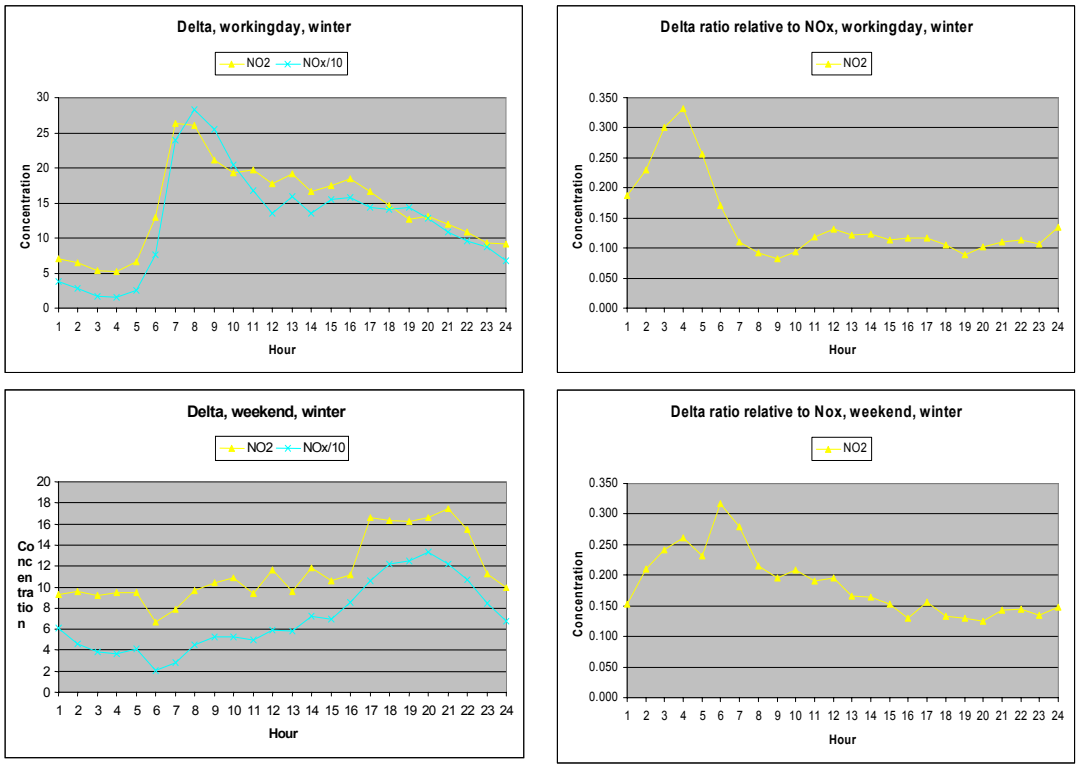


Figure C.4: Average concentration variation over the day, Skaarersletta, Oslo, DeltaC and delta ratio relative to NO_x. These graphs are for only four months of data (January – April).

Annex D

Road information form sent to cities

Annex D: Road information form sent to cities

The next worksheet contains some tables to be filled in.

* Please fill in the **white cells**, as far as possible.

* You may fill in a comment on the values that you filled in (e.g. "very uncertain estimate", or "based on our database").

* Clarification of the content of several cells is indicated by a red right-top corner. The clarification is made visible by clicking the cell.

* An example sheet is provided.

Distance of exposure

Especiallly the distance of exposure may be difficult to deal with. However, for the largest roads, it is clearly very important whether the traffic is near people or not.

We prefer a crude estimate to nothing, but if it is impossible to make an estimate, the form offers the possibility to make an estimate for road types without subdividing according to the distance of exposure ("All exposure distances").

City:	

Traffic intensities of the busiest road of each type (vehicles/day)

	Distance road axis <--> location of exposure			Comment (optional)
Urban motorway	All exposure distances	<50m	>50m	

	Distance road axis <--> location of exposure			Comment (optional)
Urban street, non-canyon	All exposure distances	<25m	>25m	

	Total canyon width			Comment (optional)
Urban street canyon	All exposure distances	<25m	>25m	

Please fill in the (estimated) **traffic intensity** (vehicles/day averaged over the year) for the **busiest road segment** of this type.

Exposure of traffic participants should not be taken into account.

Total length of busy roads (km)

	Distance road axis <--> location of exposure			Comment (optional)
Urban motorway	All exposure distances	<50m	>50m	

	Distance road axis <--> location of exposure			Comment (optional)
Urban street, non-canyon	All exposure distances	<25m	>25m	

	Total canyon width			Comment (optional)
Urban street canyon	All exposure distances	<25m	>25m	

Please fill in the (estimated) **total road length** (in **km**) of all **roads segments with traffic intensity of 50% or more** of the value that you have indicated above in the yellow table.

Exposure of traffic participants should not be taken into account.

