8th WCTR

A MULTIMODAL MODEL FOR TRAFFIC AND TRANSPORT IN FLANDERS (ANTWERP) : SENSITIVITY TO DIFFERENT POLICIES, WITH SPECIAL ATTENTION FOR FINANCIAL AND REGULATORY MEASURES

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Abstract

A multimodal model for traffic is used to identify through two opposite scenario's (trend versus sustainable) which measures can have a significant influence on the generated passenger traffic during the evening rush hour. The sensitivity analysis is done with data of the Antwerp region. As a result of this analysis we conclude that even in the long run planning measures are least effective, followed by infrastructure measures that may stimulate local people to make use of public transport. Regulatory measures and especially financial measures have clearly the most significant impact on modal choice and passenger traffic generation during the evening rush hour.

INTRODUCTION

Getting stuck in an endless traffic jam or waiting for an eternity for public transport are experiences that must be familiar to nearly everyone. At such moments, one is easily led to formulate solutions to the mobility problem. Of course, everyone does so from one's own experience and background : geographers and planners (especially in Belgium) will call for strict urban planning that addresses the issue of the spatial separation of working and living; the engineer will recognise numerous possibilities for the construction of new or the improvement of existing infrastructure; the legal expert will come up with clever rules regarding parking; and the well-paid economist will consider the idea of letting the user pay.

Endless discussions in the past between advocates and opponents of one or another measure have at least made people realise that there is no global solution, and that the only acceptable way forward is that of a package of measures. As Wegener (1995, p 160) concludes : "the consequence is that a synergetic mix of incentives and restrictive measures seem necessary : incentives to promote higher-density mixed-use development and environment-friendly modes such as public transport, cycling and walking, and constraints on urban sprawl through stricter land-use control and on car driving through speed limits, parking restrictions and higher fuel taxes". On this issue some empirical evidence from the USA and Western Europe has already been brought together by Banister (1995). This, however, does not simplify the analysis. The question remains, exactly what balance of measures is required? In a former article the relative impact of spatial measures against economic measures is analysed (Verhetsel, 1998). In this paper we will use the same methodology to analyse more in depth the relative impact of varying financial and regulatory measures.

The Flemish Authorities are presently developing a traffic model that will allow forecasts of the impact of packages of measures by the year 2010. In Flanders there has been untill now a high degree of "wasteful commuting" (Hamilton, 1989) because government subsidises the home-to-work trips in an excessive way by tax regulations. At the moment location has a very modest effect on the cost of commuting and commuters are virtually footloose, even if they wish to minimise commuting costs. In this paper, we shall try to identify those measures that can have a significant impact during the evening rush hour. Our analysis has more to do with real world problem-solving than with model-building. This traffic model describes private and public road transport as well as haulage. In the current analysis we concentrate on policy measures that can provide a solution for passenger traffic problems. The analysis focuses on the busiest period of the evening rush hour, i.e. between 4.30 and 5.30pm. The model was initially developed for the Antwerp region. In the future, it should become possible to make similar calculations for other Flemish regions and for Flanders as a whole. The passenger transport model is a simultaneous demand model that makes integrated calculations of the relational patterns and modal choice on the basis of time and costs. The model was inspired by the so-called "Randstad-model" (first implemented in the Netherlands) (RIJKSWATERSTAAT, 1988). More information on the model can be found in Verhetsel (1998).

We first give an overview of the policy measures and how these are introduced in the model through two alternative scenarios. Next we describe the resulting traffic flows for each alternative scenario as a whole. Subsequently the relative impact of each different policy package on evening rush hour movements is analysed. Finally we focus on the impact of some specific financial and regulatory measures.

THE POLICY MEASURES

After the model had been tested and modified for 1991, packages of policy measures were drawn up and their impact on future (2010) traffic flows measured. Packages of measures may relate to four distinct aspects :

- planning: the geographical distribution of residents, the working population, and employment per traffic zone in the year 2010.
- infrastructure: adaptation of the basic network for motor traffic and public transport
- regulations: changes due to legislation on parking, vehicle occupancy, effects of traffic management by telematics
- the financial aspects: variations in petrol prices, parking fees, public transport fees, road pricing, car ownership.

