The Minaraad

Environment and Nature Council of Flanders

Study document on the introduction of a system of duties for road traffic

Study commissioned by the Minaraad and carried out by Anneleen De Smedt, deputy of the director

September 2005

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This study document examines the problem of mobility in the context of the climate conference and in the context of the social debates on the introduction of a system of duties for road traffic. First of all, there is a detailed picture of the **issue of mobility**, which reveals, amongst other things that the road traffic emissions make an important contribution to climate change (60% of greenhouse gas emissions) and that the interim objective for Flanders (total across all the sectors) was not achieved. Furthermore, traffic is also responsible for the emission of acidifying pollutants, ozone precursors, fine particulates, etc. Other familiar problems include nuisance caused by noise and traffic jams. All this results in external (environmental damage) costs which are not charged on to the "consumer", but which are certainly harmful. On the one hand, the external costs can be expressed quantitatively (in €), but they can also be converted into DALYs, or the number of years of healthy human lives that are lost. The external costs vary enormously depending on the place and time of mobility. The costs of congestion are an extremely important factor. However, if it is not the marginal but the total external costs that are examined, the costs of environmental damage are greater than the external congestion costs.

Subsequently there is a description of **four strategies for achieving sustainable mobility,** in which economic instruments to steer behaviour – such as a mileage tax – form an important basis of the policy mix. Reducing the need for mobility and controlling the demand for transport are the most permanent strategies to reduce the negative impact of mobility. Within the range of policy instruments that have been used, economic instruments that steer behaviour therefore play a crucial role in achieving a real push-pull policy. These instruments result in the greatest welfare efficiency and in the long term they are also the only instruments which can really work. Preferably, the environmental pollution that is caused will be passed on to the actual polluter and it will be possible to charge on the costs to the polluters themselves, resulting in a sense of accountability.

The second chapter outlines the **policy framework and the policy intentions.** Attention is devoted in particular to the Eurovignette directive and the review of this directive (although this has not yet been approved). Furthermore the complicated federal and Flemish structure of taxes and duties on road transport are described. It is also necessary to take into account the obligations arising from the Kyoto protocol and the climate policy plan in drawing up a system of duties for road traffic. The introduction of a financial and economic instrument for road traffic can, after all, make an essential contribution to achieving the Kyoto objectives.

Chapter 3 explains a number of **recent studies** which show that the introduction of a greatly differentiated mileage tax is one of the most efficient methods, on the one hand, to achieve a reduction in the total road traffic and on the other hand, to achieve significant environmental benefits. The social justice of an advanced mileage tax and the effect of steering behaviour towards a modal shift and towards safer and more viable traffic are also mentioned. The revenue must be spent wisely in order to increase acceptability. Expenditure on social security or to reduce the tax on labour are also acceptable, and could result in increased welfare.

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Introduction

The Flemish Minister of the Mobility, Kathleen Van Brempt, commissioned a study related to the various possibilities for the introduction of a system of duties for road traffic. On 27 May 2005, the Government of Flanders was informed of this Quickscan study and decided to subject the study and the possible options for the introduction of a new system of duties to a broad social debate first of all. After all, the objectives put forward and the system of duties that is wanted first have to be explained before the appropriate type of system is determined and can be drawn up in more detail. The SERV (Social Economic Council of Flanders) was charged with the task of organising this social debate which took place from September to December 2005.

Minister Peeters, the Flemish Minister of the Environment, gave the starting signal for the Flemish Climate conference on 6 June 2005. This conference was established as a detailed process of consultation on climate policy in which the Minaraad also actively participates. Several working groups have been established in the climate conference, including a working group devoted to mobility. After all, the mobility sector is responsible for an important contribution to the emission of greenhouse gases in Flanders. The aim is to determine the priority policy objectives during the follow-up process in various working sessions, which will be united in the short term in an ambitious Flemish climate policy plan for 2006-2012. In the long term the aim is to achieve a low-carbon and sustainable Flemish economy.

As there is a clear synergy between the social debate on the Quickscan study and the debate in the climate conference, and in view of the great importance which the Minaraad attaches to the issue of mobility, it was decided to draw up a study document to give to the members of the Minaraad background information on the effect of different taxation systems in the context of both processes. With this document, the Minaraad hopes to provide the members with an important contribution to determine their point of view in the debates. The document provides a survey and an analysis of the problems (both of the policy context and of a series of recent studies) and can be used as a background document in the context of both debates.

The study was drawn up by Anneleen De Smedt, deputy of the director of the secretariat of the Minaraad. The working group which monitored the drawing up of the study document consisted of the members of the working group for Town and Country Planning and the members of the working group for Instruments. The members of Komimo (Mobility union) were also involved.

The status of a study document means that the document was commissioned by the Council to support both debates. By establishing a study document the members of the Council only committed themselves to finding out about the elements that were included, not to endorsing the content. Following this study document, the Minaraad will formulate a series of recommendations with regard to a possible system of duties for road traffic at a later stage.

Hubert David, Chairman of the Minaraad

I. Description of the problem

1.1. General description of the issue of mobility [1]

1.1.1. The mobility issue in Flanders

General

Traffic and mobility are an essential aspect of our society. However, this also has another side. The transport sector causes air pollution which is harmful to man and nature and is also responsible for nuisance caused by noise and light, fragmentation and barrier effects, acidification of the climate, etc. One important problem in the issue of mobility is the "traffic jams" caused by road traffic, the loss of time, extra environmental impact because of stationery vehicles, frustrations which contribute to a metaphorical acidification of society,…The large number of accidents resulting in injuries and traffic fatalities is another difficult problem.

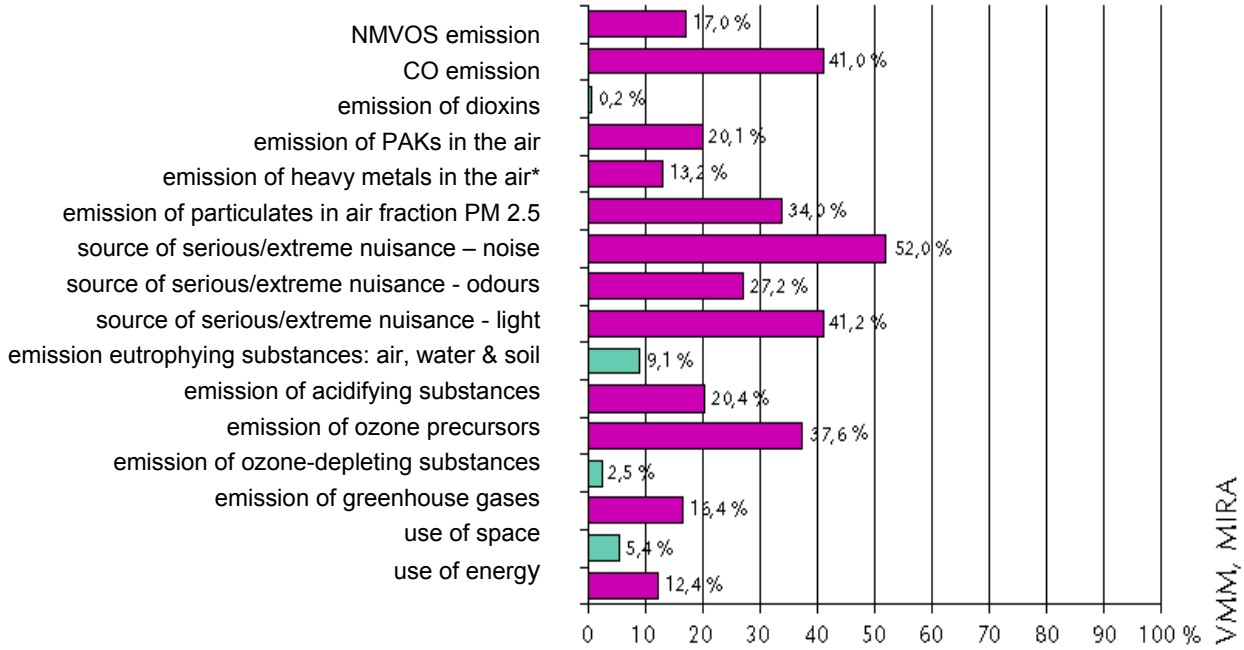
However, "being mobile" is essential: we move to and from the workplace, we move about in our free time to engage in sport, visit friends, etc. And yet, access to mobility is not equally divided. For example, access to public transport depends on your place of residence and the timetables which apply for the stops which are closest to you. Not everyone can afford to have a car. People who are less affluent are usually dependent on public transport and rely on this to be able to travel about and take part in social life. However, there is some question of transport poverty (or increasing personal inaccessibility) and increasing lack of equality as regards transport between drivers and users of public transport.

Traffic is an important source of pollution, and amongst other things, causes emissions of carbon monoxide (CO), nitrous oxides (NO_x), non-methane, volatile, organic particles (NMVOS), carbon dioxide (CO_2) and fine particulates (PM_{10} and $PM_{2.5}$). These emissions contribute to climate change to an important extent (see below), photochemical air pollution (ozone pollution) and acidification. [2] By way of information, figure 1 provides a summary of the environmental profile of the transport sector in Flanders.

[1] The description of the issue of mobility is largely based on the Mira report, MIRA-T 2004. VMM, Environment and Nature Report Flanders. Topics MIRA-T 2004. Leuven, Lannoo, Campus, 2004, 454 pp.).

[2] SO_2 and NO_X cause acidification. NO_X is also an ozone precursor and therefore also causes photochemical air pollution and is furthermore part of the fertilizing nitrogen emissions. The most important greenhouse gases in the transport sector are CO_2, CH_4 and N_2O and HFKs (amongst other things, as a result of air conditioning systems in cars).

Environmental Profile of the transport sector (Flanders, 2002-2004)



* non-weighted average of the shares for the eight heavy metals

Source: MIRA-T 2004, VMM

Figure 1: Contribution of the traffic with regard to different environmental topics: environmental profile of the transport sector (Flanders 2002-2004)

1.1.2. Emissions resulting from mobility

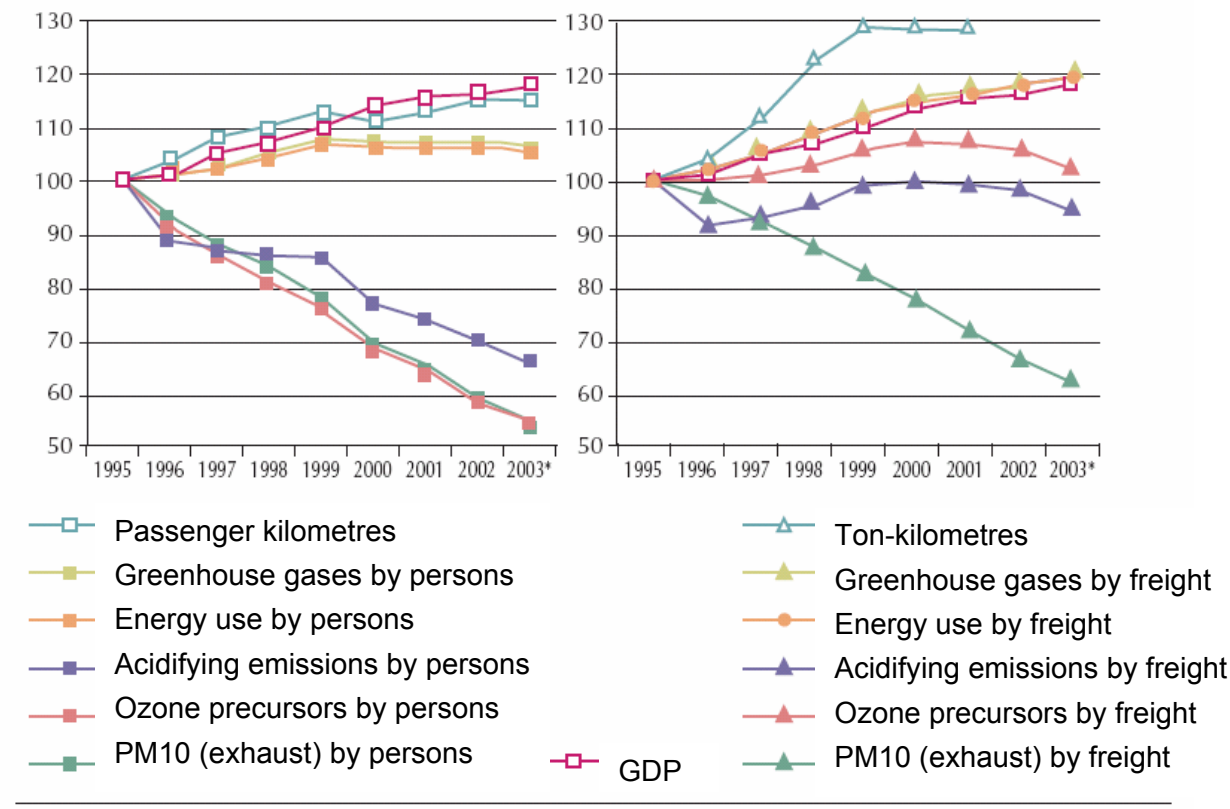
The eco-efficiency of the transport sector. Car traffic on roads has particularly made an important contribution in the last ten years to the general strong decline in the emission of most pollutants in the transport sector. However, for NO_X and CO_2, significant efforts are still needed to achieve the Flemish objective (see figure 2 and figure 3). Figure 2 shows the eco-efficiency of the transport of people (road transport, railway traffic) and the transport of goods (road traffic and railways and inland shipping). The evolution of the use of energy, the emission of greenhouse gases (CO_2, CH_4 and N_2O), acidifying pollutants (SO_2, NO_X and NH_3) ozone precursors (NMVOS, NO_x, CH_4 and CO) and fine particulates (PM_{10} from exhaust gas emissions) is compared with the evolution of the mileage of persons and tonnage and the Gross Domestic Product of Flanders (GDP).

Passenger transport

(1995 = 100)

freight transport

(1995 = 100)



* provisional figures

Source: APS. De Lijn, Labeeuw (2004), NMBS, Energy Balance Flanders Vito, Vito, VMM

***Figure 2**: Eco-efficiency in transport (Flanders, 1995-2003)*

There is a relative lack of connection between the use of energy and the emission of greenhouse gases on the one hand, and the passenger transport on the other hand. In addition to the slowdown in the growth in the number of passenger kilometres driven by cars, the increase in the use of diesel in private cars and the increase in the share of more efficient cars are explanatory factors for this. There was a strong decline in the emission of acidifying components, ozone precursors and PM_{10} (from exhaust gases) in the period 1995-2003, even though the mobility of people increased by 15%. Therefore there is a complete lack of connection between these three indicators and the kilometres driven by people. This is the result of the steady increase in stricter European emission norms for new vehicles and fuel specifications in the last decade.

There was a marked growth in the flow of transport for the *transport of goods* between 1995 an 1999 (approximately +30%), but this growth stagnated from 2000-2001. [3] In overall terms, the number of ton kilometres in the period 1995-2001 increased much more rapidly than the gross domestic product. The use of energy as a result of freight transport increased, but from 2000 to a lesser extent. Between 1995 and 2001, there was relative

[3] There are no figures available for 2002 and 2003.

lack of connection between the use of energy (and the related CO_2 emissions) and the flows of transport caused by freight transport. There was only a slight decline in the emission of ozone precursors from 2001, with the introduction of the Euro 3 engines. During the period 1995-2001 there was a relative lack of connection with flows of transport. Both the emission of acidifying pollutants, and that of fine particulates (PM_{10} from exhaust gases), caused by freight transport was completely unconnected to the number of ton kilometres. The fall in emissions is a result in the stagnation in the flows of freight transport and the introduction of European emission norms for new vehicles.

Figure 3 shows the evolution of CO_2, NO_X, NMVOS, PM_{10} and SO_2 emissions for the transport sector from 1990. In 2003, road traffic was still the main polluter (>90%) in the transport sector. With the exception of CO_2, there was a fall in the emission of pollutants between 1995 and 2003. However, for CO_2 the Flemish objective for transport was exceeded (stabilisation in 2010 compared to 1990) by 24% in 2003 (14,339 kton CO_2).

There was a slight fall in the emissions of NOx from 92,493 tons in 2003, as a result of the replacement of old vehicles by vehicles of a newer generation. However, with the normal addition of Euro 4 and 5 vehicles into the number of vehicles, their share in 2010 will still be too low to achieve the objective of 42,670 tons. The larger share of diesel vehicles also accounts for this.

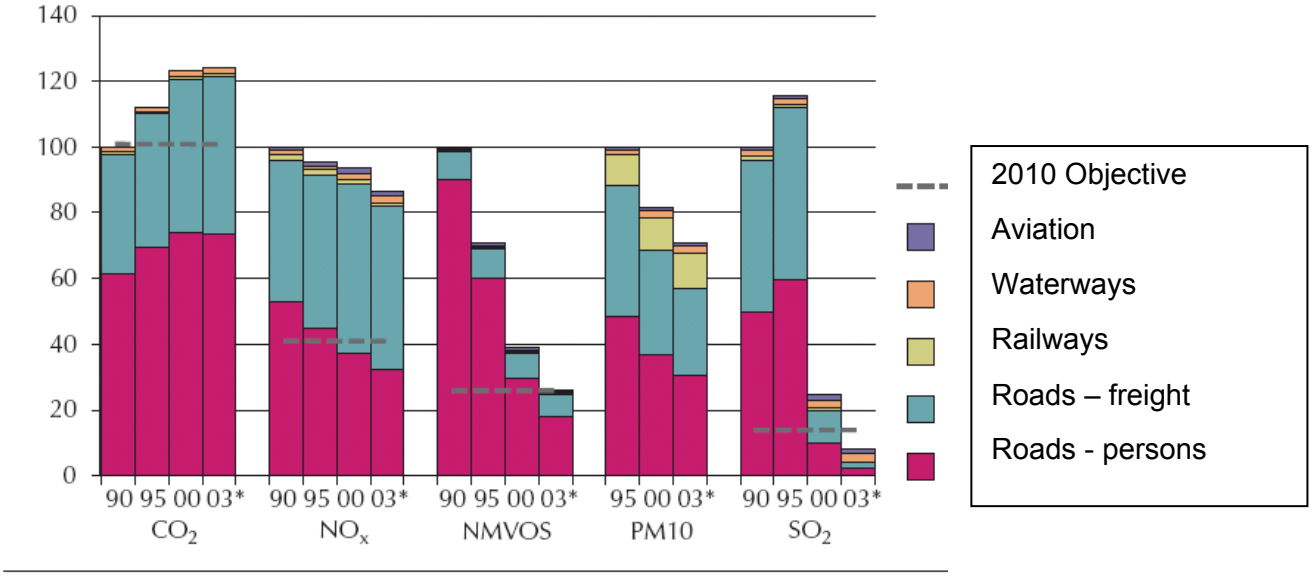
The NMVOS emissions continued to fall and amounted to 21,723 tons in 2003. Although it is assumed that the flows of transport for road traffic will continue to grow, the objective for 2010 (20,960 tons) will be achieved as the result of further technological developments.