Total length of all roads in your city (km)

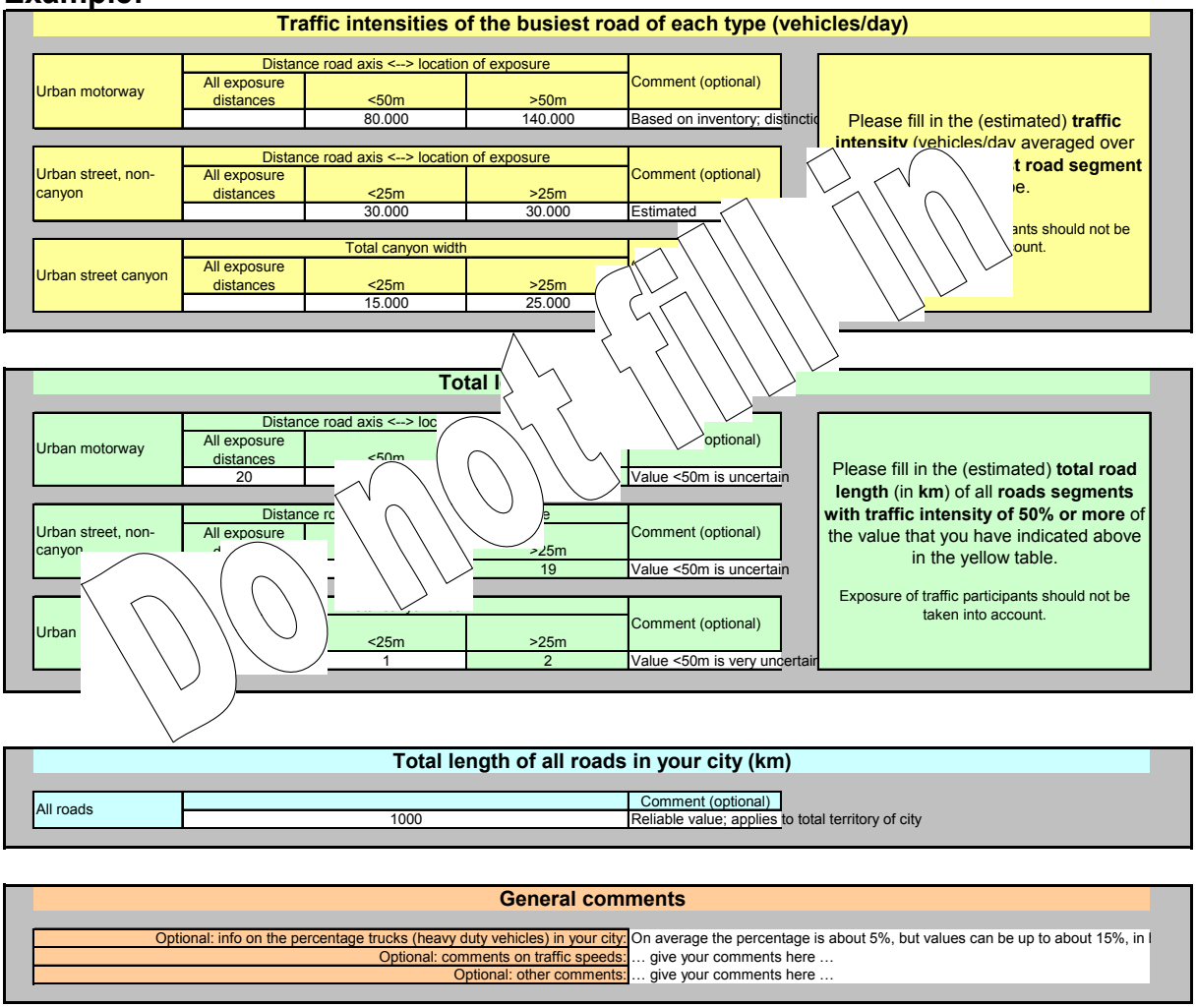
		Comment (optional)
All roads		

General comments

Optional: info on the percentage trucks (heavy duty vehicles) in your city:	… give your comments here …
Optional: comments on traffic speeds:	… give your comments here …
Optional: other comments:	… give your comments here …

Annex D: Road information form sent to cities

Example:



Traffic intensities of the busiest road of each type (vehicles/day)

	Distance road axis <--> location of exposure			
	All exposure distances	<50m	>50m	Comment (optional)
Urban motorway		80.000	140.000	Based on inventory; distinctio

	Distance road axis <--> location of exposure			
	All exposure distances	<25m	>25m	Comment (optional)
Urban street, non-canyon		30.000	30.000	Estimated

	Total canyon width			
	All exposure distances	<25m	>25m	
Urban street canyon		15.000	25.000	

Please fill in the (estimated) **traffic intensity** (vehicles/day averaged over **t road segment** e.

ants should not be ount.

Do not fill in

Total l

	Distance road axis <--> loc			optional)
	All exposure distances	<50m		
Urban motorway	20			Value <50m is uncertain

	Distance ro		e	
	All exposure		>25m	Comment (optional)
Urban street, non-canyon			19	Value <50m is uncertain

		<25m	>25m	Comment (optional)
Urban		1	2	Value <50m is very uncertain

Please fill in the (estimated) **total road length** (in **km**) of all **roads segments with traffic intensity of 50% or more** of the value that you have indicated above in the yellow table.

Exposure of traffic participants should not be taken into account.

Total length of all roads in your city (km)

		Comment (optional)
All roads	1000	Reliable value; applies to total territory of city

General comments

Optional: info on the percentage trucks (heavy duty vehicles) in your city:	On average the percentage is about 5%, but values can be up to about 15%, in l
Optional: comments on traffic speeds:	… give your comments here …
Optional: other comments:	… give your comments here …