Two alternative scenarios were investigated :

- a trend scenario which gives an indication of how the mobility issue will develop if the current policy is maintained. This means that demand and supply develop according to market principles that do not have to include external costs. In fact it supports the actual power relations in the mobility debate (priority for automobile constructors, infrastructure developers).
- a policy scenario that aims at steering mobility by controlling transport demand by means of spatial planning based on proximity and compactness, and by making optimal use of public transport in satisfying mobility requirements. This scenario tries to incorporate a set of measures that fit within a policy of sustainable development.

Table 1 provides an overview of how the various packages of measures might be implemented for the two scenarios. This was determined with the help of a great many experts in the field. The measures are a reflection of the most likely course of action taken if future policy in one or the other direction were to be outlined at this present moment.

IMPACT OF ALTERNATIVE SCENARIOS

Table 2 provides an overview of the calculations of shifts in traffic generation during the evening rush hour resulting from the implementation of the trend and policy scenario. One notes that in 2010, i.e. the planning horizon, the resulting traffic flows are quite different for each of the scenarios. A continuation of the current policy trend would result in a growth of the number of passenger kilometres during the evening rush hour by some 38%. The corresponding number of additional car kilometres would amount to 43%, compared to 11% for public transport. In absolute terms, we are talking about an increase of over two million kilometres during the evening rush hour. The additional traffic burden that this would bring forth on available infrastructure is barely imaginable. The traffic density per carriageway would increase enormously and at certain crucial places capacity would be exceeded. The capacity breach is most dramatic in the trend scenario on the Antwerp ring road. On stretches of road where capacity is exceeded, the explanatory power of the model is limited. In particular queuing on carriageways leading to the Kennedy tunnel (in both directions : to France and to The Netherlands), the Waasland tunnel and the approach to the motorway to Germany would lead to behavioural changes : alternative means of transport, roads, timing become very interesting.

Under the policy scenario, growth of the number of passenger kilometres during the evening rush hour would be limited to 8% (+414,077 km), with public transport accounting for the entire increase (+111%, +897,219 km). In the next paragraph we identify the measures that are responsable for the different impact of the scenarios.

Table 1 - Overview of packages of measures for the two scenarios

TREND SCENARIO

Planning:
The emphasis is on a continuation of current spatial developments: further de-urbanisation on the one hand and continuing growth of the tertiary sector coupled with a greater concentration of employment in inner city areas and a number of peripheral locations. These trends are guided by the possibilities reated by the so-called "Gewestplannen", i.e. regional development plans designed in the period of growth in the 1960s and 70s. These plans encompass the judicial framework that exists today.

Infrastructure:
Modifications to the motor traffic network required from a maintenance and safety point of view, and the completion of current and necessary projects of regional importance; in addition, there is the strategic plan aimed at realising a main Flemish-European transport axis.
As regards public transport, an unchanged policy is expected to result in a further decline of provisions as a result of increasing costs and congestion on the road network.

Regulations:
Status quo 1991.

Financial measures:
Introduction of a motorway tax for heavy lorries, a carbon dioxide emissions tax on petrol and diesel. A decrease in expenditure on fuel in real terms, public transport fares follow inflation, higher parking fees.

POLICY SCENARIO

Planning :
A strict location policy which aims at concentrating future growth (in housing and employment) in and around cities. Spatial organisation in accordance with the principles laid down in the "Ontwerp Ruimtelijk Structuurplan Vlaanderen". This plan provides a Flemish context for the replacement of existing land-use plans.

Infrastructure :
No fundamental investments in the motorway network; merely funding of inevitable projects relating to safety and maintenance, and of current projects of regional importance.
Public transport is developed extensively in the entire region, both in terms of infrastructure and frequency. All residential nuclei in rural areas are served by the public transport system. In urban areas, public transport is given absolute priority.

Regulations :
The implementation of an extensive electronic traffic control system (so-called "telematics"), separate carriageways for buses and car-poolers, closing of approach roads. Cars of non-residents are banned from inner cities, implementation of a strict parking policy in areas of employment.