The emissions of SO_2 fell to 761 tons in 2003 as a result of the tax incentive measures for low sulphur (50ppm) road fuels from November 2001. The objective for 2010 (1,250 tons) was achieved, and will also be achieved in 2010, as only petrol and diesel with 10ppm sulphur will be available on the market for road traffic from 2009.

The emission of fine particulates (PM_{10}) [4] reveals a falling trend and amounted to 6,527 tons in 2003. This trend will continue to 2010 because of the stricter emission norms (Euro 4) for particulates in exhaust gases of new diesel vehicles. The norms will particularly be drastically reduced in 2006 for heavy road vehicles. There was an increase in the share of non-exhaust emissions of PM_{10} from 20% in 1995 to 34% in 2003 (1,885 tons in 1995, 2,194 tons in 2003). It will only be possible to draw up a better evaluation of the PM_{10} emissions when emissions limits are also drawn up for these pollutants.

[4] In the calculation of PM_{10} emissions, both exhaust and non-exhaust emissions of traffic are taken into account. The non-exhaust emissions are caused by the wear on tyres, brakes, the road surface, rails and overhead cables.

Emission (1990=100)



*provisional figures

Source: Energy Balance Flanders (Vito, VMM)

Mira-T 2004, VMM

NB: The reference year for PM_{10} is 1995. For other substances, the reference year is 1990. No objective has yet been formulated for PM_{10}. The share for aviation is low: only the emissions on taking off and landing are taken into account. If the emissions during the flight were also taken into account the share of aviation would increase significantly.

Figure 3: *Evolution of the emissions of CO_2, NO_x, NMVOS, PM_{10} and SO_2 by transport (Flanders, 1990, 1995, 2000, 2003)*

1.1.3. The emission of greenhouse gases in the context of the climate problem

The climate treaty was drawn up in 1992 during the World Summit on Sustainable Development in Rio. The accompanying Kyoto Protocol (1997) imposes binding reduction objectives for greenhouse gases [5] for the period 2008-2012. During this period, Flanders has committed itself to achieving a reduction in greenhouse gases of 5.2 % compared to the emissions in 1990. As an interim objective, Flanders has put forward the stabilisation of the emissions in 2005 compared to the reference year 1990. For the "traffic" sector, a stabilisation of the CO_2 emissions compared to 1990 has been put forward as an objective by 2010.

[5] The most important greenhouse gases are CO_2, CH_4, N_2O, SF_6, HFKs and PFKs. The relevant greenhouse gases in the transport sector are CO_2, CH_4, and N_2O and HFKs (amongst other things, as a result of air conditioning systems in cars). The greenhouse gases have different heating potentials and in order to allow for comparisons, the amount of greenhouse gases (the mass) is converted into CO_2 equivalents.

However, in 2004, the figures were anything but optimistic. The emissions of greenhouse gases in 2003 were almost 4Mton CO_2 equivalents above the reference level of 1990 or in other words, 4.5% higher than in 1990. The transport sector caused 16.4% of these emissions in CO_2 equivalents and therefore comes in third place in the order of sectors which are responsible for these emissions. The increase in the emissions in Flanders is mainly due to an increase in the CO_2 emissions. In the transport sector the emissions of CO_2 are also responsible for 96% of the total emissions of greenhouse gases.

Table 1 provides a summary of the share of the different forms of transport in the total CO_2 emissions of the transport sector and also shows the evolution in comparison with 1990. The transport of persons and the transport of goods by road account for the largest share in the total emissions. The CO_2 emissions of transport by road (freight and persons) and inland shipping increased compared to 1990.

***Table 1**: Summary of CO_2 emissions in the transport sector per mode of transport*

	1990 Share in the CO_2 emissions per mode of transport (%)	1990 CO_2 emissions (kton CO_2)	2003 Share in the CO_2 emissions per mode of transport (%)	2003 CO_2 emissions (kton CO_2)
road - persons	61.5	7113.3	59	8480.2
road - freight	36.1	4177.0	39	5591.6
railways	0.9	100.4	0.004	58.8
inland waterways	1.4	164.7	0.015	211.9
aviation	0.1	8.3	0.0	0.0
Total	100 %	Ca. 11 560	100 %	Approx. 14 340
Objective for 2010: **'stabilisation at the level of the reference year 1990'**	100%		Distance from 2010 objective: 24%	Distance from objective: approximately 2775 kton CO_2

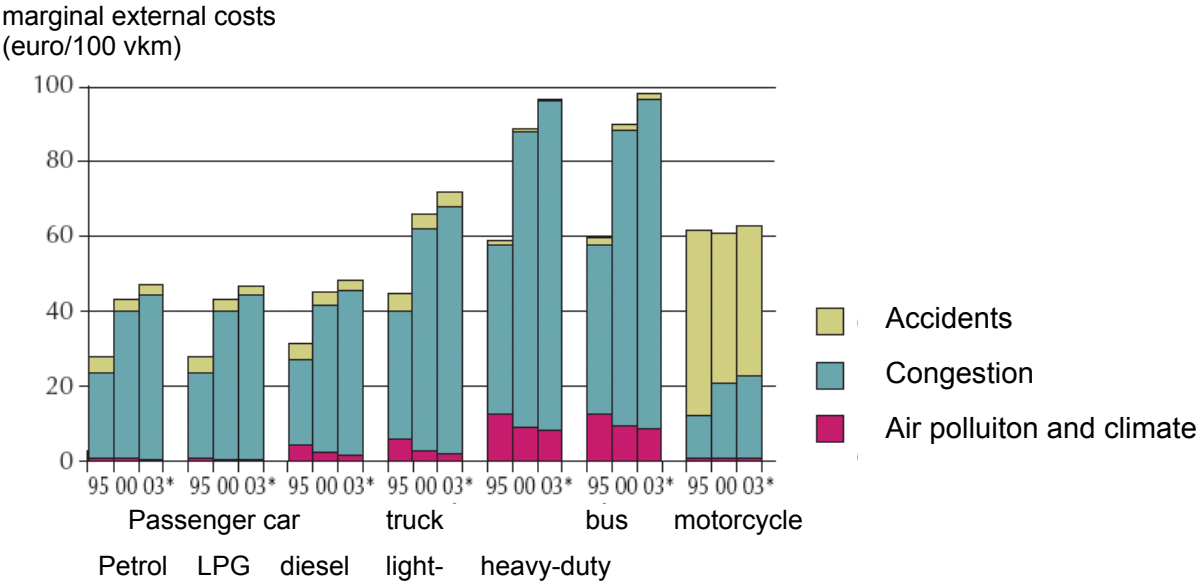
Source: Mira-T 2004, VMM + own calculation

1.1.4. Impact of mobility: effects on man, the environment and society

Traffic incurs external costs which are passed on to society. These costs can be expressed in marginal external costs and should be interpreted as follows: the extra (monetary) costs expressed per extra kilometre that is driven. The external costs consist of congestion costs (time costs), accident costs, costs related to the maintenance of the roads and costs of environmental damage resulting from climate change and air pollution (caused by acidification, photo-chemical pollution, and PM_{10} exhausts). [6]

[6] In MIRA-T 2003 the marginal external costs also included nuisance caused by noise. In MIRA-T 2004, this was not included. This makes it difficult to make a comparison between the two documents.

The marginal external congestion costs are largest for all types of vehicles, particularly during the rush hour and in cities. During the period 1990-2003, the marginal costs of environmental damage fell for every class of vehicles as a result of the stricter legislation on emissions for new vehicles. Diesel vehicles result in the highest environmental damage costs because of the emission of particulates. After all, particulate matter has the greatest impact on public health. For each vehicle kilometre, the marginal environmental damage costs are higher for a bus than for a diesel car. However, this is not the case per passenger kilometre because of the conversion in relation to occupation. A similar argument applies if the environmental damage costs of a light and heavy truck are compared per ton kilometre rather than per vehicle kilometre. **If it is not the marginal, but the total external costs that are examined, the environmental damage costs are higher than the external congestion costs.**



* provisional figures

NB 1: The calculation of the marginal external congestion costs was adapted compared to MIRA-T 2003. There was a better estimate, on the one hand, of the volumes of traffic and on the other hand, of the impact of an increase in the volume of traffic on the travel time covered (De Ceuster, 2004).

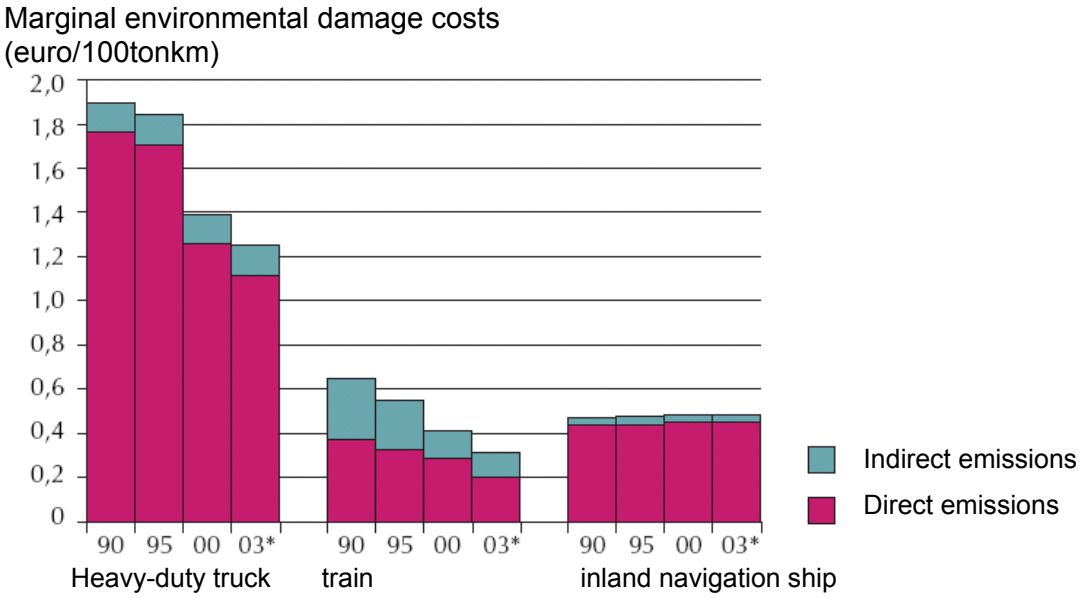
NB 2: Only the external costs for fine particulates from exhaust gases were included in the calculation.

Vkm = Vehicle kilometre

Source: MIRA-T 2004, VMM (T&M Leuven VITO).

Figure 4: *Marginal external costs for the different types of vehicles in road traffic (Flanders, 1995, 2000 and 2003)*

Figure 5 shows a comparison of the marginal environmental damage costs for the transport of goods per mode of transport. Heavy vehicles clearly have a lower score than transport by train or inland shipping (expressed in ton kilometres).



* provisional figures

** taking into account the share of diesel and electrical vehicles in freight transport (depending on the year)

In the emission calculations for the railways and inland shipping the technological progress is not yet taken into account, except for CO2, in contrast with road transport.

Source: Mira-T-2004, VMM (VITO)

Figure 5: *Evolution of the marginal external environmental damage costs for freight transport per means of transport*

In order to wholly charge the negative external costs to the road user, it would be necessary to triple the taxes. Part of the negative external costs are charged to the road user in the form of road taxes. In an optimal transport system, the taxes should be equal to the marginal external costs. After all, in that case the road user would take into account the damage that is caused. According to economic principles, this optimal situation should not only apply for average values, but for every means of transport for every time and in every place. However, the current system results in too much traffic at particular times and places with the wrong means of transport. Appendix 1 contains a summary of the evolution of the marginal external costs (MEC) compared to the taxes, for 5 types of vehicle. Research shows that if it is opted to charge all the costs of road traffic to the user, the taxation would have to triple. [7] Furthermore, the taxes would have to vary depending on the place, time and type of vehicle (see below) to serve as the correct incentive.

The marginal extra costs of road traffic in Flanders differ greatly depending on place and time (see figure 6). The average vehicle (including buses and trucks) caused approximately 11 euros of damage per (extra) hundred kilometres driven in non-urban areas during the off-peak period in 2002. However, in urban areas, this is nine times higher during the peak period; almost 97 euros of damage per hundred (extra) kilometres driven; in other words, this is one euro of damage per kilometre. The situations “urban/off-peak period”, and

[7] De Ceuster, G., Internalisation of external costs of road traffic in Flanders. Study commissioned by the Flemish Environment Company, MIRA, MIRA/2004/04, Transport & Mobility Leuven.

"non-urban/peak period" lie between the two above-mentioned extremes. Even during the off-peak period the external costs in the city are higher than the "non-urban/peak period". The marginal external environmental costs (air pollution, climate change, nuisance caused by noise) account for between 80% (urban, peak) and 24% (non-urban, off-peak) of the total marginal external costs of road traffic.

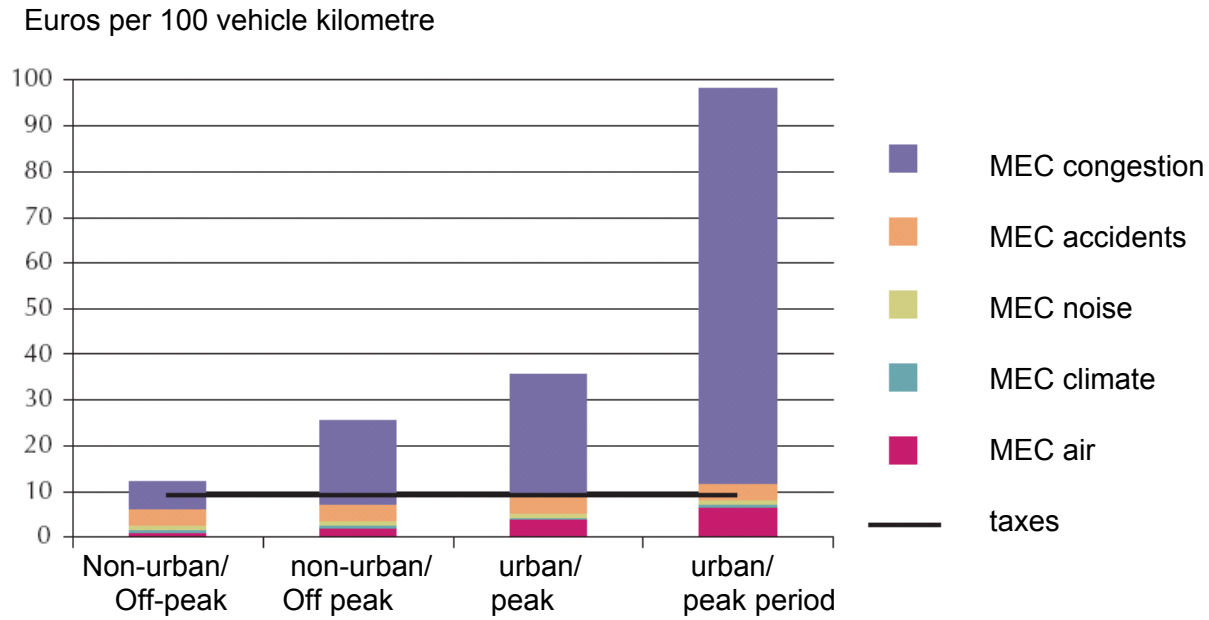
The differences between the situations are also noticeable per category of damage: in the city, the marginal external cost for air pollution and climate change are respectively 6 and 1.5 times higher during the peak than outside the city during the off-peak period. The higher levels can be explained by the lower speed of vehicles (so that there are more gear changes with higher fuel consumption, therefore resulting in higher emissions) and the higher population density in the urban area (so that more people are exposed to air pollution). The differences are particularly large for the congestion costs (caused by traffic jams): in the two extreme situations there is a difference of factor of 15. The marginal external congestion costs are much higher during the peak hours and in the city because there are many more vehicles on the road at that time for which the traffic jams are a nuisance. One extra vehicle causes a loss of travel time which causes a nuisance to more people. Because of the large number of vehicles on the road in this situation, one extra vehicle also has a greater impact on the traffic jams. In the city this effect plays a very important role because of the narrow roads.

For the external costs relating to noise and accidents it was not possible to make a differentiation. For nuisance caused by noise this would presumably lead to higher figures in the city and during off-peak hours, after all, the night is the most sensitive period when there is actually very little traffic. The marginal external costs of accidents would probably be lower in the city and during peak hours because in this case there are relatively less serious accidents (in relation to the number of kilometres driven per vehicle). For the taxes, no differentiation could be made either between peak/ off-peak periods and urban/non-urban. [8]

Figure 6 shows that the internalisation of the external costs of road traffic is extremely minimal during the peak period in urban areas. The taxes form only a fraction ($1/12^{th}$) of the damage caused per additional kilometre driven per vehicle. Outside urban areas in the off-peak period, the external costs of road traffic are much better covered by the taxes: they account for the marginal external costs considered for approximately 80%. The marginal external costs of nuisance caused by noise and accidents could be higher here (if a differentiation had been made).