Financial measures :
Individual transport is charged for congestion and external costs by means of a new motorway tax for all vehicles, road pricing which will see variable car costs increase by 50% inside urban ring roads, a carbon dioxide tax. Car ownership is discouraged by abolishing tax incentives for the purchase and use of a car for travelling between the home and work.

Table 2 - Impact of the different scenarios (generated passenger kilometres during the evening rush hour)

	1991	TREND SCENARIO			POLICY SCENARIO		
		ABSOLUTE	DIFFERENCE WITH 91	INDEX 1991=100	ABSOLUTE	DIFFERENCE WITH 91	INDEX 1991=100
PUBLIC TRANSPORT	806 578	892 314	85 736	111	1 703 797	897 219	211
CAR	4 679 464	6 703 827	2 024 364	143	4 196 322	-483 142	90
TOTAL	5 486 042	7 596 141	2 110 100	138	5 900 119	414 077	108

Market shares of public transport/cars (%)

1991		TREND SCENARIO		POLICY SCENARIO	
PT	CAR	PT	CAR	PT	CAR
15	85	12	88	29	71

THE PACKAGES OF MEASURES ASSESSED

In order to measure the sensitivity of the traffic model to the various packages of measures, we have made calculations for a number of fictitious scenarios. In this particular study, we successively incorporated into the reference scenario of 1991 first the package of planning measures from the trend scenario and afterwards the policy scenario. The resulting forecasts are entirely fictitious, for reason that within one scenario there must be a certain logic connecting the various packages of measures. It is, for example, rather absurd to concentrate socio-economic activities for the year 2010 geographically in urban areas, without assuming that the public transport network would be adapted accordingly. In other words, these are fictitious forecasts that are merely intended to measure the sensitivity of the model to packages of policy measures.
We present the results of the fictitious forecasts with, in succession, the effects of the different policy measures relating to planning, infrastructure, regulatory and financial aspects. In this order, the measures are determined increasingly less by "spatial characteristics".

If one compares the various packages of measures with each other (table 3), one will come to the conclusion that the more "spatial" in nature the measures taken, the smaller the impact on the kilometres generated. The impact of the spatial component (planning and infrastructure) is clearly secondary to the other components : financial measures in particular are very effective. Rodier et al (1997) summarise some studies in the USA with similar results : road pricing strategies reduce daily vehicle miles with 10-15%, land use measures might project a 10% reduction but such measures take up to 20 year to become truly effective.
We have to keep in mind that so far, we have only considered the effects on the area studied as a whole. But it is quite possible that the various packages of measures have varying effects on different sub-regions. We could, for instance, examine whether the planning and infrastructure measures have a more pronounced local effect than regulatory and financial measures. Differences may certainly be expected to occur between rural and urban regions. Some evidence on these topics is already published (Verhetsel et al, 1998).

Table 3 - Effects on traffic generation of the packages of measures (growth indexes 1991-2010)

		TREND	POLICY
PLANNING	PUBLIC TRANSPORT	106	105
	CAR	110	106
INFRASTRUCTURE	PUBLIC TRANSPORT	101	115
	CAR	100	99
REGULATORY	PUBLIC TRANSPORT		118
	CAR		95
FINANCIAL	PUBLIC TRANSPORT	110	152
	CAR	127	62

Least effective are planning measures, followed by infrastructure measures and regulatory measures, with financial measures clearly having the most significant impact. The varying impact is more pronounced in the policy scenario than in the trend scenario. This is quite logical, as current policy is largely maintained in the trend scenario so that differences with 1991 are much smaller. Our conclusion is identical with Wegener (1995, p 160) : "This implies that in metropolitan areas with inexpensive transport, little planning control and a deregulated land market, policies to influence location or travel behaviour only by incentives must fail". We fully agree with his explanation that distinguishes between accessibility as a scarce resource (as is the case in classic urban economic theories) and ubiquitous accessibility. In our study area with subsidised car trips from home to work, without serious time losses up till now, and without external costs to be paid, we work under the condition of ubiquitous accessibility. Then location changes have little effect on traffic patterns, and vice versa. The next paragraphs gives an idea of the impact of specific regulatory and financial measures.