For an effective internalisation of the external costs of road traffic a precise range of instruments is needed: in principle, a polluting car should pay more for each kilometre driven than an environmentally friendly car, more should be paid in urban areas than in rural areas, and during the peak hours more than in the slow hours.

[8] On the one hand, the reduction in taxes by deducting the costs for traffic from home to work could not be taken into account (if these advantages were included, the taxes would be lower, particularly during the peak period). On the other hand, the taxes would be slightly higher during the peak period and in the city because of higher fuel consumption (and therefore higher fuel taxes.



MEC = marginal external costs

For MEC noise, MEC accidents and taxes, no differentiation could be made between the different situations.

Source: Mira-T 2004, VMM. (Source: De Ceuster (2004), MEC climate and MEC air come from Vito)

NB: The taxes refer to the duties. These comprise fuel excise duties, various transport taxes (road tax, registration tax, the Eurovignette), VAT (on fuels, maintenance, purchasing a car), the tax on the insurance premium and the payment for the registration plate.

Figure 6: *Marginal external costs versus taxes: the distinction between peak period, slow periods and urban versus non-urban traffic (Flanders 2002)*

Disability adjusted life years or the years of healthy life lost due to environmental factors. As indicated above, mobility causes several environmental problems and external costs. These environmental problems have consequences for human health and can be translated into the number of years of healthy life that are lost (the number of DALYs) [9] which a population loses as a result of illness or premature death. Table 2 gives some figures for Flanders.

The effects caused by PM_{10} and $PM_{2.5}$ dominate the total number of disability adjusted life years (71%), followed by effects resulting from the impact of noise (18%). The transport sector has a great deal of responsibility for this: this sector is responsible for approximately 34% of the emissions of $PM_{2.5}$, for 37.6% of the emissions of ozone precursors and for 52% of serious nuisance caused by noise. [10] The total impact of sickness that has been calculated can be expressed as a loss of 600 years of healthy life in the annual concentrations of the pollutants observed per 100,000 inhabitants in 2003. On average, half a year of healthy life is lost for an inhabitant in Flanders as a result of the set of environmental factors considered, if the situation remains unchanged.

[9] DALYs: disability adjusted life years.
[10] See figure 1, "Contribution of the traffic in different environmental topics: environmental profile of the transport sector" page 6.

Table 2: *Total number of years of disability adjusted life years lost as a result of different pollutants causing air pollution (Flanders, 2002-2003)*

(DALY's)	Disability adjusted life years lost 2002	Disability adjusted life years lost 2003
Total	**33.248 (100%)**	**35.908 (100%)**
Total PM10 & PM2.5	22.300 (67%)	25.518 (71%)
Total ozone	785 (2%)	879 (2%)
Total noise	6.528 (20%)	6.528 (18%)
Total carcinogenic substances (except PM_{10})	2.032 (6%)	2.009 (6%)
Total PB	1.601 (5%)	974 (3%)
DALY/inhabitant/year	**0,006**	**0,006**
DALY/inhabitant/ 70 years	**0,41**	**0,44**

percentage contribution of the different subtotals between brackets

Source: Vito

The health impact can also be expressed in monetary value: the external health costs caused by air pollution and nuisance caused by noise. [11] Altogether this amounts to 2,276.2 million euros/year (in 2002). 62% of the health costs are due to the impact of fine particulates. The relatively small effects on health such as the loss of days of active participation and days on which people suffer from certain symptoms of the respiratory passages as a result of air pollution have an important economic implication (absenteeism). After all, a large group in a population are exposed to this. 16% of the costs are attributed to effects on health resulting from ozone and 12% resulting from noise.

[11] The external health impact resulting from air pollution and nuisance caused by noise is part of the environmental damage costs shown on page 14 and figure 6. The external environmental damage costs caused by air pollution (page 14 and figure 16) only come from the transport sector and also cover damage to buildings, materials and agricultural crops (i.e., not only health costs). The external health impact, as indicated above (p. 16) is caused by several environmental topics and by several sectors (i.e., not merely by the transport sector). Therefore the figures shown on page 14 (and figure 6) are not simply comparable to the figures indicated above (p. 16). Furthermore, the figures indicated above (page 16) are taken from MIRA-T 2003 and not from MIRA-T 2004.

1.2. Four strategies to achieve sustainable mobility, in which economic instruments which steer behaviour serve as an important basis in the policy mix

Long-term objectives for sustainability. In previous recommendations [12] the Minaraad adopted a number of clear viewpoints. In the Minaraad, the mobility issue has always been approached in the context of sustainability. This translates into the following *long-term objectives at the economic, social and ecological level*: [13]

- economic: aiming for the optimum achievability of all social functions, in which the user pays the correct price, taking into account all the external costs;
- social: improving traffic safety and the (traffic) viability and remedying traffic inequality by improving accessibility and by achieving an acceptable level of basic mobility;
- ecological: limiting the environmental damage of transport to an acceptable level, increasing the environmental performance, level of occupation and level of loads of transport means, and moving towards more environmentally friendly modes of transport.

A coherent approach based on four complementary strategies. Therefore solving the problems of mobility will require a coherent approach aimed at driving fewer kilometres, more efficient mobility and cleaner vehicles. This requires ***four complementary strategies***, which each have a positive influence on the three sustainability objectives indicated above. The various strategies can be achieved by several instruments:

1. *Interventions in the mobility system:* with this strategy, Flanders should aim to reduce as far as possible the need for (motorised) mobility. There are possibilities to achieve this with the policy on town and country planning, the policy on locations, with chain mobility for people and goods, with the applications of telematics, by charging on costs which are now imposed on society, and by all sorts of social reorganisations (e.g., with regard to the transport of goods, the decentralisation of services or the timetables of working hours).

2. *Interventions in the choice of transport:* in this respect, Flanders should aim for a better modal shift (a larger share of public transport and a shift towards a larger share of the soft modes of transport, namely by bicycle or by foot) and a better use

[12] (1) Minaraad, Advice of 4 December 2003 on the Flanders mobility plan, version 2003/69).
(2) Minaraad, Advice of 9 September 2004 on the 2004 Progress Report on the Flemish Cimate Policy Plan, version 2004/35.
(3) Minaraad, Advice of 5 April 2001 on the Antwerpen Mobiel Management Company, version 01/12.
(4) Minaraad, Advice of 7 June 2001 on the future financing of the Flemish Environment Policy and the role of environmental taxes in this, version 2001/22.

[13] The long-term objectives are defined in the Flanders Mobility Plan. Source: LIN Department, Mobility Unit. Flanders Mobility Plan, towards sustainable mobility in Flanders. Ministry of the Flemish Community, Brussels, 2003,170 pp.

of vehicles with company transport plans, innovative forms of collective transport and financial incentives such as a possible mileage tax.

3. *Interventions in traffic system*: this means working on more efficient traffic and optimalising the existing flows with telematics, categorisation and the organisation of roads, with possibilities in residential areas for the construction of provisions of public transport and of traffic safe passages and with all sorts of measures to "de-fragment" natural areas (tunnels, ecoducts, nature-friendly verges or banks, etc.).

4. *Interventions at the level of the vehicle*: technical improvements aimed at fuel-efficient and quieter engines and the adaptation of driving behaviour as a result of all sorts of educational initiatives. The possibility of an intelligent speed limiter in the future is also part of this strategy.

The need for economic instruments within the mix of policy instruments to achieve sustainable mobility. As indicated above, there are various different instruments and routes to achieve sustainable mobility. In order to achieve a more sustainable mobility policy with a greater steering effect, it is necessary to develop a balanced and effective mix of policy instruments. The mobility policy must be composed of: [14]

- instruments which help to create structure such as transport management, the optimalisation of the organisation of public transport…
- physical regulating instruments: norms for vehicles, location policy in town and country planning,…
- instruments for economic regulation: variable car costs, push-pull policy by pay-as-you-drive in combination with subsidies (tax advantages) for public transport,…
- instruments for social regulation: raising awareness with regard to driving behaviour, the choice of the mode of transport, creating public support for the policy,..

These different instruments will always have an effect on one or more of the above-mentioned strategies. Reducing the need for mobility and controlling the demand for transport form the most structural strategies to reduce and control the negative impact of mobility. Within the range of policy instruments used, **economic instruments which imply behavioural steering** play a crucial role in order to achieve a total push-pull policy. Economic instruments with behavioural steering result in the greatest welfare efficiency and in the long term are actually the only instruments which can really work. [15] A push-pull policy means that environmentally friendly alternatives are encouraged, while activities which have a negative impact on the environment are discouraged. Preferably the environmental pollution that is caused will be passed on to the actual polluter and the government will be able to charge on the costs to the polluters themselves. This results in a sense of accountability. However, the effectiveness of economic instruments is also determined by the link with a well-developed policy of enforcement. In many cases this will be more

[14] Minaraad, Advice of 5 March 1998 on Mobility and Infrastructure, ed.1998/7.
[15] Minaraad, Advice of 5 March 1998 on Mobility and Infrastructure, ed. 1998/7.

effective and efficient than setting up and controlling rules (command and control measures).

The regulatory character of taxes In this respect, the Council has always based its previous advices on the *regulatory character of taxes* in terms of methodology: i.e., there is a preference for environmental taxes which are elaborated in such a way that they result in the *maximum achievable change of behaviour, steer*ing towards the environmental objectives put forward. In addition, the Council considered that in order to achieve the regulatory effect of environmental taxes to the greatest possible extent and also to increase the acceptability of the taxes, *taxes would have to be predictable*. Furthermore, as far as possible, they should take into account the economic strength of the sectors concerned in order to obtain a socially justified regulation. The revenue from the regulatory taxes is used most effectively for:

- the funding of government expenditure which has a temporary and degressive character;
- the funding of expenditure to remedy and compensate for damage incurred by environmental pollution;
- the funding of expenditure with which the payers of the taxes are stimulated to take remedial measures (therefore part of the revenue should preferably be used on behalf of the payers).

1.3. Defining the research field of the study document

The negative impact of mobility on the environment and society is a well-known problem. However, it is not the intention to examine the entire interaction between the environment and mobility. After all, the discussion on mobility issues has again become topical in the context of the introduction of a road vignette (or another system of taxes for road traffic), and in the context of the Flemish Climate policy plan. Therefore research will focus on the analysis of the environmental problems in the above-mentioned present processes. Thus in this document, the desirability of systems of taxation for Flanders is also assessed in the light of the potential contribution to a reduction in greenhouse gases. However, the contribution to other (environmental) problems caused by mobility should not be lost sight of.

Positioning in the social debate on the Quickscan study or the introduction of the road vignette. The Flemish Coalition agreement puts forward the introduction of the road vignette to replace road tax. This means that everyone, including foreigners, pay for the use of the Flemish road infrastructure. This shows that similar to recent evolutions in some other European countries, Flanders wishes to pass on the costs of the use of the infrastructure to all users fairly. After all, up to now only heavy trucks have paid a fee for the use of the motorways (Trans European Network) in the form of the European road vignette.

Positioning in the climate conference [16] The climate treaty was concluded in 1992 during the World Summit on Sustainable Development in Rio. The related Kyoto Protocol (1997) laid down binding reduction objectives for greenhouse gases for the period 2008-2012. During this period, Flanders undertook to achieve a reduction in greenhouse gases of 5.2% compared to the emissions in 1990. As an interim objective, Flanders put forward the stabilisation of the emissions in 2005 compared to the reference year 1990. For the transport sector, a stabilisation of the CO_2 emissions compared to 1990 is put forward to 2010. However, in 2004, the figures were anything but optimistic: during 2003 the emissions of greenhouse gases were almost 4 Mton CO_2 equivalents above the reference level of 1990. The transport sector caused 16.4% of these emissions of CO_2 equivalents. [17]

In the light of the climate conference, the follow-up processes that were put forward and in view of the great importance attached to tax and economic instruments in the context of the climate policy, the introduction of the road vignette or an alternative system of taxes is an essential element. After all, the introduction of a considered system of taxes could make an important contribution to the reduction of greenhouse gases emissions and other emissions from traffic. Therefore this financial instrument should also be approached in the light of the Kyoto objectives and the climate policy plan to be drawn up in 2006-2012.

[16] The figures are based on the MIRA-T 2004. VMM. Environment and nature report Flanders: Themes MIRA-T 2004. Leuven, Lannoo Campus, 2004, 454 pp.

[17] See chapter 1.1.3, The emission of greenhouse gases in the context of the climate issues, p. 10.

II. Policy framework and policy intentions

2.1. The European context

The European Directive 1999/62/EC or the "Eurovignette directive" was adopted on 17 June 1999. This directive established a number of framework rules which would have to be followed by the member states if they wished to introduce a toll and/or a tax on use or if they established a tax on traffic (for heavy trucks). The directive comprises the following important elements.

- The directive only relates to vehicles intended for freight transport by road for which there is a maximum permitted total weight of at least 12 tons.
- The Belgian (Flemish) road tax for heavy trucks may not be lower than the *minimum* rates established.
- The member states can introduce *reduced rates or an exemption of road tax* for service vehicles such as military vehicles, fire engines, and vehicles for road maintenance or vehicles to provide first aid. Vehicles which are used by natural or legal persons and for which the freight transport is not the main activity are also eligible for a reduced rate or for exemption.
- Levying a toll and/or a user charge (tax on use) can only be applied to the users of "motorways", bridges, tunnels or mountain passes in the territory of the European Union. *Tolls* [18] and *users' rights or user charges* [19] may not be levied *at the same time* for a particular section, except for the use of tunnels, bridges and mountain passes which form part of road networks for which user taxes are levied.
- *The users' taxes, including administrative costs,* may not be higher than the *maximum rates* established. The rate of the user taxes is proportional to the duration of the use of the infrastructure concerned and can only be collected on an annual basis in a member state for the vehicles of that country.
- Weighted average tolls must be related to the costs for the construction, exploitation and expansion of the infrastructure network concerned. They may be made dependent on the categories of vehicle emissions and the time during the day.

The directive leaves member states free to apply specific taxes or specific duties for vehicles or loads which fall outside the norms in terms of weight or size (exceptional transports). Furthermore the directive does not form an obstacle to collecting specific taxes for the registration of vehicles or to introducing parking fees or specific duties for city traffic. The (additional) introduction of regulatory taxes specifically intended to combat traffic jams related to particular times and places is also permitted. Furthermore, the directive permits the member states to use a percentage of the user rate or toll for the *protection of the environment or the balanced expansion of the transport networks.*

[18] Toll: A sum to pay for driving a particular section on a particular infrastructure, the level is based on the distance covered and on the category of the vehicle

[19] Users' rights: a sum which gives the right to make use of certain infrastructure with a particular vehicle during a certain amount of time. Also named user charges.

The revision of the Eurovignette directive. On 23 July 2003, the European Commission submitted a **proposal** to change the Eurovignette directive of 1999. A summary is given below of the most important changes in the (original) draft compared to the applicable directive.

- The duties should reflect the costs of the transport better:
  - the taxes should be related to the costs of the construction of new infrastructure, the exploitation, the maintenance and the expansion of the infrastructure network concerned. As the damage caused to the road surface depends to a great extent on the pressure of the axle, a classification of vehicles into four categories is put forward so that the tolls can be differentiated more efficiently;
  - the actual costs of accidents for society as a whole should be taken into account. Therefore this also entails the administrative costs of government departments and loss of production potential.
- There is a possibility of using a differentiated system of rates depending on the type of vehicle (weight and polluting character), the time (and the level of congestion), the place of use (urban versus rural), the distance covered, the type of infrastructure and the speed.
- The maximum permitted total weight was reduced to 3.5 tons which means that more trucks are affected by the directive.
- In order to avoid traffic taking shortcuts, the traffic network to which the directive applies is extended with connecting parallel roads.
- The revenue from the tolls and duties should be used for the maintenance of the existing road infrastructure on which the tolls are applied and for the balanced expansion of the transport sector in general. The aim is to help to fund the missing links in the Trans European Network with the revenue, but there is also a possibility of investing in other transport modalities if the need arises. Therefore the member states may not use the money for their general expenditure such as health care.
- In order to meet the extra costs related to the introduction of a system for infrastructural duties (tolls and/or taxes on use), the draft directive provides for the possibility that the member states can offer a compensation by reducing the annual tax on vehicles (road tax - harmonised by the Directive 1999/62/EC). By introducing duties on the use of the infrastructure, road tax (an annual fixed sum based on the possession of a car) can be partially replaced. [20] This means that the amount that is charged (the tax) will be a clearer reflection of the use of the infrastructure and the costs related to this.

There is no consensus yet on the change in the EU directive. Following a first reading, the European Parliament formulated several amendments, but the European Commission did not accept a number of these amendments.

At the meeting of the EU ministers of Transport in Luxembourg (21/04/2005) a *political compromise* was achieved (on the basis of a majority of votes). The compromise of the council determines, inter alia:

[20] The amendments on the revision mean that road tax can be only partially, not wholly replaced. A partial reduction is permitted up to the set minimum for road tax. However, there is still no consensus on the revision of the EU directive.

- that the revenue no longer has to go specifically to the transport sector although this continues to be a recommendation. (Belgium supports maximum freedom for the expenditure of the revenue in order to fund a sustainable mobility policy);
- that the cost price for the construction and maintenance of roads can be charged up to thirty years when determining the size of the duties;
- that the member states can vary the toll depending on the emissions (in order to combat environmental damage), the time of day or season;
- that a distinction is made between systems of concessions and taxes on use. These do not have to use the same methodology (Belgium supports a compulsory methodology for every type of toll system);
- that a discount is introduced for frequent users (Belgium does not support this either).