A DETAILED LOOK ON REGULATORY MEASURES

The impact of the regulatory policy package as a whole

As regulations in the trend scenario are unchanged in comparison to the situation in 1991, we can only discuss the impact of regulations in the policy scenario. The situation of 1991 is changed with respect to parking: a number of strict regulations are introduced. This would have a profound impact on the situation, especially in inner cities. Therefore we give in the table also some details on the impact of the introduced parking regulations in the innercity of Antwerp. Further we can analyse the consequences of introducing telematics to increase road capacity.

The number of passenger-kilometres (table 4) during the evening rush hour would decline by 2% (-92,920 km). Car use in particular would be discouraged (-5%, -235,538 km). Public transport, on the other hand, would grow by 18% (+142,618 km). As a result, a 3% shift would occur in passenger traffic from private to public transport.
In the inner city the parking restrictions have a much larger impact than in the area studied as a whole. The use of public transport (45%) relative to car use (55%) increases to an unexpected high level. As Verhoef et al (1995) prove theoretically, regulatory measures like parking restrictions may be only second best after electronic road pricing (ERP). But because they already exist in many cities, the extension may be easier than the introduction of a completely new system such as ERP.

Table 4 - Impact of regulatory measures (generated passenger kilometres during the evening rush hour)

	1991	1991 +POLICY		
		ABSOLUTE	DIFFERENCE WITH 91	INDEX 1991=100
STUDIED AREA				
PUBLIC TRANSPORT	806 578	949 196	142 618	118
CAR	4 679 464	4 443 926	-235 538	95
TOTAL	5 486 042	5 393 122	-92 920	98
INNER CITY				
PUBLIC TRANSPORT	21 914	29 437	7 523	134
CAR	45 170	36 326	-8 844	80
TOTAL	67 084	65 763	-1 321	98

Market shares of public transport and cars (%)

	1991		1991 +POLICY	
	PT	CAR	PT	CAR
STUDIED AREA	15	85	18	82
INNER CITY	33	67	45	55

The impact of telematics and parking restrictions

Again we use some fictitious forecasts. Here we incorporate in the trendscenario successively varying measures of telematics and parking restrictions. The resulting generated kilometres are brought together in appendices 3 and 4. These numbers learns us that isolated regulatory measures can make only a small difference in the market shares of public transport during the evening rush. So a frequently proposed measure like halving the parking places would have a too small impact to compensate for the (political) negative reactions of the users. One can also doubt about the effectiveness of isolated investments in telematics infrastructure.

ANALYSIS OF FINANCIAL MEASURES

The impact of the financial policy package as a whole

We analyse first the effects of various financial measures on traffic flows during the evening rush hour, with an unchanged context in terms of planning, infrastructure and regulations.

Table 5 - Effects of financial measures (generated passenger kilometres during the evening rush hour)

	1991	1991 +TREND			1991 +POLICY		
		ABSOLUTE	DIFFERENCE WITH 91	INDEX 1991=100	ABSOLUTE	DIFFERENCE WITH 91	INDEX 1991=100
PUBLIC TRANSPORT	806 578	885 621	79 043	110	1 223 098	416 520	152
CAR	4 679 464	5 930 432	1 250 968	127	2 904 699	-1 774 764	62
TOTAL	5 486 042	6 816 053	1 330 011	124	4 127 797	-1 358 244	75

Market share of public transport/car (%)

1991		1991 +TREND		1991 +POLICY	
PT	CAR	PT	CAR	PT	CAR
15	85	13	87	30	70

Results (table 5) vary significantly according to whether or not financial burdens are imposed on private car use. A continuation of the present financial policy with regard to car use would result in an additional 24% (=1,330,011 km) passenger kilometres during the evening rush hour, mostly accounted for by car traffic (+27%, +1,250,968 km), which is not discouraged whatsoever. Public transport would grow by 10% (%79,043 km).
Financial measures that aim at charging private transport for external costs would result in a spectacular decline of car use during the evening rush hour (-38%, -1,774,764 km). Public transport would generate 52% more in passenger kilometres (+416,520 km).
This is consistent with results of Verhoef et al (1995) who prove, in a theoretical manner, that financial measures are best and regulatory measures (parking restrictions) the second most effective intervention. One can doubt the willingness to pay, thus the political feasibility of road pricing. At the end of November 1997 the government of the Netherlands decided to introduce road pricing after some years of doubt, technical problems and even behavioural research (Verhoef et al. , 1996). This decision undoubtedly helps the Belgian (and thus the Flanders) government in mental preparation for road pricing in their own country. For a more theoretical analysis of this problem of political feasibility refer to Lave (1994). Next paragraph learns more about the impact of specific financial measures.