The Belgian federal minister of transport voted against the political compromise mainly because of the following three (Flemish) demands:

- By analogy with the extremely vulnerable areas such as mountain areas, Flanders is asking for a general increase in the toll rates because of the degree of urbanisation and the greater impact in urban areas. For example, in mountainous areas, an increased rate (+25%) is permitted in order to avoid congestion and environmental damage;
- the toll should vary on the basis of the congestion on the roads (therefore Belgium requests even greater flexibility in making the toll more variable);
- the basis for the calculation is based purely on the use and maintenance costs of the infrastructure. Flanders wants the ecological costs to be taken into account as well.

The compromise of the council will be presented for a *second reading* [21] to the European Parliament which has co-decision powers. The Flemish and federal ministers of transport hope that the European Parliament will listen to their comments. The European Parliament argues for the internalisation of the external costs and for a mark-up for urban areas (all the large urban areas in Belgium fall under this). In this respect, the points of view of the Parliament therefore closely correspond to the points of view of the Flemish and federal ministers. Thus it is a matter of waiting to see which amendments of the European Parliament will be taken over. The vote in Parliament is expected at the beginning of 2006.

Therefore drawing up a (new) system of taxes for Flanders must still be based on the directive applicable in 1999. However, there is a recommendation to take into account the compromise of the council of 21 April 2005 and closely follow the revision procedure. The member states are free to introduce an additional system of duties on the other roads, as well as a tax or toll in the context of the European directive. This system of duties can relate both to private traffic and to freight traffic. However, on the TEN-T roads (and parallel connecting roads in the revision of the directive) the set maximum levels apply for tolls or taxes on use for freight traffic (12t or 3.5t in the current directive and revision respectively), and it is not possible to levy a toll and a tax on use at the same time (except for bridges and

[21] The second reading of the European Parliament is taking place at the moment and will be completed by the end of 2005 or the beginning of 2006.

tunnels). The car traffic on the TEN-T roads does not fall under the provisions of the directive and can therefore also be covered by a new system.

The Eurovignette. The Eurovignette was drawn up on the basis of an international Convention which was signed on 9 February 1994 by Germany, the Netherlands, Belgium, Luxembourg and Denmark. Denmark joined in 1998 and Germany left the Eurovignette convention in 2003. The Eurovignette is a joint elaboration of a system of duties in the context of the EU directive described above. The original directive dates from 25 October 1993, but was overturned by the European Court of Justice and later replaced by the new EU Directive dated 17 June 1999. The sums in the Eurovignette were adapted to the Eurovignette directive of 1999.

The Eurovignette is a certificate which introduces a **fixed tax** for heavy trucks on motorways (i.e. the maximum permitted total weight amounts to at least 12 tons). The price of the vignette does not depend on the number of kilometres driven or on the time at which the trucks use the motorway. The tax does depend on the environmental class and the number of axles of the truck (and its trailer), and is collected at the national level. The income is distributed across the participating countries on the basis of a distribution key. As the Eurovignette does not depend on the distance that is covered on a particular infrastructure, but does permit the use of infrastructure for a particular time, the Eurovignette should be viewed as a **tax on use** [22] as defined in the EU directive (and not as a toll, as erroneously indicated in the Quickscan study).

As long as the Eurovignette arrangement applies in Belgium, it is not possible to levy an extra toll for heavy transport on the road network on which the Eurovignette applies. However, private traffic and light freight transport are not covered by the Eurovignette and can therefore be additionally taxed in Flanders (or Belgium), without Belgium having to withdraw from the Eurovignette. For heavy traffic, an additional toll on bridges or tunnels is also possible. However, the Eurovignette convention will have to be adapted to the future revision of the Eurovignette directive which anticipates an expansion to cover light transport, amongst other things.

The collection of the money for the Eurovignette in Belgium takes place at the federal level. The costs of enforcement are also covered by the federal state. Therefore the income means a net income for Flanders. In 2004 this amounted to 66.6 million euros for Flanders. [23] As the income from the Eurovignette is also an extension of the regionalised taxes, the three regions must agree if the system is abandoned or if the system is differentiated between the regions.

In Belgium there are currently 41 collection offices [24] of the Federal Administration of Direct Taxation, sector for collections competent for collecting the Eurovignette. In addition there are twenty customs offices at the border crossings, where it is also possible to purchase a

[22] According to the definitions given in the European Directive 1999/62/EC (shown in footnote 18 and 19).
[23] Deloitte Business Advisory NV. Quickscan – Road vignette, Final report 2005, Ministry of the Flemish Community, Brussels, 2005, 85 pp.
[24] The collection offices were indicated in a Ministerial Decree of 9 January 1995, (Belgian Bulletin of Acts and Decrees, 21.01.1995).

Eurovignette. [25] Furthermore, there are a number of special sales outlets exploited by a private firm called AGES.

Vehicles which are registered in Belgium must always pay the annual sum. Belgium made use of the option included in the Convention to extend the obligation to the entire road network and not restrict it solely to the motorways. Foreign vehicles have a choice of a day vignette or a Eurovignette for one week, one month or one year.

The Euro 4 and Euro 5 norms are European emissions norms for exhaust gases which relate, inter alia, to fine particulates, NOx, carbon monoxide and hydrocarbons [26] They apply for new private cars, vans, trucks and buses. New vehicles are currently subject to the Euro 4 norm which has been in effect since 2005. In addition, the European Union is working on the Euro 5 Norm, which will enter into effect in mid-2008, and will replace the Euro-4 norm. The Euro 5 norms for trucks and buses have already been determined. The norms for private cars and vans are being determined at the moment. [27] The Euro 5 emission norms that were established and the proposals for Euro 5 emissions norms for private cars can be described as ambitious.

CAFE Programme: Clean Air for Europe In May 2001, the European Commission started the CAFE programme. CAFE is not a strategy, but a programme related to the technical analysis and policy development of air quality. The CAFE programme will lead to the creation of a thematic strategy on air pollution (air quality). This strategy will be one of the thematic strategies in the context of the Sixth Environmental Action Programme (see following paragraph). The CAFE programme is an initiative to bring together different aspects of the EC air quality policy (including the emission policy) in one context. The areas which are given priority in the context of CAFE are:

- polluting substances indicated in the Framework directive on air quality [29]
- cross-border air pollution;
- substances emitted by a number of different sources.

A proposal for the revision of the NEC Directive will also be drawn up in the CAFÉ programme. [30]

Strategy for air quality in the context of the 'sixth environment action programme". Environment 2010: Our future, our choice'. [31] On 21 September 2005, the European Commission proposed a strategy for air quality in the context of the Sixth European environment action programme which forms the elaboration of the European strategy for

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[25] Ministerial Decree of 1 December 1998 (Belgian Bulletin of Acts and Decrees, 27/02/1999).
[26] Hydrocarbons: non-methane hydrocarbons (NMHC) and methane (CH_4).
[26] Hydrocarbons: non-methane hydrocarbons (NMHC) and methane (CH4.
[27] PriceWaterhouseCoopers. Bio fuels and other renewable fuels for transport. Study on the transposition and implementation of directive 2003/30/EC on the promotion of the use of bio fuels or other. Final report. The Federal Public Service of Public Health, Food Chain Safety and Environment, DG Environment).
29 The subsidiary directives are an elaboration of the framework directive "Directive 96/62/EC on the assessment and management of air quality".
[30] See chapter 2.1. The European context, p.27 (NEC Directive or National Emission Ceilings Directive.
[31] Source: http://europa.eu.int/eur-lex/ and http://europa.eu.int/comm/environment/air/cafe/index.htm

sustainable development as agreed in Göteborg. The Göteborg strategy for sustainable development aims, inter alia, for a better reflection of the social costs of the different modes of transport. The strategy for air quality is aimed at developing a long-term strategic and integrated policy in order to limit the negative effects of air pollution on the environment and on health. In this strategy stricter norms are put forward for air quality by 2020 for sulphur, nitrogen, soot particles, ammonia, fine particles and ozone. As transport bears significant responsibility for air pollution, this sector will be confronted with additional environmental measures:

- the European Commission is planning the introduction of a compulsory soot filter for diesel cars (expected date: autumn 2005);
- in 2006, stricter emission laws will be drawn up for trucks: the Euro 6 norms.

In the context of the strategy for air quality, the European Commission is undertaking to formulate proposals for legislation to adapt the European directives on air quality, including the NEC directive. Amongst other things the strategy states that in 2005, the Commission will adopt a proposal for new product norms for private cars (Euro 5 norms). In addition, the Commission suggests streamlining the legislation on air quality and proposes reforming the Framework directive on air quality and the subsidiary directives in a single directive (the Ambient Air Quality Directive).

NEC directive or National Emission Ceilings Directive. The directive 2001/81/EC aims to tackle cross-border environmental problems with regard to acidification, and tropospheric ozone formation. For this purpose, national emission ceilings were determined for different pollutants. The Belgian emission ceilings were divided into four sub-ceilings: [32] one Belgian figure for the emissions of the transport sector and three ceilings for the other sources of each of the regions. These sub-ceilings are shown in table 3. The reduction compared with 1990 which corresponds with this is shown in brackets in every case. The regions are all responsible for their own ceilings. The Flemish ceilings have already been converted in VLAREM II. The figure for the transport sector must be achieved in the first place with federal product measures; the regions can take supporting measures at the level of the mobility policy.

[32] At the Interministerial Conference on the Environment of 24 March 2003, an agreement was concluded between the federal and regional ministers of the environment on the distribution of the Belgian emission ceilings into four sub-ceilings.

Table 3: *Emission ceilings in 2010 for the three regions and the transport sector (in Kton) and the percentage reduction compared to 1990.*

	Transport **Kton (percentage reduction cf. 1990)**	**Flanders** **Kton (percentage reduction cf. 1990)**	**Wallonia** **Kton (percentage reduction cf. 1990)**	**Brussels** **kton (percentage reduction cf. 1990)**	**Total** **Kton (percentage reduction cf. 1990)**
SO_2	2 (-87.9%)	65.8 (-73.4%)	29 (-71.8%)	1.4 (-75%)	**99 (-73.4%)**
NOx	68 (-57.8%)	58.3 (-41.1%)	46 (-38.4%)	3 (-35.4%)	**176 (-48.1%)**
VOS	35.6 (-71.9%)	70.9 (-50.0%)	28 (-43.3%)	4 (-34.8%)	**139 (-58.1%)**
NH_3	-	45 (-42.4%)	28.7 (-1.2%)	-	**74 (-31%)**

In the context of the thematic strategy for air quality, the European Commission will submit a proposal for the revision of the NEC Directive in 2006, possibly increasing the norms. [33]

On 5 July 2005, the European Commission proposed a draft directive which aims to eliminate the registration taxes for cars. In Belgium the registration tax (BIV) should disappear and be included in the annual road tax. This must be achieved during a transitional period of 5 to 10 years. In this way the European Commission hopes to achieve an adaptation of the tax structure and hopes to achieve a uniform structure of taxes in Europe. According to the EU, a CO_2 contribution for all private cars should also gradually be incorporated in this annual road tax. By 2008, road tax and the gradual conversion of the BIV should be based for 25% on the CO_2 emissions of the car; by 2010, the tax should be based on this for 50%.

[33] See chapter 2.1 The European context, p. 26.

2.2. The federal and Flemish context

2.2.1. Taxes and duties on road transport

In addition to the traditional taxation on cars, excise duty is also levied on fuels, but there are also tolls and taxes on use. In broad lines, there are four taxes or duties which are paid:

1. the single registration on new cars (BIV) and registration taxes;
2. an annual tax on the possession of a car: the road tax, the additional road tax for LPG vehicles and the tax compensating for excise duties for diesel cars;
3. excise duties on fuels;
4. tolls and users' taxes

1. Purchase tax and registration tax

The regional tax *on the registration of a new car (BIV)* is paid once. For vehicles which run on LPG or other liquid hydrocarbons there is a reduction. Obviously VAT is also levied on the purchase of a car (21% in Belgium).

Vehicles must be registered before they are allowed to drive in traffic. The Director of Registrations (federal government) issues a registration number and registration certificate (number plate) for every car that is registered. A *registration tax* must be paid for this (amounting to € 31). This is a *federal tax*, which is arranged on the basis of the Royal Decree of 20/07/2001 on the registration of vehicles (and amendment decisions of 23/02/2005, 22/12/2003 and 18/03/2003). [34]

2. Road tax: the tax on ownership of a vehicle [35]

Road tax (regional competence) must be paid annually for the use of vehicles on the public highway. Road tax varies, depending on the type of vehicle (motorcycle, truck, private car), on the basis of the engine, the cylinder content or the maximum permitted mass (MPM) of the vehicle.

In addition to the basic tax for petrol vehicles, LPG users and diesel users must pay an additional tax. The *additional LPG tax* is collected because the excise duties were abolished. From 1 January 1996, diesel users must pay *a tax to compensate for excise duties* (ACOB) in addition to the road tax in order to compensate for an increase in customs on petrol. As a result of the Programme Act of 5 August 2003, this tax to compensate for customs will gradually be reduced and it will abolished on 1 January 2008. This abolition will be compensated by higher customs on diesel fuel.

[34] F. PONET. Road transport booklet 2005, Mechelen, Wolters Kluwer Belgium, 2005, 310pp.

[35] GEZINSBOND - STUDIEDIENST. Under the spell of the car. Family policy in Flanders. 34th year, 2, Brussels, 2005, 48 pp.

3. Excise duties on fuels

The sale price of fuel is determined by the basic price, the excise duties and the VAT (21%). More than 50% of the diesel price and more than 60% of the petrol price currently consists of taxes, including excise duties and VAT. [36]

Since 2003, the *special excise duties* have been subject to the *Cliquet system* which entails an annual increase in the special excise duties for petrol and diesel. [37] This increase can only be introduced from the first reduction of the maximum price (determined in the programme agreement). [38]

Some categories of professional diesel users are eligible for a system of repayment of the diesel already used with a low sulphur content. [39] This *regulation for professional diesel* ensures that the transport sector for persons and goods is exempt from the increases in special excise duties, or in other words, for an exemption of the Cliquet system. Amongst other things, the exempted categories include taxi companies and freight transport companies of goods with a maximum permitted mass (MPM) of more than 7.5 tons).

The level of the excise duties for 2005 are laid down in the Programme Act of 27/12/2004 (Belgian Bulletin of Acts and Decrees, 31/12/2004). The excise duties on energy products (fuel) consist of excise duties, special excise duties, and a contribution for energy. No customs is levied at all on LPG although there is 21% VAT. The revenue from the excise duties goes to the federal government. On 8 June 2005, the Belgian and federal government decided to reduce the excise duties on bio fuels, [40] which was laid down in the Programme Act of 11 July 2005 (Belgian Bulletin of Acts and Decrees, 12/07/2005). Pure vegetable oil was wholly exempted from customs. These reductions, in combination with a compulsory mixture of bio fuels with traditional petrol from the pump should lead to approximately 2% of the fuel consumed by the end of 2005 consisting of bio fuel.[41] This means that Flanders is on the right path for achieving the objective of 2% by the end of 2005, as determined by the EU directive 2003/30/EC in connection with the promotion and use of bio fuels and others. According to this directive, 5.75% of the fuel used should consist of bio fuel by 2010.

4. Tolls and taxes on use

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[36] Gezisbond-Studiedienst. Under the spell of the car. Family policy in Flanders. 34th year, no. 2. Brussels, 2005, 48pp.

[37] However, by Royal Decree it is also possible to determine a particular price level for fuels above which the Cliquet system can be applied in reverse, i.e. above which a reduction of the special excise duty can be applied. (However, this does take into account the European minimum levels set.)

[38] Royal Decree of 5 August 2003: Programme Act (Belgian Bulletin of Acts and Decrees, 7 August 2003) and the Royal Decree of 27 December 2004 on the Programme Act (Belgian Bulletin of Acts and Decrees 31/12/2004).

[39] Royal Decree 29 February 2004 with various provisions on excise duties. (Belgian Bulletin of Acts and Decrees, 05/03/2004).

[40] http://www.agripress.be/start/artikel/98568/nl

[41] De Morgen (Gorik Van Holen). Study indicates that the measures of the Minister for the Environment, Bruno Tobback are the right measures. De Morgen, 15/07/2005, p. 4.

The Eurovignette [42] is a fixed toll for the use of motorways. This toll affects heavy goods vehicles (with a maximum permitted mass of more than 12 tons).

In Flanders, a toll only applies for the Liefkenshoek tunnel in Antwerp. The future Oosterweel link in Antwerp (the controversial Lange Wapper bridge) will also be co-financed by a toll. For the development of a system of tolls it is necessary to take these two tolls into account. According to the EU directive (and the revision), a general mileage charge (toll) can be combined with extra tolls for these bridges (for freight traffic). Preferably these specific charges will be integrated in a new system of taxes (if it is opted to introduce this). In the distribution of the revenue, it is necessary to make sure that the funding of the Oosterweel link (and the Antwerp Masterplan) are not jeopardised).

The question remains whether the tolls for the Liefkenshoek tunnel and the Oosterweel link are affected by the directive and the revision. The directive applies only to TEN-T roads (and parallel connecting roads in the revision of the directive). In principle, the ring roads around cities fall under the urban area and are therefore outside the range (of the revision) of the directive. In that case, urban duties are possible, without restrictions imposed by the directive. However, some ring roads do fall under the TEN networks and are affected by the directive. In that case, provisions apply for freight traffic, not for cars and the size of the duty must be related to the costs of the infrastructure (and the accidents) (in the revision of the directive). As the tolls for the Liefkenshoek tunnel and for the Oosterweel link apply for both freight and cars, it can be argued that it is a purely urban duty and is therefore not subject to the EU directive. However, no conclusive decision on this has been taken.

Taxation of cars is a regionalised Flemish competence. The Lambermont Agreement led to a State reform in which some competences were moved from the federal to the Flemish level. From 1 January 2002, the transfers of competence that were established and the new financing system entered into effect. The revenue of the regionalised competences is wholly allocated to the regions, in relation to the localisation of taxation. However, the federal State collects the taxes. The regional taxes were extended, inter alia, to the tax on the registration of vehicles (BIV) and the Eurovignette. [43]

Since 1 January 2002, the traditional taxation of cars has therefore been a regional competence in Belgium. At the moment, the taxation of cars in the three regions is still completely coordinated and there is an agreement between the three regions that this will continue to be the case in the future. A differentiation between the regions is only possible if all the regions agree to this. The traditional taxation of cars consists of the taxation on the registration of vehicles (BIV), road tax, additional road tax (LPG vehicles) and taxes to compensate for customs (diesel vehicles) which are paid annually. [44] Table 4 provides a summary for the distribution of competences for the different taxes and charges for road traffic.

***Table 4**: Distribution of competences for the taxes and charges for road traffic*

[42] See Chapter 2.1, The European Context, p. 24.

[43] A. Alen. Addendum – The Fifth State Reform of 2001 – State law 2001-2002 academic year, Leuven Catholic University of Leuven, 2001, 27p (can be consulted on the website: www.law.kuleuven.ac.be/pubrecht/const/nieuws/addendum.doc).

[44] http://www.emis.vito.be/autoverbruik/index.asp?pageChoice=Fiscaliteit.

Category	Tax / levy	Competence
1Purchase tax and registration tax	BIV	Flemish competence
	registration tax	federal competence
2. Tax on ownership of a vehicle	Road tax	Flemish competence
	Additional LPG tax	Flemish competence
	Tax to compensate for excise duty (diesel users)	Flemish competence
3. Excise duty on fuel	Ordinary excise duty, special excise duty and energy contribution	federal competence
	Clique system	federal competence
	Professional diesel users	federal competence
4. Tolls and taxes on use	Eurovignette	Flemish competence
	Liefkenshoek tunnel and future Oosterweel link	Flemish competence

2.2.2. Flemish policy context

(Draft) Flanders mobility plan approved in principle by the Government of Flanders on 17 October 2003. [45] The mobility plan reflects the policy framework for the mobility sector. Focusing on 2010 and looking forward to 2030. The mobility plan is based on five basic objectives for sustainable mobility: achievability (of a location), accessibility (to transport), safety, viability and the quality of the environment and nature. [46] In order to achieve the five strategic objectives and the related critical success factors, five packages of measures were selected to guarantee an integrated approach to the problems of mobility:

In the package of measures for the "efficient use of methods of transport and infrastructure" attention was devoted to **duties on use** and to the internalisation of environmental costs (at the federal level). Duties on use make it possible to internalise social costs and vary them, but at the same time also to differentiate them in terms of place, time and quality. In this way, they support the efficient use of trucks and cars, as well as a better spread of the demand for traffic and transport over time. The *conditions* which the Flemish Parliament imposes on the introduction of duties on use are:

- the existence of real possibilities for alternatives in terms of time (sufficient flexibility in working hours and supply times);
- alternative methods of transport of a sufficiently high level of quality;
- not jeopardising the competitive position of companies;
- the simultaneous abolition or reduction of fixed costs.

If these conditions are not met, the duties on use will not have the effect of regulating traffic and will merely increase costs for users without the possibility of adapting behaviour. There is a proposal to move from a time-based vignette (Eurovignette) to a variable system of charging for mileage for freight transport. In order to confront private car users directly with

[45] LIN department, Mobility unit, Flanders Mobility Plan, towards sustainable mobility in Flanders, Ministry of the Flemish Community, Brussels, 2003, 170 pp.

[46] See chapter 2.2.2., Flemish policy context, p. 34, and see chapter 1.2., Four strategies to achieve sustainable mobility in which economic measures which steer behaviour form an important basis for the policy mix, p. 17.

the social costs of their mobility as well, the proposal here to is to introduce a system of duties on the use of private cars, in the first instance, in specific locations (cf., tunnels, bridges, etc.), and subsequently on the entire road network. In these measures it is also extremely important to avoid social exclusion. In this respect, the introduction of this submeasure depends on the progress that is made with regard to improving the quality of alternative modes of transport.

The environmental costs of transport are significant. Therefore the mobility policy requires a **supporting fiscal policy** which will encourage both citizens and industry to change behaviour. This is possible by implementing a policy which focuses on charging on these costs to users of the infrastructure and other transport systems as efficiently and accurately as possible. An additional project at the federal level is the proposal to internalise the environmental costs in consultation with the surrounding countries and other regions **by means of excise duties on fuel**.

For each legislative period, a policy memorandum must be drawn up (cf. *infra*) setting out the main lines for the mobility policy for the next five years, in accordance with the main lines in the coalition agreement and in the Flanders mobility plan.

Mobility policy Memorandum 2004-2009 [47] The policy memorandum underlines the aim for a more sustainable mobility and falls in the context of the Flanders Mobility Plan. Sustainable mobility is achieved via five lines (objectives) which must be followed simultaneously:

- *improving accessibility,* in which the objectives are given to making the system of transport physically accessible, keeping mobility affordable and giving access to the communication and information networks. Basic mobility, accessible public transport and encouraging and expanding new forms of collective and sustainable public transport are key concepts in this respect;
- improving *traffic safety* linked to quantitative objectives in connection with injuries and victims of traffic;
- *guaranteeing the achievability (accessibility)* of Flanders, putting forward the following relative objective: weighing up the social efficiency and cost efficiency, both with regard to the differentiated development of the transport system over time and space (multimodal) and with regard to whether or not to encourage social processes (enlargement of scale versus spatial proximity, concentration versus spread, etc.). Improving the competitive speed of public transport is also an important aspect;
- *improving the viability of traffic* by reducing traffic congestion and driving speed and by increasing the value of the use and experience of the public domain;
- *reducing environment damage and damage to nature* to an acceptable level with a reduction in the traffic emissions to the traffic emission ceilings and by opposing the fragmentation of natural areas. The volume of traffic (in terms of vehicle kilometres), driving speeds as well as vehicle technology are important starting points for reducing environmental damage. The combination of constantly increasing the norms with regard to vehicle emissions, fuels and engine noise and ever greener tax

[47] Cabinet of the Flemish Minister of Mobility, Van Brempt. Mobility Policy Memorandum 2004-2009. Ministry of the Flemish Community, Brussels, 2004, 101 pp.

measures at the level of traffic and transport should serve as new incentives for improving the environmental efficiency of vehicles. The following traffic emission ceilings are aimed for:

- 35.6 kton for NO_x;
- 22.2 kton for volatile organic substances (VOS);
- 1 kton for SO_2;
- as regards the CO_2 emissions of traffic and transport, the aim is for a stabilisation in 2010 compared to 1990. The approach of the CO_2 emissions is directly related to the total energy consumption in the sector and must therefore be approached in this way.

The accessibility will be increased by implementing **a steering price policy in which the user of the infrastructure also pays**. This executes the Flemish coalition agreement which states that:

"We are aiming for the introduction of the road vignette to replace road tax, so that in future, everyone, including foreigners will pay for the use of our road infrastructure. We are examining the possibility of introducing positive incentives for safe driving behaviour."

Therefore according to the policy memorandum, the road vignette may not be added to a series of (other) duties on use, but must be introduced *to replace road tax*. Procedurally, steps must be taken in consultation with the federal government and the other regions: the steps which are necessary so that all Flemish people can be exempted from road tax, steps to possibly leave the system of the Eurovignette and steps in order to clarify the competence with regard to the collection of the funds, control and enforcement. In addition, the process must be entirely followed within the contours of the European rules (EU directive). In fact, the policy memorandum reveals that it is necessary to take into account the specific Flemish situation and that consequently not every system of duties is possible in Flanders. For example, a *motorway toll is unacceptable simply for reasons of traffic safety.* After all, the alternative roads to avoid motorways in Flanders are extremely numerous (parallel regional roads), usually accompanied by dense ribbon development. Therefore any new system would have to cover the whole road network in order to avoid such undesirable subsidiary effects. Social consequences must also be calculated in this system; the new system should in no case lead to new forms of transport poverty or inequality. It is also necessary to check how a road vignette can be used to steer mobility and it is necessary to examine a variable price policy with regard to traffic safety and the environment. From the point of view of sustainable mobility it is unacceptable to fund only road infrastructure with the revenue of the new system. After all, sustainable mobility implies a *multimodal approach*. The policy memorandum indicates that further research is needed (the Quickscan study is the result of this).

Flemish climate policy plan. With regard to the Kyoto Protocol (1997), Flanders has committed itself with regard to the reduction objectives for greenhouse gases for the period 2008-2012. [48] During this period, Flanders will have to achieve a reduction in greenhouse gases of 5.2% compared to the emissions of 1990. To this end a Flemish Climate policy plan is being drawn up for the period 2006-2012 and the starting signal for the activities was given during the Flemish climate conference on 6 June 2005.

[48] See chapter 1.1.3, The emission of greenhouse gases in the context of climate problems, p. 10, and see chapter 1.3, Improving the research field of the study document, p. 20.

Within these activities, the necessary attention is also devoted to the 'post- Kyoto' era. The Flemish Climate policy plan should not focus merely on the period 2006-2012, but will also have to devote sufficient attention to measures which can achieve significant reduction in greenhouse gases in the long term. This long-term dimension will have to apply within the joint strategy with regard to the post-2012 period drawn up in the EU. During the European Council of March 2005, heads of state and government leaders stated that, taking in account the 2° C objective ,[49] the developed countries should consider reduction figures amounting to 15-30% compared to 1990 by 2020.

The introduction of a fiscal-economic instrument such as a road vignette or an alternative system of duties can make an essential contribution to achieving the Kyoto objectives. Policy measures in favour of the climate can also result in important *secondary benefits* with regard to the rational use of energy and the use of natural resources, and can therefore also lead to important reductions of other polluting substances (fine particulates, emissions of sulphur). (Hopefully), the measures in the climate policy plan will take these secondary benefits into account.

[49] The European Council of the Environment ministers proposed "restricting the worldwide increase in temperature to 2 °C above the pre-industrial level" as a long-term objective (in 1996 and in 2005).

III. Recent studies

The paragraphs below summarise a number of recent studies. Therefore the conclusions that are shown should also be interpreted in the context of these studies and do not reflect a general conviction on the part of the Minaraad.

3.1. Peeters Advice and the Free University of Amsterdam: the Effectiveness and feasibility of an advanced mileage charge [50]

General principle for the mileage charge. A mileage charge allows for a complete variability in car costs, so that the actual use (and actual costs) incurred are taxed. By replacing the taxes on the purchase and the taxes on the ownership of cars with the mileage charge, the introduction of the mileage charge is a way of achieving variability in the costs of cars. Fixed costs are reduced while at the same time there is an increase in the variable costs of cars, so that the costs for the average driver remain the same. An advanced mileage charge makes it possible to accurately differentiate in terms of energy consumption, emissions, nuisance caused by noise, the lack of safety of traffic, driving behaviour and congestion. This differentiation has a positive effect on the environmental impact, traffic safety and accessibility. This is contrast with a system based on excise duties, which merely deals with the sales of fuel and therefore some emissions.

Technical calculation for the mileage charge. The study recommends the "in car" system which involves mounting an OBU (On Board Unit) in the cars in combination with a DSRC system [51] for the control. For reasons of privacy it is proposed that the collection of information is decentralised as far as possible and to make an independent organisation (company) responsible for the payments (with a prepaid chip card), the inspection, the control, the maintenance and the fitting of the equipment. Central registrations are only viewed when there is a case of possible fraud or clear errors in the registration. The system will only work in a way that obviously steers behaviour if sufficient information is given about the costs which are charged. This means that drivers can anticipate (the costs) and adapt their behaviour.

The study examined the effects (for the year 2008) of four different examples of advanced mileage charges for private cars. In all the versions the Dutch) MRB [52] (road tax) is abolished and incorporated in the mileage charge. The BPM [53] (purchase tax) is also incorporated in all the versions.
In some versions a purchase tax (BPM) is introduced depending on the fuel consumption of the car (BPM-V on the basis of the car's environmental performance). In version 4, there is an extra supplement to achieve certain environmental objectives. The mileage charge also compensates for the loss of income from excise duties.

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[50] Peeters Advice, Free University of Amsterdam. The effectiveness and feasibility of an advanced mileage charge. The Main Report. Foundation of Nature and the Environment, Amsterdam, September 2000, 96 pp.
[51] DSRC: Dedicated Short-Range Communication: the OBU in the car communicates with the portals by the road side by microwave.
[52] MRB: The Dutch vehicle tax, comparable to the Flemish road tax.
[53] BPM: Dutch purchase tax comparable to the Flemish purchase tax)

The rate is differentiated in terms of:

- real emissions and real energy consumption, in relation to vehicle characteristics and driving behaviour (speed and engine capacity);
- noise emissions in relation to the speed and dependent on the place and time in connection with the actual nuisance;
- the type of fuel;
- the lack of safety in traffic on the basis of the risk of accidents resulting from driving behaviour (driving speed);
- the time of day (peak versus non-peak traffic) on parts of routes that are sensitive to congestion.

The level of the rate depends on the entire or partial abolition of the BPM and the MRB. After all, the starting point is that the mileage charge is both budget neutral for the government (income from taxes and duties) and for the average driver (except for version IV).

The study compares the following versions:

- In *version I*, there is complete variation: both the BPM and the MRB are wholly replaced by the mileage charge and the income that is lost is compensated for by the rate of the charge. Therefore this version is budget neutral for government and for the average driver.
- In *version II,* the BPM is replaced by the variable BPM-V with an average level (approximately 2270 euros per car) equal to half of the present purchase tax. This version is also budget neutral. [54]
- In *version III*, this BPM-V has an average revenue of 0. The BPM-V is a bonus-malus system to encourage the purchase of cars with low fuel consumption. This means that the space for varying the costs of a car are fully used and at the same time an incentive is introduced to purchase cars with low fuel consumption. This version is also budget neutral.
- In *version IV,* an extra effective package of measures is drawn up for the environment, in which the budgetary neutrality for the government of the three other versions, has been abandoned at least as regards taxation on cars. The extra revenue is compensated by a reduction in other taxes.

The characteristics of the versions are summarised in table 5.

[54] All the sums are converted in euros: € 1=2.20371 Dutch guilders (source: http://mineco.fgov.be/euro archives/vademecum/3 nl.htm).
BPM -V: a BPM which is made dependent on the car's consumption.

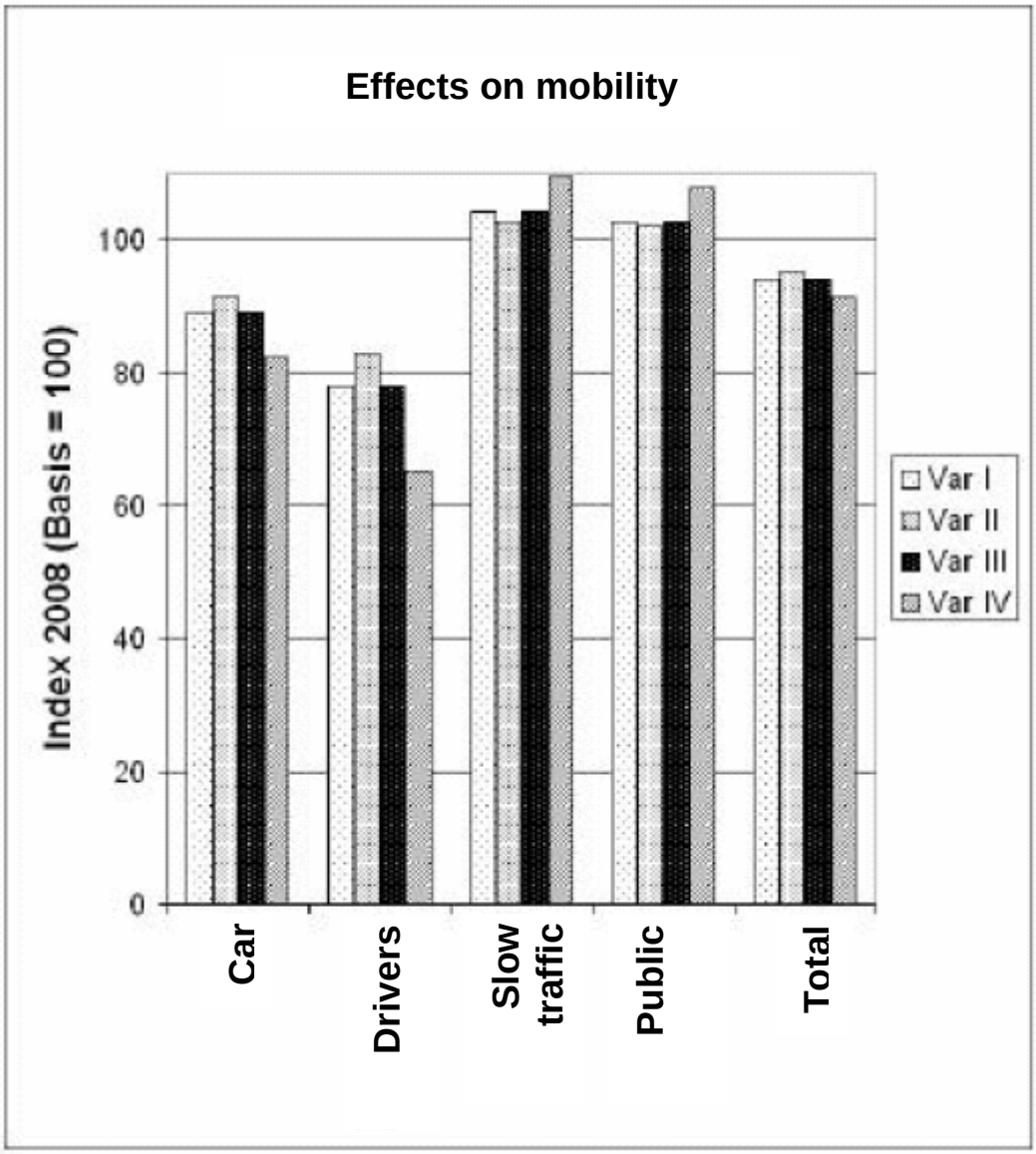
Table 5: *Summary of the versions – Study of Effectiveness and Feasibility of the advanced mileage tax (the Netherlands)*