The impact of varying fares for parking and public transport, degree of car ownership and fuel prices

As for the specific regulatory measures we calculated some fictitious forecasts. We introduced now successively the different specific financial measures in the trendscenario The produced passenger kilometres during the evening rush and the difference with the genuine trendscenario are summarised in appendices 5 to 8.
These calculations learn that especially a real increase in fuel prices would cause a shift from car to public transport, as well in the whole studied area as in the innercity. A real increase of 0% means

that for the year 2010 the actual fuel price (1991) is increased proportionally with the estimated higher personal income of 2010 and also compensated for the extent to which cars become less expensive due to technology innovations. Fuel prices are often regarded as a very fair policy measure because "the user pays". Though it can be argued that some users cause more external effects with a certain short trip than others with a longer one. These spatial and temporal fluctuations are not counted for by fuel prices.

Second best for a shift from car to public transport during the evening rush is a decrease of the fares for public transport. In some Flemish cities experiments are going on to make public transport free for everyone on any time (Hasselt) or for particular groups on certain occasions. Hopefully soon some results of these experiences will be published.

Higher fares for parking, even double, have minor effects on behaviour during the evening rush. Only in the innercity some results can be expected from such an isolated measure. It is not likely that car ownership can be reduced, effects will remain small even if it is socially attainable.

In this analysis we have always to keep in mind that we consider isolated measures, nowadays reasonable policy will always combine a series of policy measures, these will reinforce each other.

We made also a number of calculations with varying fares for road pricing on certain links. We decided not to publish the results because we have serious doubts about the usefulness of the model when introducing such drastic innovative financial measure. The model was designed in a very different reality. When looking at the results of such an analysis, the temptation is strong to conclude that roadpricing is an outstanding policy measure. For a correct presentation of things we prefer to conclude that roadpricing, and probably all financial measures, has a major impact but that we have not enough information to estimate the consequences, especially not on a detailed geographical level.

CONCLUSION

A traffic model to forecast the multimodal passenger flows during the evening rush in 2010 is used to analyse the impact of different policy measures to reduce traffic problems in the Antwerp region. In fact, by introducing different policy packages and isolated policy measures in the model we estimate the sensitivity of the model to these inputs. Because the model was build very carefully by experienced model builders and the calibration for 1991 gave good results, except for links that reach saturation level, we can get an idea of the impact of different traffic policies in reality.

A package of policy measures that follows the actual trend results in totally other passenger flows and modal choice in accordance to a policy scenario that aims a sustainable development. When comparing the impact of planning, infrastructure, regulatory and financial measures differences become clear. We cannot expect too much from planning measures. Infrastructure measures may stimulate people to make use of public transport. Nevertheless, regulatory and financial interventions have stronger effects.

Isolated regulatory measures like parking restrictions and the introduction of telematics only have a small impact, except for some areas in the innercity. Though one notes that the effects of scenarios are usually greater than those of the constituting packages separately. The effects of the separate policy packages enhance each other, which was precisely what was intended when the scenario was developed: the various elements must be adequately geared to one another. There are of course strong interrelations between different measures.

But even isolated financial measures have a major impact on the resulting modal choice, especially real increases in fuel prices and a decrease of the fares for public transport. But we fear that the used model is no longer valid to forecast evening rush behaviour when introducing such innovative policy measures. The trip generation and attraction rates, the transport distribution functions, the travel resistance coefficients were estimated in a period with a very different context. So we can conclude that the impact of financial measures will be considerable, but we cannot estimate the precise impact.

Further research is needed to collect evidence on the impact of financial measures on traffic behaviour during the evening rush. Hopefully the first experiments and experiences will lead to scientific useful results. For planners and geographers more research is required about the local effects of different measures with special attention for the implicit spatial effects of regulatory and financial policies. In addition, one should not lose sight of the fact that all analyses have concerned the Antwerp area, a region with a strong, dominant centre and a dispersed suburban zone. For the rest of Flanders, with the exception of Brussels, new analyses are required.