	Version I	**Version II**	**Version III**	**Version IV**
Characterisation	'Total variability'	'Partial variability'	'Bonus-Malus BPM'	'Environmentally optimal'
BPM_V	no	yes	yes	yes
Average BPM_V (€/car)	Not applicable	Approximately 2270	0	Approximately 2270
OBU Costs	purchase price (i.e., a fixed cost)	purchase price	purchase price	Mileage tax (costs of incorporating OBU are funded by government and charged on in level of tax)
Budget neutral for government	yes	yes	yes	No

Source: Peeters Advice, Free University of Amsterdam (2000)

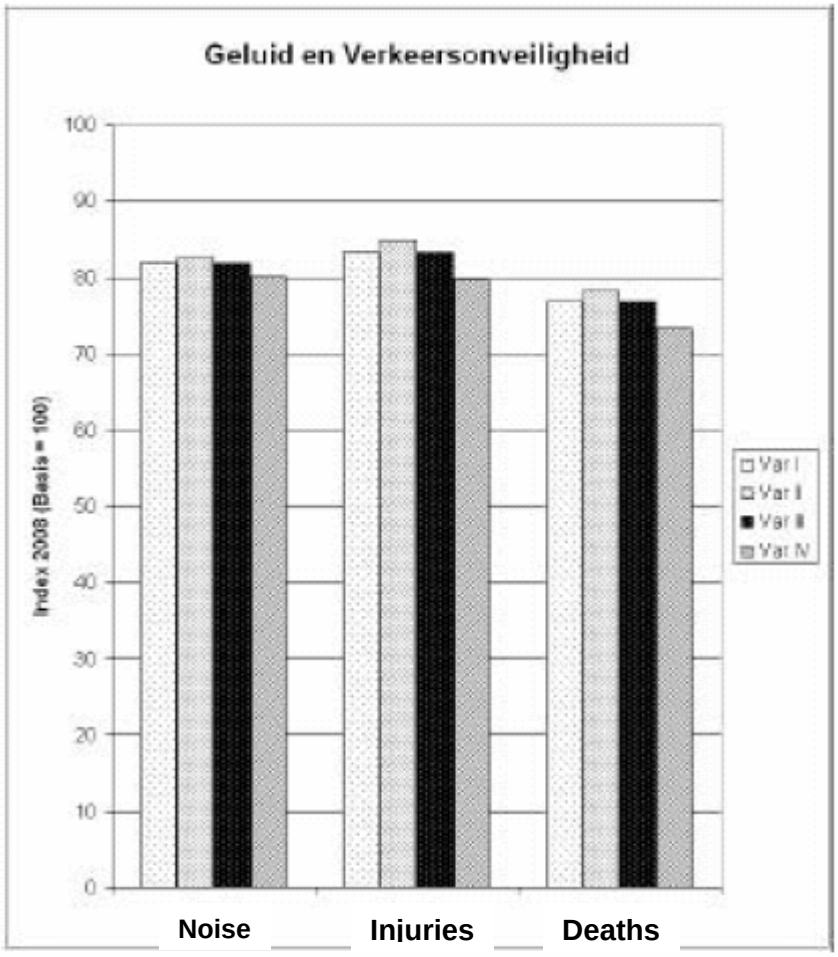
Research results. In all the versions **the number of cars** will increase. The greatest increase amounts to approximately 8% and occurs for versions I and III, where the fixed costs are lowest. However, **the total mobility (number of kilometres travelled) falls** in all the versions, in fact the total mobility involving cars is even significantly lower than in the basic scenario. The measure also promotes the use of slow traffic and public transport. The level of occupation of cars also increases. Therefore the mobility system becomes more efficient and sustainable (see figure 7). Appendix 2 shows the level of the costs for the four versions and reflects the structure of the fixed and variable costs for version II.

The four versions also have a **positive effect on nuisance caused by noise, and on the lack of safety in traffic** (see figure 8). All the versions lead to a reduction of approximately 20% of the number of victims of traffic (injuries and deaths). The nuisance caused by noise also falls by approximately 20% for all the versions.



Source: Peeters Advice, Free University of Amsterdam (2000)

***Figure 7**: Effects on mobility (kilometres travelled for the versions in 2008 (Basic scenario = 100).*



Source: Peeters Advice, Free University of Amsterdam (2000)

Figure 8: *Effects on the nuisance caused by noise and the lack of safety of traffic for the four versions in comparison to the basic scenario (index=100).*

The effects on emissions and energy consumption also depend on the fuel mix in the cars. In turn, this is dependent on the differentiation of the mileage charge, depending on the sort of fuel and any extra regulations in this respect (e.g. a system of licenses). In general it can be said that energy consumption can be reduced by 20-40% with the introduction of a mileage charge. For emissions reductions apply up to 70% for fine particulates (see appendix 3).

The effect on congestion depends first of all on the extent of differentiation of the mileage charge at times and in places that are sensitive to congestion, the possibility of anticipating this and the level to which drivers are prepared to anticipate this. Furthermore, the effect depends on the extent to which driving behaviour is influenced. A third effect which contributes to a reduction in the congestion concerns a decline in the growth of car traffic (compared to the basic scenario in 2008). It is to be expected that congestion will decrease significantly with the introduction of a mileage charge.

In general, the following conclusions can be drawn:

- all the versions of a differentiated mileage charge score better at the environmental levels that were examined than the present system. Depending on the sort of nuisance (and the extent of differentiation), a mileage charge can reduce environmental nuisance by 20% to 70%;
- the mileage charge will have a positive effect on congestion;
- the mileage charge contributes to a modal shift and a decline in the total number of kilometres travelled. The number of kilometres decreases by 10% to 20% in comparison to the current taxation system (in 2008) and the level of occupation increases;
- version II – partial variability – always has a lower score, version III and IV, respectively "bonus-malus BPM" and "environmentally optimal" always have the best results. Both at the level of mobility effects (greatest modal shift and greatest reduction in mobility as a whole), the reduction in nuisance caused by noise and the lack of safety in traffic, and at the level of a reduction in energy level and emissions (which applies for all the fuel mixes that were examined), these two versions have the highest score;
- The system is socially fairer as the polluter is confronted more directly with the costs that are incurred.

3.2. Quickscan study 2005

The "Quickscan road vignette study, final report April 2005" was commissioned by the Flemish Minister of Mobility, Van Brempt, and carried out by the Deloitte study bureau, and provides a summary of various relevant systems of taxation in different countries. However, the study does not come to any conclusions about the most desirable system for Flanders. After all, this depends on the objectives aimed for in the introduction of a system of taxes. In order to determine this, the study is now being subjected to a social debate. As the result of this debate will have important consequences on traffic, and on acceptable conditions and the environment, it is very important to consider the choices thoroughly.

The value of the Quickscan study. The study describes the position of the Eurovignette and possible types of tolls and charges, linked to their technical execution. As indicated above, a brief survey is also given of the various European initiatives and examples outside Europe. Finally, a number of decisive characteristics, peripheral conditions and restrictions are explained in relation to the Flemish situation: the dense road network, the relations between Flemish and federal competences, the margin of negotiation for pricing in the context of the EU directive, etc. The implementation possibilities of the various systems will have to be examined in more detail. Simulations of the effects of the systems on the possible diversion of flows of traffic are not yet available.

The Quickscan study comes to the following decisions:

- a system of tolls for trucks on the basis of the routes that are taken is feasible for Flanders. The technical support for this system is based on an OBU (On Board Unit), a GPS (Global Positioning System) or the tachograph, GSM communication and a number of beacons;
- for *private cars* it is recommended that in the first instance, *a fixed or variable system based on vignettes is introduced for the entire road network.* In that case,

the system for private cars would be time-related, in contrast with the system of tolls for trucks;
- urban tolls have positive effects on congestion, but are often not financially profitable.
- In the very short term it is feasible to introduce a fixed time-based toll vignette (for all vehicles), which will gradually be replaced by an electronic toll on motorways for trucks over 3.5 ton MTM (maximum permitted mass), based on the distance covered. However, it should be pointed out that this Czech system was introduced with the aim of creating extra revenue for the repairs of roads.

3.3. Nouwen Commission: Environmental effects, paying for mobility differently [55]

The impact research of toll systems on emissions of CO_2, NOx and fine particulate reveals that comparable versions of the intelligent mileage charge are the most environmentally efficient. The Environment and Nature Planning Bureau examined the environmental effects of ten possible versions of pricing policy for road traffic. Altogether the potentials for emission reduction of the 12 (sub) versions were compared with a reference scenario for the emissions of **CO_2, NO_x and fine particulates** (PM_{10}). The results are expressed in percentage and absolute changes in comparison to the emissions in the reference scenario for the year 2020.

Appendix 4 gives a summary of the research results. The study shows that the versions 1A 'partial variability', 1B 'total variability', and 5 'variability + congestion charge' are always amongst the versions with the best scores at every level. These versions of mileage charges lead to the greatest reduction in vehicle kilometres (freight and private traffic) and the greatest decline in CO_2, NO_x and fine particulate emissions.

Therefore the study concludes that a variability of the fixed taxation on cars by means of a mileage charge can lead to the most significant environmental gain, depending on how this is designed. The differentiation in rates should preferably be expressed very strongly and should be dependent on the type of fuel, weight and the price of the new vehicle. This results in a decline in car mobility and congestion and furthermore the environmental performances improve for CO_2, NO_x and fine particulates for every kilometre driven. For the most extensive variability (version 1B) the following environmental gains can be expected on average:

- CO_2: approximately 2.8 Mton less CO_2 emissions than in the reference scenario, or 10% gain;
- NO_x: approximately 14.8 kton or 42% gain compared to the reference scenario;
- fine particulates: approximately 1.3 kton PM_{10} less or 23% gain compared to the reference scenario.

[55] Environment and Nature Planning Bureau (Geurs, K.T. van den Brink, R.M.M.) Environmental effects, Paying differently for Mobility, MAP Environment, the Netherlands, May 2005, 57 pp.

In all the variability versions it is particularly the social and recreational traffic that declines. This is extremely sensitive to higher car costs. Traffic from home to work responds much less to the variability and business traffic responds hardly at all.

Environmental gains are less pronounced in a "more level" differentiation for the mileage charge, for variability in fuel excise duties and for congestion tolls. A "more level" rating system leads to less pronounced environmental gains, as the share of diesel engines will increase and consequently the environmental performances of cars (for NO_x) will fall.

A **variability of fuel excise duties** leads to a smaller decline in car mobility but does result in a strong reduction in CO_2. The NO_x and PM_{10} emissions of road traffic decline to a limited extent (3-4%). Consumers are encouraged to drive less wastefully and to purchase more economical cars. However, the study did not take into account the expectation that without additional measures, part of this environmental gain (approximately 1-2% points) will "leak away", because drivers will tend to start buying fuel abroad. In addition, the use of diesel cars could start to increase greatly, particularly in border areas. This could lead to a deterioration of the air quality in larger cities in the border area.

The effect of **congestion tolls** on emissions and air quality is small. The pricing versions with congestion charges that were examined in specific locations during the peak for road traffic (congestion charges and charges at particular places) lead to rather limited environmental gains on a national scale (0-5% decrease in CO_2, NO_x and PM_{10} emissions). It is not expected that these sorts of charges will lead to a great improvement of the quality of air along the motorways in the short term (2010) or in the longer term (2020). The environmental gain is limited because road transport barely responds to the congestion charges and because the emission of freight traffic – for which time is particularly an important factor – is dominant in the quality of the air by the motorways. Thus, one of the consequences of a congestion charge is also that if there is an improvement in the flow of traffic in congestion sites, the space that is made available on the road network (by a change) in the choice of routes will be partly taken up by freight traffic, which can wholly cancel out the environmental gains at a local level.

The introduction of a **mileage charge for heavy freight traffic** will particularly lead to a decline in emissions and an improvement of the air quality in the short term. The introduction of a mileage charge differentiated in terms of environmental categories for heavy freight traffic on the network of main roads (in accordance with the current charges for heavy freight traffic in Germany) will lead to an accelerated shift towards cleaner freight trucks in the short term (2010), and therefore in a reduction in emissions and an improvement in the air quality by the motorways. However, the introduction of a differentiated charge based on the current environmental categories will have limited effects in the long term, as almost the entire fleet of trucks will comply with the strictest environmental category (Euro 5 norms) by 2020, even without a mileage charge. Therefore a further (stricter) differentiation will be necessary in order to achieve a stronger reduction in emissions with the mileage charge in 2020 (the need for Euro 6 norms). In addition, the decline in CO_2 and NO_x emissions will partly be compensated and the decline in PM_{10}emissions will wholly be compensated by an increase in emissions from inland shipping and the railways, because of the expected modal shift resulting from the introduction of the mileage charge.

3.4. VKW Meteina (Bruno De Borger): Mobility, pay-as-you-drive and the pricing structure in the transport sector [56]

In a sustainable policy mix, a strongly differentiated form of pay-as-you-drive is essential. Drastic reforms of the prices and taxes in the transport sector are necessary to respond to the subsidiary effects of transport (congestion, pollution, accidents). The comparison of the social costs and the existing transport costs reveal that during the peak hours, road transport is "subsidised". Therefore there is an argument for introducing strongly differentiated pay-as-you-drive in the long term, depending on the traffic congestion and the environmental nuisance. In fact, this is the only policy instrument which directly and efficiently responds to the problems of congestion, as it entails a better pricing system for mobility. By introducing a charge, the flow of traffic is reduced to the desired level (from the economic point of view), so that only the mobility for which people are prepared to cover the entire social costs takes place. In order to be successful, two conditions must be met.

- pay-as-you-drive must be incorporated in a total package of measures, with sufficient attention to public transport, the interests of commuters, traffic safety etc. Acceptable alternatives must be provided for those who are "priced off the road" by the mileage charge. Many of the "soft" proposals for improved mobility (better cycle paths, company transport plans, better information provision, improved public transport, etc.) have hardly any effect on the traffic congestion without pay-as-you-drive, but they are suitable as complementary measures;
- the government will have to specify the use of the revenue for the population, or the political and social acceptability of the system will be difficult. On average, the individual extra charges will be higher than the fall in private costs resulting from reduced congestion (in other words the individual value assigned to time). Therefore the revenue of the government arising from the mileage charge must be used to finance measures which are popular with the drivers who are taxed: better infrastructure, public transport alternatives, less income tax.

A general introduction on the entire road network seems difficult to achieve in the short term. However, a number of **transitional steps** can be made relatively quickly and will still have very favourable effects.

1. **Variability in the taxes** has a positive effect, although this is only limited in comparison to pay-as-you-drive in the long term. The variability relates to opposing the increased use of diesel vehicles by increasing the tax on the use of diesel, increasing the general tax on use with a differentiation between peak hours and off-peak hours in combination with a reduction in the tax on car ownership.
2. **Cordon pricing has a great potential for the improvement of mobility in cities and for the urban environment**. The favourable effects can be greatly increased further if they are supplemented with a far-reaching revision of the parking policy (by charging the real costs of parking), and with a carefully considered delineation of paying zones The influence also increases noticeably when there is a double cordon.

[56] De Borger, B., Mobility, driving on account and the pricing structure in the transport sector. 2005, Wilrijk, VKW, Think tank, 47 pp.

3. **Large-scale subsidies for making public transport "free of charge"** (or drastically reducing the price) **is certainly not an acceptable alternative**, amongst other things, because of the limited price sensitivity of car traffic to lower rates in public transport. Furthermore, it is necessary to take into account the costs related to funding subsidies for public transport. A well-designed system of public transport for affordable prices is necessary if pay-as-you-drive is introduced in the long term.
4. **The rapid introduction of the mileage charge for freight traffic** is admittedly a limited and a rough measure, but it does have predominantly positive effects, particularly if the revenue is used to improve employment. Given that other countries are working on this system, the policy advice is for the mileage charge on freight transport to be introduced as quickly as possible. The mileage charge can replace the Eurovignette and fixed road tax, and could aim to cover all the social costs which are not covered by the diesel excise duty. In addition, foreign transport is also taxed. Preferably the charge should differentiate between peak hours and off-peak hours. It could even be justified to charge more than Germany. The problems of congestion, the risks of accidents and pollution are, after all, higher in small, densely populated countries.

The partial introduction of pay-as-you-drive can have a positive effect. The arguments of critics against a partial introduction of pay-as-you-drive (on part of the road network) should be taken seriously. It is necessary to examine the concrete implementation in order to find out whether a partial introduction would be effective. After all, it is the characteristics of alternative roads, the quality of public transport, time savings on congested roads, the size of the planned charge, etc. which determine to what extent traffic taking alternative routes and extra accidents (on the alternative roads) can be expected. However, foreign literature shows that the introduction of pay-as-you-drive continues to be an effective measure on specific parts of the network in extremely diverse circumstances, even taking into account the negative subsidiary effects mentioned above. *However, this conclusion cannot be transposed to the Belgian situation.*

It has been demonstrated that the **close links between traffic congestion, traffic from home to work and the labour market** are not in themselves a convincing argument against pay-as-you-drive. The relationship between congestion charges and the labour market is extremely complex. There are arguments for permitting a partial reduction for commuters, but these are as much due to the excessively high tax on labour in Belgium, as to the characteristics of commuting in itself. Deducting the costs of commuting by car can only be justified if the government introduces pay-as-you-drive.

The argument that policy must be coordinated at the European level cannot be used as an excuse not to introduce mileage charges or pay-as-you-drive in Belgium: charging external costs in Belgium without any European coordination would be much less harmful than not charging the external costs or not taxing transit traffic.

The socially divisive consequences of a mileage charge can only be assessed if the use of the revenue is also taken into account. Mayeres and Proost [57] examined the socially divisive effect of a mileage charge which was budget neutral for the government for two scenarios, viz. spending the revenue in order to reduce the tax on employment and spending the

[57] Mayeres, I., Proost, S, Reforming transport pricing: an economist' perspective on equity, efficiency and acceptability, KUL-CES, 2003.

revenue to fund an increase in the expenditure on social security (cf. infra).

The study suggests that an **intelligent use of the revenue (for social security in order to promote employment by means of lower taxes on employment) certainly gives possibilities to make the system acceptable from the point of view of social divisions as well.** After all, the revenue aspect must be taken into account. Furthermore, the study points out that there is not a single economic argument to merely invest the revenue only in road traffic.

The fear of transport poverty is doubtful if the introduction of a mileage charge is linked to a good development of public transport. There should be a comparison between the current transport poverty (as a result of congestion and inappropriate public transport) and the future situation in which congestion has declined and the provisions of public transport will increase because of the expenditure of the revenue.

3.5. Mayeres and Proost (CES-KU Leuven): Reforming transport pricing: an economist's perspective on equity, efficiency and acceptability [58]

The study shows that from an economic point of view, charging the marginal social external costs of transport leads to greater efficiency and consequently greater welfare if the expenditure of the revenue is taken into account. The gains in welfare are expressed in €/(person x year) and varies from € 140 to 180/person/year (see appendix 5). The marginal social costs are equal to the marginal costs for the use of raw materials and the marginal external costs for congestion, air pollution, accidents and damage to the road network. Charging the marginal social external costs creates surplus revenue which can be spent in two different ways: on the one hand, in order to reduce the tax on employment, and on the other hand, in order to be able to pay a higher social security.

On the basis of a CGE [59] model, it is possible to compare the consequences of charging on the marginal social external costs against a reference scenario, viz. the Belgian situation in 1990. [60] Policy reforms (in particular, price reforms to charge for the marginal social external costs) in both scenarios result in a similar change in the pricing per person kilometre or per ton kilometre. The price of transport increases and this is greatest for diesel cars during the peak hours, for the use of public transport during the off-peak hours and for freight traffic during the peak hours. On the other hand, there is a great decline in the demand for transport. The strongest decline occurs for private cars during the peak hours (approximately -14%) and for the use of buses, trams or the metro during the slow hours (approximately - 20%). On the basis of these data it may be said that there is a net loss of consumer surplus for almost all modes of transport and that this system will therefore not be accepted. However, the advantages of the reduced external costs and the expenditure of the extra revenue must also be taken into account. Taking into account the socially divisive effects leads to the following conclusion:

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[58] Mayeres, I., Proost, S, Reforming transport pricing: an economist' perspective on equity, efficiency and acceptability, KUL-CES, 2003.

[59] CGE model: Computable General Equilibrium model for Belgium (for further information, see Mayeres (1999, 2000).

[60] The emission characteristics of the different modes of transport of 2000 were taken into account but not those of 1990.

- the first scenario results in unequal divisive effects: the lowest and highest income classes benefit, the middle class loses out. The highest class has the greatest gain in welfare as this class benefits most from a reduction in the congestion and a reduction in the tax on employment;
- the second scenario has strong positive effects for the lowest income classes and negative effects for the richest class. The second scenario reveals a less proportional gain in welfare between the different social classes and is most advantageous for the economically weaker class. For the highest class there is a decline at the level of welfare.

The study suggests that an intelligent use of the revenue (for social security or to promote employment by means of lower taxes on labour), certainly does provide opportunities for making the system acceptable, also from the point of view of social division. After all, the revenue aspect must be taken into account. Appendix 5 shows some of the results of the study.

3.6. INFRAS: External costs of transport – update study 2004 [61]

The study focuses on research on the external costs of transport. The study concludes that the following actions must be taken in order to internalise the external costs correctly:

- in Europe, a charge must be introduced for heavy freight traffic on the basis of the distance that is covered. It is appropriate that the tax is not merely applied on motorways, but that the system should be extended to cover a larger or even the complete network. The external costs not only have to take into account the costs of accidents, but also the costs of environmental damage such as air pollution, nuisance caused by noise and climate change;
- for private traffic, a tax should be introduced in urban areas in the first place, focusing on a better use of the road capacity. A differentiation on the basis of the environmental characteristics of the vehicles is desirable;
- the pricing policy for fuels should be adapted in Europe – for all types of transport – in order to meet the demands of a climate strategy in the long term;
- in addition, subsidiary measures should be introduced in order to increase the efficiency of transport: for example, multimodal information systems, high tech "road management", an environmentally friendly and safe style of driving, supported by measures to restrict speed (tightening up on speed restrictions,…).
- (…)

These various instruments for the internalisation of external costs must be supported by a multimodal strategy containing the following basic elements:

- multimodal financial funds, (partly) funded by the tax for the internalisation of the external costs in the transport sector;
- the internalisation of external costs for accidents and of external environmental costs should be made a priority.

[61] INFRAS, IWW (C. Schreyer, C. Schneider, M. Maibach, Professor W. Rothengatter, C. Doll, David Schmedding). External costs of transport update study. October 2004. IWW, University of Karlsruhe and INFRAS. International Railway Union. 169 pp.

3.7. T&E (European Federation for Transport and Environment): Paying Properly, not Paying differently [62]

T&E proposes that in order to achieve a more sustainable mobility, car taxes must be reformed, and Not only by relating them to the CO_2 emissions (as proposed by the European Commission). [63] T&E argues for reforming the taxes in such a way that they comprise two components. On the one hand, the effective use must be taxed and on the other hand, car ownership must continue to be taxed. The tax on use should be based on the emissions, the tax on car ownership should reflect the space claimed by road transport (T&E considers the use of space by motorised traffic in the specific region or city where the car is registered and used and relates this to the percentage of territory reserved for motorised individual transport). This leads towards car-pooling and car-sharing.

3.8. Conclusion of studies

The various studies provide a number of important elements for determining and developing a Flemish system of taxes. These are summarised in table 6. However, the studies have different perspectives. The results should always be seen in the light of the research. The figures/percentages that are presented are only given by way of example (so that a comparison can be made, but cannot be (wholly) compared with each other). For example, the study of the Nouwen Commission worked with the results for the year 2020, the study of the Free University of Amsterdam and the Peeters Bureau uses the results for 2008.

[62] T&E (European Federation for Transport and Environment): Paying Properly, not paying differently. Towards a taxation of passenger cars that addresses both car ownership and usership. October 2002. 2 pp.

[63] See chapter 2.1. The European context, p. 28.

Table 6: *Summary of the effects of different systems of taxation (for Flanders)*

	SYSTEM	GENERAL EFFECT/COMMENTS	MOBILITY					ENVIRONMENT		
			Decline in vehicle km (cars and/or freight traffic)	**Congestion**	**Modal shift**	**Traffic victims**	**Noise**	**CO_2**	**NO_x**	**PM_{10}**
Variability in fuel excise duties	**Budget neutral variability through fuel excise duties with exemption for freight transport (version 9)**	- Slight reduction in traffic; - incentive for non-wasteful driving behaviour and low consumption cars; - extra subsidiary effects: "filling up abroad" & increase in the share of diesel cars in the border area **Therefore poorer air quality in border towns (which will certainly apply for the Flemish situation).**	- 1% compared to basic scenario	*no influence on behaviour*	*no influence on behaviour*	*no influence on behaviour, slight decline in traffic, therefore, also slight decline in victims of traffic*	*slight*	strong decline (approximately -20%)	slight decline (approximately -10%)	slight decline (approximately -10%)
	General increase in excise duties on fuel **(comparable with version 10)**	Slight because of the large degree of elasticity in behaviour and car usership in relation to the price of fuels. Also take into account "leakage" abroad (filling up in other countries)	slight: - 1% (price increase of 33 % would lead to a decline of 9,34%) [64]	*no influence on behaviour*	*no influence on behaviour*	*no influence on behaviour*	*Dependent on decline in traffic*	*Dependent on decline in traffic and effect on all vehicles (more diesel cars, LPG, …)* In version 10: almost no decline in these emissions		

[64] See Flanders mobility plan (calculation by BBL). N.B. The fall in the use of petrol and diesel as a result of the higher prices which were noted during the first half of 2006 (approximately -11%), should also be partly attributed to a fall in the number of Dutch people filling up their cars in Belgium. (Therefore the fall will be smaller than 11%.) Furthermore, it is necessary to wait and see whether this is a temporary phenomenon.

Corridor	**Introduction of 'péage'-system (corridor duty based on distance)**	NOT FEASIBLE BECAUSE OF THE DENSITY OF THE ROAD NETWORK IN FLANDERS								
	Tolls on newly constructed road sections (distance based) **(version 4)**	A large-scale increase in capacity of the road infrastructure will continue to promote the growth of car traffic. Furthermore, this tax has almost no effect on a regional scale, the tax only works locally. **Therefore the introduction of this type is not efficient**: traffic increases and consequently the negative effects of mobility and effects on the environment will also increase.	increase in traffic (+1%)	will increase	*no influence on behaviour*	*+ 1%*	*increase*	+ 1%	+ 1%	+ 1%
Cordon or zone toll	**Urban tolls.** **(cf. static duty on staying) (version 7)**	Positive (temporary) effect on congestion BUT often not financially feasible. Furthermore, this tax has almost no effect at a regional level, the tax only works at the **local level**.	-2%	*only local effect*	*only local effect*	*only local effect*	*only local effect*	(approx.) - 2%	(approx.) .) -2%	(approx.) -2%
	Duty on passing during peak hour at one point (cordon	A tax on staying (such as this one) has almost no effect at the regional level, the tax only works at the	-2%	*only local effect*	*only local effect*	*only local effect*	*only local effect*	approximately-2%	approximately -2%	approximately -2%

		toll or ring round city). **(version 6)**	**local level**.								
MILEAGE	**Limited form of mileage charge**	**Congestion charge during peak hours for every km driven (both fixed sum and depending on actual congestion, on main road network and subsidiary road network where there is a congestion problem.** **(version 8)**	- Positive: reducing distances from home to work; - negative: however, business traffic increases because of the increased accessibility, social-recreational traffic is affected less; - increase in the level of use. .	- 4%	*limited*	*Modal shift* towards railways and inland shipping			approximately - 4 - 5%	approximately - 4 - 5%	approximately -4 to 5%
		Mileage charge for heavy freight traffic, differentiated by environmental class of vehicle **(version 3)**	Short-term: reduction in emissions but increased shift towards cleaner trucks (which could also be expected without this measure); Long-term: positive effects on air quality are removed by a *modal shift* towards "more polluting" inland navigation and railways; In the short term, a mileage charge for all freight traffic could be useful as a transition towards a general mileage charge.	**no reduction**					- 3%	- 3%	- 1%
	Partial variability MRB and BPM	**Advanced mileage charge** **Version 1A (complete variability MRB and only a quarter variability BPM).**		- 11%	Yes				approximately - 10%	approximately - 30%	approximately - 16%

		Comparable to version II 'partial variability'.	Level of occupation of cars is increased: car pooling is promoted	- 8%	Yes	yes: smallest	-15% injuries - 22% fatalities	- 18%	-28%	- 31%	- 28%

MILEAGE CHARGES	**Complete variability MRB and BPM**	**Advanced mileage charge.** **Version 1B (complete variability MRB and BPM).**		-16%	Yes	yes			approximately - 14%	approximately - 42%	approximately - 23%
		Comparable to Version I 'complete variability'.		- 11%	Yes	yes: average	- 17% injuries - 23% fatalities	- 19%	-27%	- 30%	-27%
		'Hofstra' version: comparable to complete variability (1B), but less pronounced differentiation: only differentiation by type of fuel and weight of vehicle. **(version 2)**	A less pronounced differentiation than in the current taxation regime results in a smaller environmental gain and will even lead to greater NO_x emissions. The environmental gains in themselves depend on the increase in the share of diesel.	- 15%					approximately - 19%	approximately + 10 (to + 20%)	approximately 9%
		Advanced mileage charge. **(comparable to 1B: complete variability') + extra incentive for purchase of cleaner cars.** **(= version III bonus-malus)**		- 11%	Yes	yes: average	- 17% injuries - 23% fatalities	- 19 %	- 32%	- 35%	- 32%
	NO budget neutral mileage	**Differentiated mileage charge)** **+ congestion charge.** **(version 5= 1A + 8A)**		- 13%					approximately - 13%	approximately - 32%	approximately - 19%

		Comparable to the differentiated mileage charge + extra environment supplement		- 18%	yes	Yes: largest	- 20% injuries - 26% fatalities	- 20%	- 43%	- 45%	- 43%

Explanation of table

- ST: Short-term, LT: Long- term

- Versions I to IV refer to the study: “Effectiveness and Feasibility of an Advanced Mileage Charge” (2000). This study was carried out only for passenger cars and therefore there was no estimate of freight transport! For the versions in this study, an estimate is given of the relative effect on congestion in the study (cf. in table 6: average, smallest, greatest).

- Versions 1-9 refer to the study: “Environmental effects. Paying differently for Mobility” (2005).

- The systems marked in grey are not applicable to the Flemish situation or will not be useful. The reason is outlined in the table.

- Text in italics: No figures available. Indicated on the basis of an estimate of the effects.

Comments

Comment 1: the emission reductions for versions I, II, II and IV were considered with the current fuel mix (BM1). For NO_x and PM_{10}, greater reductions can be achieved in every case with a different distribution of the fuel mix in cars. For CO_2, similar or slightly less favourable effects are achieved with other distributions of the fuel mix.

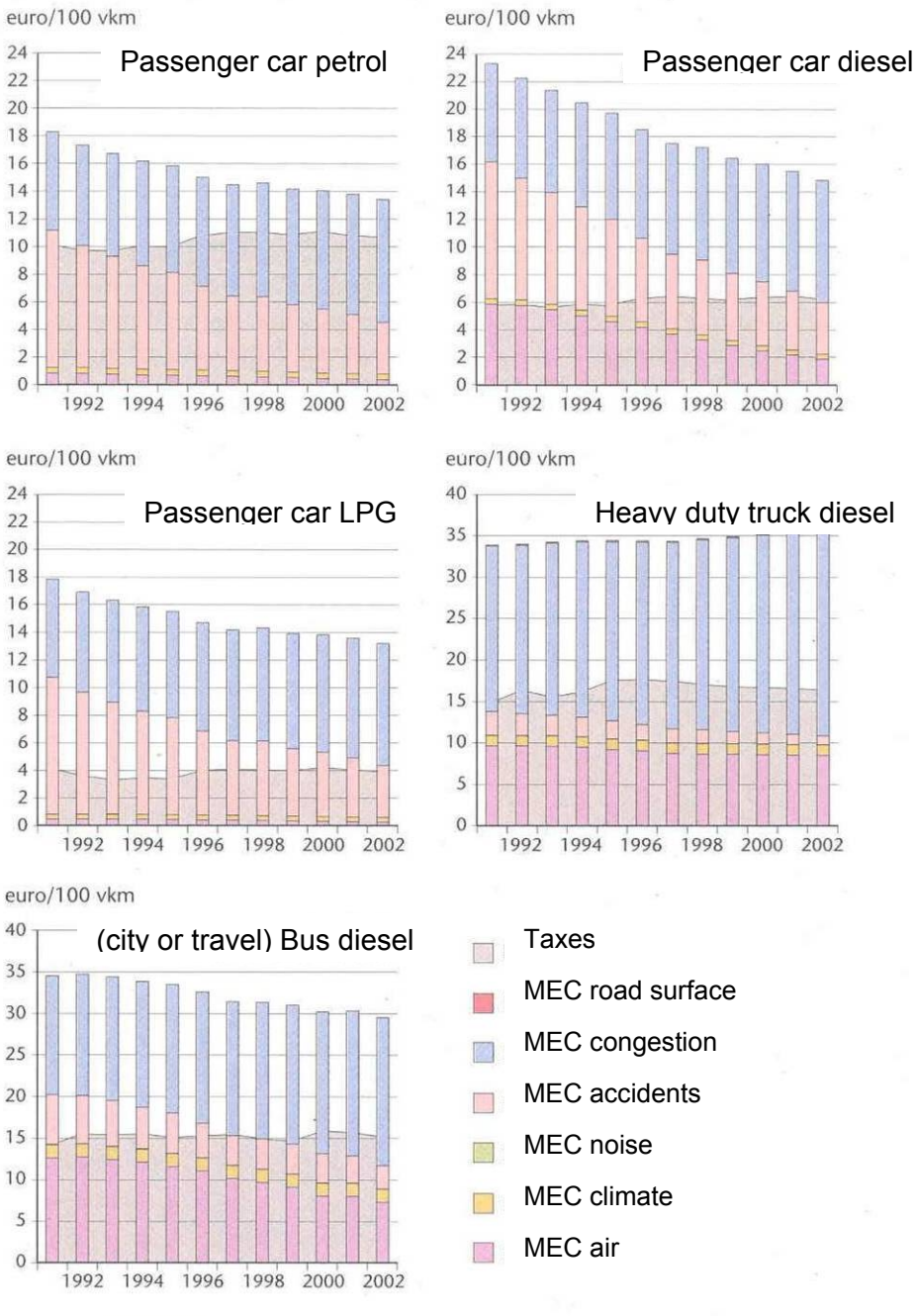
Comment 2: the percentages indicated for versions I to IV are estimates on the basis of graphs. The exact figures are not always given in the text. It is possible that there is a small error in the estimates. However, the order of size and the relations between the versions are always realistic.