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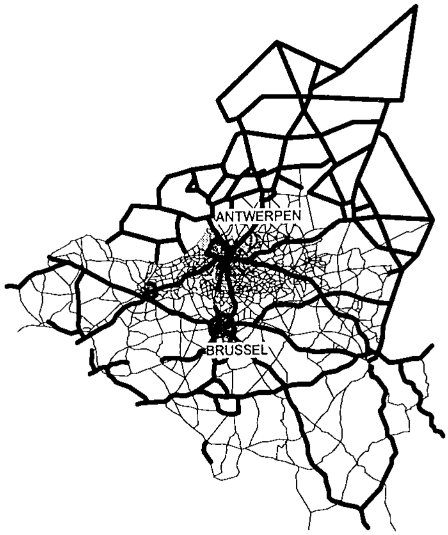
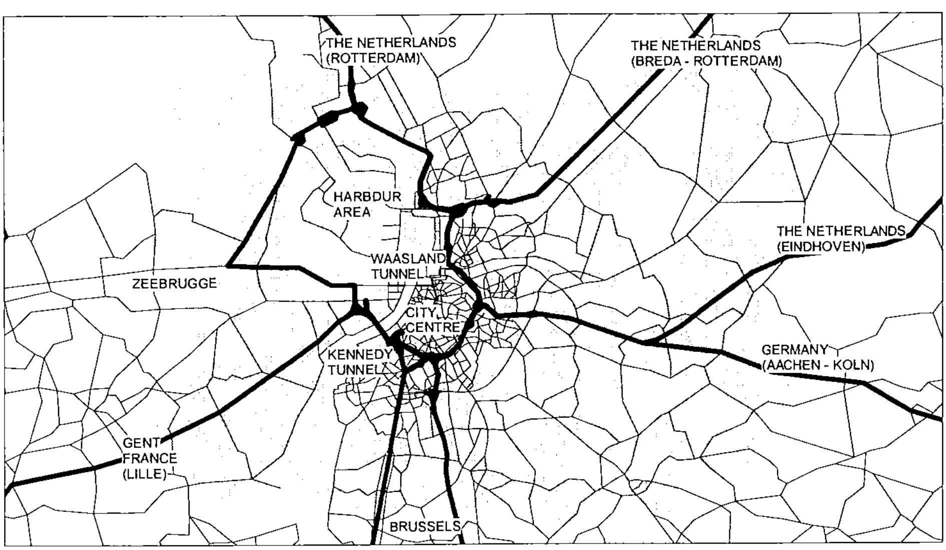
Appendix 1 - Network of roads included and area studied



Appendix 2 - Area studied (origin-destination traffic zones) and road network



Appendix 3 - Effects of telematics (generated passenger kilometres during the evening rush hour)

	TREND	TREND + INCREASE OF CAPACITY WITH 5%			TREND + INCREASE OF CAPACITY WITH 15%		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100	ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	892 240	-74	100	891 869	-455	100
CAR	6 703 827	6 702 805	-1023	100	6 707 222	3 395	100
TOTAL	7 596 141	7 595 045	-1 097	100	7 599 091	2 950	100

Market shares of public transport and cars (%)

	TREND		TREND + INCREASE OF CAPACITY WITH 5%		TREND + INCREASE OF CAPACITY WITH 15%	
	PT	CAR	PT	CAR	PT	CAR
STUDIED AREA	12	88	12	88	12	88
INNER CITY	30	70	30	70	30	70

Appendix 4 - Effects of parking restrictions in the neighbourhood of railway stations (radius 800m) (generated passenger kilometres during the evening rush hour)

	TREND (=1 FOR EVERY 5 JOBS)	TREND + HALVE OF THE PARKING PLACE (= 1 FOR EVERY 10 JOBS)		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	918 810	26 496	103
CAR	6 703 827	6 677 507	-26 321	100
TOTAL	7 596 141	7 596 317	175	100

Market shares of public transport and cars (%)