Comment 3: the figures for emissions in the study: “Environmental effects. Paying differently for Mobility” sometimes vary for car traffic and freight traffic. In that case the table indicated an “approximate” figure and reference is made to the figures in the text or the figure for car traffic is given (so that the results can be compared more effectively with the study of the University of Amsterdam & Peeters). For car traffic, the “middle” column was looked at in every case (cf. table in appendix 4).

Conclusion. This table clearly shows that the introduction of a mileage charge is the most efficient method, on the one hand, to achieve a reduction in the total road traffic and on the other hand, to also achieve a significant environmental gain compared to the basic scenarios. The Dutch studies also indicate the social justice of an advanced mileage charge and the steering effect on behaviour towards a modal shift and towards safer and more viable traffic. A stronger variability in the mileage charge leads to the best results at every level. The revenue must be spent wisely in order to increase the acceptability. Expenditure on social security or on the reduction of the tax on labour is acceptable, amongst other things.

Appendix 1: Marginal external costs (MEC versus taxes) for five types of vehicles (Flanders 1991-2002).

Source: Mira-T 2003, VMM, p. 433. (source: De Ceuster, 2003; MEC climate and MEC atmosphere come from VITO).



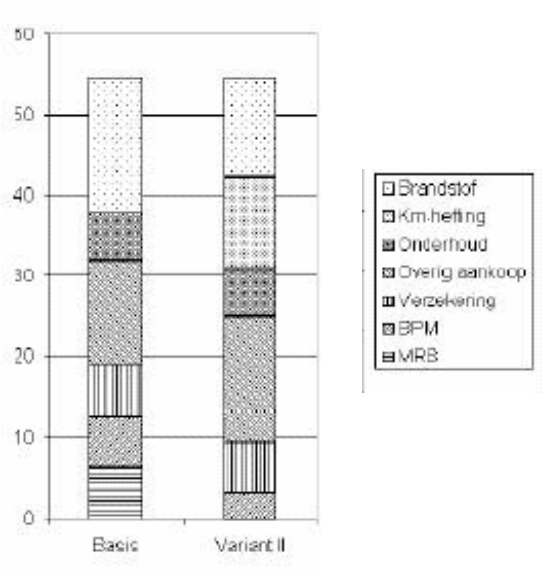
Appendix 2: Size of the intelligent mileage charge: a few figures

The research at the Free University of Amsterdam [65] drew up the figures for the Dutch situation of a budget neutral introduction of a mileage charge, with a variability of the car costs. The table below provides a comparison of the size of the tax for the different versions. The figure shows the structure of the car costs for the Dutch situation: for version II. In 2008, one car kilometre that is driven would cost approximately 0.7 former Dutch guilders or € 0.32.

***Table*:** Summary of the total costs or the total costs for an average car

Costs	Unit	1998	Version			
			I	II	III	IV
Mileage charge (average)	€/km	0.00	0.09	0.06	0.09	0.12
Costs per vehicle per year	€/veh/km	3863.94	3569.89	3661.55	3569.89	3767.28
Costs per vehicle kilometre	€/km	0.25	0.33	0.31	0.33	0.40
Total costs of driving	Billion €/jaar	24.77	24.74	24.78	24.74	25.40

Structure of car costs, total per year in 2008 (in billion Dutch guilders per year)



Structure of car costs per vehicle kilometre in 2008 (in guilders per kilometre)

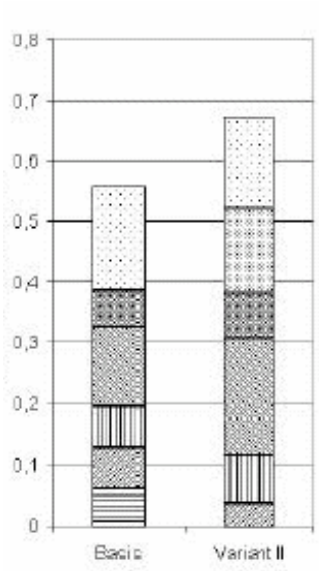


Figure: Structure of the car costs: variability of the costs with a mileage charge

[65] The research was commissioned by the foundation for nature and the environment and carried out by the Free university of Amsterdam and the Peeters Advise bureau. The Economic and Social Institute of the Free University (2000): "Effectiveness and feasibility of an advanced mileage tax", main report commissioned by the Nature and Environment Foundation.

Appendix 3: Reduction in energy use and CO_2, NO_x, fine particulates, PAKS and VOS with the introduction of an intelligent mileage tax: some figures. [66]

The effects on emissions and energy use also depend on the fuel mix, and this in turn depends on the differentiation of the mileage charge depending on the fuel mix and any additional regulations in this field (for example, in the form of a system of permits). In order to show the **influence of the fuel mix,** the results of the following sub-versions are given in the figure below:

- BM1. The mileage charge is chosen in such a way that the current share of diesel and LPG, accounting for 20% and 11% of mileage respectively, are maintained.
- BM2. The mileage charge for diesel and LPG are chosen in such a way that the total fuel costs plus mileage charge become equal to those of petrol, so that diesel and LPG will largely disappear.
- BM3. The mileage charge is chosen in such a way that diesel disappears and LPG maintains its current share of 11% of the mileage.
- BM4. The mileage charge is chosen in such a way that diesel disappears entirely and LPG takes over the share of diesel, thus accounting for a total share of 31% of the mileage.

For some emissions the abolition of diesel vehicles is very advantageous. However, energy use and the emissions of CO_2 and VOS (volatile organic substances, including evaporation) will increase slightly. Replacing the current share of diesel by LPG on balance results in the lowest environmental effect: energy use and emissions of CO_2 and VOS only go up a few percentage points in comparison with cars with the current mix, while the other emissions were decreased significantly. However, the (current) supply of LPG is rather limited. Therefore LPG will not be able to replace all fuels.

[66] Peeters Advice, Free University of Amsterdam. The effectiveness and feasibility of an advanced mileage charge. The Main Report. Foundation of Nature and the Environment, Amsterdam, September 2000, 96 pp.

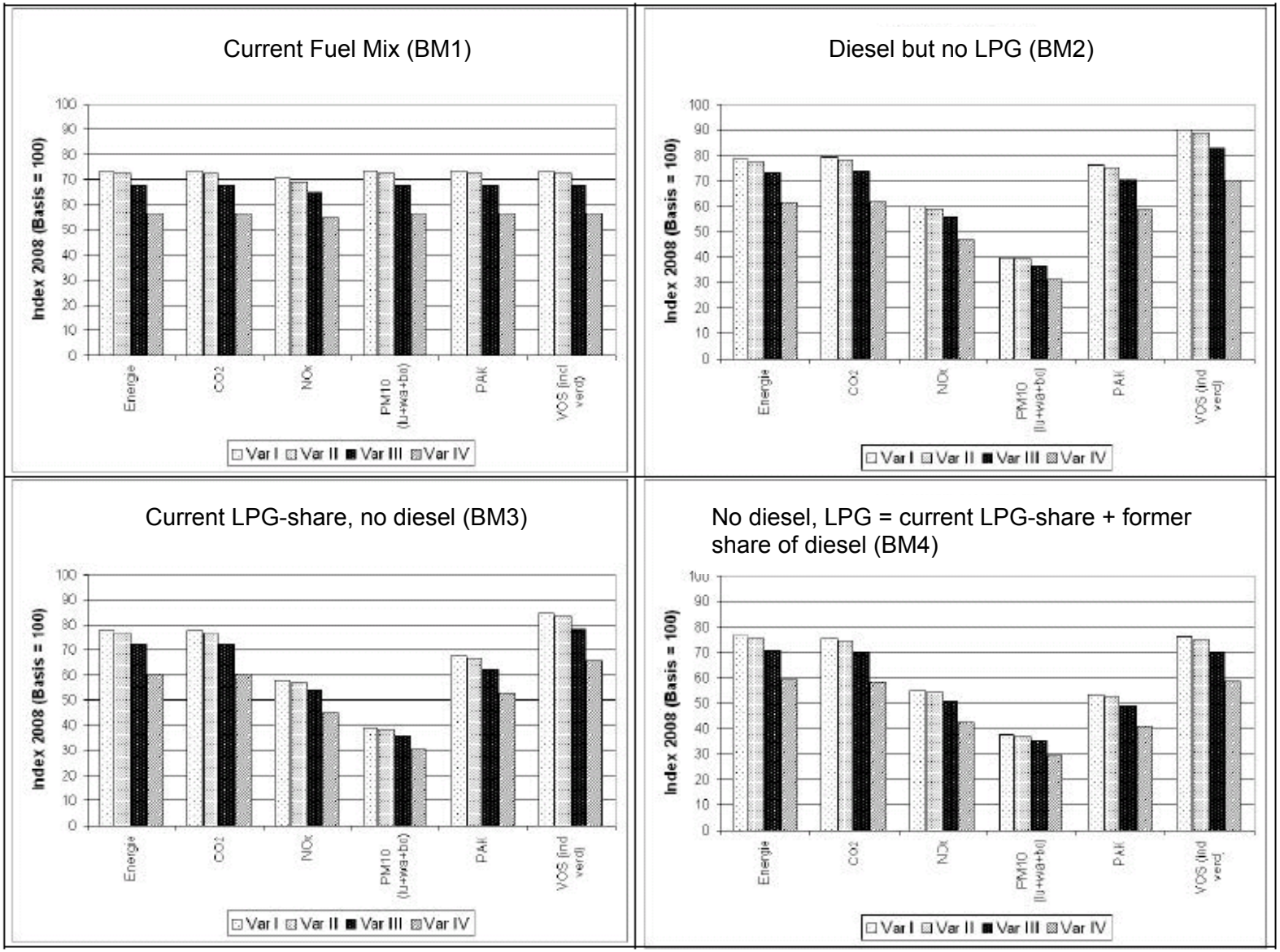


Figure: *Effects of the four versions on the environment (index 100 = basic scenario for 2008)*

Source: Free University of Amsterdam and Peeters Advice bureau (2000)

Appendix 4: Summary of effects of versions 'Paying differently for mobility' on emissions from road traffic in 2020 in comparison with the reference version

The research results of the twelve (sub)versions of the study, 'Paying differently for mobility' are shown below.

Table: *Summary of effects of versions 'Paying differently for mobility' on emissions of road traffic in 2020 in comparison with the reference version (index: reference 2020 = 100)*

	CO2				NOx				PM10			
	Car			Truck	Car			Truck	Car			Truck
	low	medium	high		low	medium	high		low	medium	high	
0 Reference	-	100	-	100	-	100	-	100	-	100	-	100
0B ref. without Construction	-	96	-	100	-	96	-	100	-	96	-	100
0C ref. with ambiteus Construction	-	101	-	100	-	101	-	100	-	101	-	100
1A MRB + ¼ BPM	91	90	89	100	58	70	80	100	80	84	87	100
1B MRB + BPM	88	86	84	100	37	58	80	100	71	77	83	100
2 Hofstra version	82	81	80	100	98	110	121	100	87	91	94	100
3 Mileage charge for freight *	-	100	-	97	-	100	-	97	-	100	-	99
4 toll version	-	101	-	100	-	101	-	100	-	101	-	100
5 variabilisation MRB + cong. Charge	88	87	87	100	56	68	78	100	78	81	84	100
6A Toll cordons	-	98	-	100	-	98	-	100	-	98	-	100
7 charge for staying	-	98	-	100	-	98	-	100	-	98	-	100
8A static congestion charge	-	95	-	100	-	95	-	100	-	95	-	100
8B dynamic cong. Charge	-	96	-	100	-	96	-	100	-	96	-	100
9 variable excise duty	81	75	77	100	80	91	102	100	91	94	97	100
10A excise duty	-	96	-	100	-	99	-	100	-	99	-	100
10B excise duty + 0C	-	97	-	100	-	100	-	100	-	100	-	100

Table 5.3: Absolute effects of versions 'Paying differently for mobility' on total emissions of road traffic in 2020, in comparison with the reference version in 2020

	CO_2 (Mton)			NO_x (kton)			PM_{10} (kton)		
	low	medium	high	low	medium	high	low	medium	high
0 Reference	-	0,0	-	-	0,0	-	-	0,0	-
0B ref. without Construction	-	-0,9	-	-	-1,8	-	-	-0,3	-
0C ref. with ambiteus Construction	-	0,2	-	-	0,5	-	-	0,1	-
1A MRB + ¼ BPM	-1,8	-1,9	-2,1	-14,7	-10,6	-6,9	-1,1	-0,9	-0,7
1B MRB + BPM	-2,4	-2,8	-3,2	-22,3	-14,8	-7,3	-1,6	-1,3	-1,0
2 Hofstra version	-3,5	-3,7	-3,9	-1,0	3,4	7,2	-0,7	-0,5	-0,4
3 Mileage charge for freight *	-	-0,4	-	-	-0,7	-	-	0,0	-
4 toll version	-	0,1	-	-	0,1	-	-	0,0	-
5 variabilisation MRB + cong. Charge	-1,9	-2,1	-2,3	-14,8	-10,8	-7,3	-1,2	-1,0	-0,8
6A Toll cordons	-	-0,3	-	-	-0,6	-	-	-0,1	-
7 charge for staying	-	-0,3	-	-	-0,6	-	-	-0,1	-
8A static congestion charge	-	-0,5	-	-	-1,0	-	-	-0,2	-
8B dynamic cong. Charge	-	-0,4			-0,9			-0,1	
9 variable excise duty	-5,1	-5,4	-5,8	-6,8	-3,0	0,7	-0,5	-0,3	-0,2
10A excise duty	-	-1,0	-	-	-0,4	-	-	-0,1	-
10B excise duty + 0C	-	-0,7	-	-	0,1	-	-	0,0	-

* including increase in emissions for inland shipping and railways as a result of modal shift

Source: Environment and Nature Planning bureau. Effects on the environment, Paying differently for mobility. MAP-Environment, the Netherlands, May 2005, 57 pp. (low – middle – high: refers to the band width which attempts to represent the uncertainties in the study).

Bijlage 5: Some figures from 'Reforming transport pricing: an economist's perspective on equity, efficiency and acceptability' (Mayeres and Proost, 2002)

The table below gives a summary of the effect on transport prices of a policy reform in which the marginal social cost is charged per kilometre.

Belgium – 1990	Benchmark	Scenario 1	Scenario 2
		MSC + lower labour income tax	MSC + higher social security transfer
Price passenger transport	(EURO/pkm)	percentage change w.r.t. benchmark	
Peak			
Gasoline car – committed[a]	0.29	21%	20%
Gasoline car – suppl.[a]	0.13	84%	82%
Diesel car – committed	0.19	69%	67%
Diesel car – suppl.	0.08	209%	204%
Bus, tram, metro	0.06	89%	91%
Rail	0.06	73%	75%
Off-peak			
Gasoline car – committed	0.29	-8%	-9%
Gasoline car – suppl.	0.13	16%	15%
Diesel car – committed	0.19	23%	23%
Diesel car – suppl.	0.08	98%	96%
Bus, tram, metro	0.06	146%	149%
Rail	0.06	72%	75%
Price freight transport	(EURO/tkm)	percentage change w.r.t. benchmark	
Truck			
Peak – committed	0.17	40%	40%
Peak – suppl.	0.17	111%	110%
Off-peak – committed	0.16	27%	27%
Off-peak – suppl.	0.16	89%	88%
Rail	0.05	7%	9%

[a] The distinction between committed and supplementary mileage allows us to model the link between car ownership and car use. The CGE model assumes that owning a car implies a certain minimum mileage. This is reflected in the committed mileage, which is proportional to the vehicle stock. The costs of committed mileage include the ownership and running costs per km. The consumers can choose to drive more than the minimum mileage per car. This is captured in the supplementary mileage, whose cost includes only running costs.

The following table shows the effect of the demand for transport with these higher transport prices.

Belgium - 1990	Benchmark	Scenario 1	Scenario 2
		MSC + lower labour income tax	MSC + higher social security transfer
Passenger transport	mio pkm/year	percentage change w.r.t. benchmark	
Peak	36532	-12.89%	-12.76%
car	29308	-14.28%	-14.14%
bus, tram, metro	4239	-3.98%	-3.64%
rail	2985	-11.93%	-12.21%
Off-peak	59684	-5.42%	-5.37%
car	51813	-3.36%	-3.27%
bus, tram, metro	4317	-20.38%	-20.41%
rail	3554	-17.30%	-17.69%
Freight transport	mio tkm/year	percentage change w.r.t. benchmark	
Road – peak	7485	-15.04%	-15.12%
Road – off-peak	32715	-11.12%	-11.30%
Rail	8354	6.51%	4.05%

Finally the table below clarifies the level of welfare gain in both scenarios. Quintile 1-5 refers respectively to the lowest and highest income classes: ε refers to 'aversion to income inequality'. In other words: if ε = 0, importance is attached only to the gain in user value. If ε = 0.5, an increase in income of 1 € for the lowest social class is considered equivalent to an increase in income of 1.4 € of the highest social class. (Therefore the principle introduces an extra weighting in favour of a social redistribution of welfare.)

Belgium - 1990	Benchmark	Scenario 1	Scenario 2
		MSC + lower labour income tax	MSC + higher social security transfers
Equivalent income (EURO/person/year)		percentage change w.r.t. benchmark	
Quintile 1	18586	0.47%	3.88%
Quintile 2	22260	0.03%	2.21%
Quintile 3	25027	-0.16%	0.75%
Quintile 4	28330	0.22%	0.00%
Quintile 5	35579	1.45%	-0.51%
Social equivalent gain (EURO/person/year)			
ε = 0		160.66	148.89
ε = 0.5		142.50	179.17