	TREND		TREND + HALVE OF THE PARKING PLACE (= 1 FOR EVERY 10 JOBS)	
	PT	CAR	PT	CAR
STUDIED AREA	12	88	12	88
INNER CITY	30	70	31	69

Appendix 5 - Effects of varying fares for parking (generated passenger kilometres during the evening rush hour)

	TREND	TREND + PARKING FARES X 1,5			TREND + PARKING FARES X 2		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100	ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	907 469	15 155	102	920 912	28 598	103
CAR	6 703 827	6 700 398	-3 429	100	6 698 246	-5 581	100
TOTAL	7 596 141	7 607 867	11 726	100	7 619 158	23 017	100

Market shares of public transport and cars (%)

	TREND		TREND + PARKING FARES X 1,5		TREND + PARKING FARES X 2	
	PT	CAR	PT	CAR	PT	CAR
STUDIED AREA	12	88	12	88	12	88
INNER CITY	30	70	31	69	33	67

Appendix 6 - Effects of varying fares for public transport (generated passenger kilometres during the evening rush hour)

	TREND	TREND + DECREASE 50%			TREND + DECREASE 20%		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100	ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	1 787 651	895 337	200	1 138 865	246 551	128
CAR	6 703 827	6 504 420	-199 407	97	6 633 320	- 70 508	99
TOTAL	7 596 141	8 292 071	695 930	109	7 772 185	176 043	102
.	TREND	TREND + INCREASE 20%			TREND + INCREASE 50%		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=1 00	ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	717 191	-175 123	80	528 787	-363 527	59
CAR	6 703 827	6 764 426	60 599	101	6 836 161	132 334	102
TOTAL	7 596 141	7 481 617	-114 524	98	7 364 948	-231 193	97

Market shares of public transport and cars (%)

	TREND		TREND + DECREASE 50%		TREND + DECREASE 20%	
	PT	CAR	PT	CAR	PT	CAR
STUDIED AREA	12	88	22	78	15	85
INNER CITY	30	70	38	62	33	67
	TREND		TREND + INCREASE 20%		TREND + INCREASE 50%	
	PT	CAR	PT	CAR	PT	CAR
STUDIED AREA	12	88	10	90	7	93
INNER CITY	30	70	27	73	24	76

Appendix 7 - Effects of varying degree of car ownership (generated passenger kilometres during the evening rush hour)

	TREND = 492 CARS FOR 1000 RESIDENTS	POLICY SCENARIO = 488 CARS FOR 1000 RESIDENTS		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	900 827	8 513	101
CAR	8 703 827	6 683 300	-20 527	100
TOTAL	7 596 141	7 584 127	-12 014	100

Market shares of public transport and cars (%)

	TREND =492 CARS FOR 1000 RESIDENTS		TREND =488 CARS FOR 1000 RESIDENTS	
	PT	CAR	PT	CAR
STUDIED AREA	12	88	12	88
INNER CITY	30	70	30	70

Appendix 8 - Effects of varying fuel prices (generated passenger kilometres during the evening rush hour)

	TREND	TREND + REAL INCREASE 0%			TREND + REAL INCREASE 50%		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100	ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	1 427 376	535 062	160	2 005 229	1 112 915	225
CAR	6 703 827	3 583 531	-3 120 296	53	2 294 461	-4 409 366	34
TOTAL	7 596 141	5 010 908	-2 585 234	66	4 299 690	-3 296 451	57

	TREND	TREND + REAL INCREASE 100%		
		ABSOLUTE	DIFFERENCE WITH TREND	INDEX TREND=100
PUBLIC TRANSPORT	892 314	2 571 463	1 679 149	288
CAR	6 703 827	1 567 675	-5 136 152	23
TOTAL	7 596 141	4 139 138	-3 457 003	54

Market shares of public transport and cars (%)

	TREND		TREND + REAL INCREASE 0%		TREND + REAL INCREASE 50%	
	PT	CAR	PT	CAR	PT	CAR
STUDIED AREA	12	88	28	72	47	53
INNER CITY	30	70	43	57	53	47

	TREND		TREND + REAL INCREASE 100%	
	PT	CAR	PT	CAR
STUDIED AREA	12	88	62	38
INNER CITY	30	70	62	38