Tijdig openbaar vervoer in nieuwbouwwijken

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Samenvatting

Een casestudy naar tijdig openbaar vervoer in nieuwbouwwijken

Eén van de doelen in ruimtelijke planning is het tijdig en adequaat aanleggen van openbaar vervoer in nieuwbouwwijken. Echter in de Nota Ruimte en de Nota mobiliteit worden deze begrippen niet verder gekwantificeerd. In de huidige situatie worden de meeste nieuwbouwwijken van hoogwaardig openbaar vervoer voorzien als de kosten voor 50 procent gedekt zijn. In praktijk betekent dit wanneer ongeveer twee derde van de huizen zijn opgeleverd. Hierdoor beschikken de bewoners in de eerste jaren niet over een hoogwaardige openbaar vervoer verbinding, met als mogelijk gevolg dat de bewoners een auto-georiënteerd reisgedrag ontwikkelen. De initiële kosten van een vroegtijdige openbaar vervoer verbinding zijn hoog, maar stel dat deze vroegtijdige realisatie meer gebruikers oplevert?

Deze studie analyseert in welke mate de tijdige realisatie van light rail faciliteiten in nieuwbouwwijken het gebruik hiervan bepaalt. Hiervoor zijn drie vergelijkbare Vinex uitleglocaties bij Den Haag geselecteerd, Wateringse Veld, Ypenburg en Leidschenveen., Het verschil tussen de wijken is het moment waarop op de light rail faciliteiten gerealiseerd zijn. Daarnaast was de beschikbare data relevant. De cases zijn geanalyseerd op bereikbaarheidsparameters, waarbij de competitiviteit van de modaliteiten vergeleken is naast het verschil tussen de wijken. Daarnaast is met een enquête het effect van zelfselectie onderzocht. Ook zijn migratiepatronen meegenomen in het onderzoek. Met deze factoren en data over het gebruik van openbaar vervoer in de wijken, is het effect van tijdige realisatie van light rail geanalyseerd. Daarnaast is ook een vergelijking met andere Vinex uitleglocaties uitgevoerd, om representativiteit van de cases in Den Haag te onderzoeken. De conclusie is dat de timing een klein effect heeft op het gebruik van openbaar vervoer in het gebied, zichtbaar in het aantal mensen dat gebruik maakt van de light rail faciliteiten in de casestudy gebieden. Het effect is echter tijdelijk.

1. Introduction

Timing in public transport is crucial. It determines, for example, whether you arrive on time at the railway station, which is important for your chances of making or missing your connection. In this research, another type of timing is considered, namely of the development of public transport facilities and the impact of this development on the use of these facilities.

An important policy topic in spatial planning and transport policy is that of improving accessibility. In transport policy, the goal is to accommodate faster travel, and to make it cleaner and safer. Next to travelling by passenger vehicle, bicycle, or on foot, one of the transport alternatives available to people is the use of public transport. In the current memorandums on spatial development, Nota Ruimte (MVROM 2006), and transport, Nota Mobiliteit (MVW 2004), one of the goals is to provide new housing developments with access to a well-timed and adequate public transport network. However, the terms well-timed and adequate have not been further defined. Early implementation of a public transport network leads to high costs in the beginning, as the number of residents in a new neighbourhood is low, initially. But what if such an early implementation would lead to more public transport use by future dwellers?

One of the thoughts that triggered this interest was that, if a public transport network would be developed in the first stages of a new housing development, residents may start using this public transport instead of their cars. This could result in less car-oriented travel patterns and more public transport users. From a contrasting point of view it may not matter when access to a public transport network is established, because residents of new housing developments tend to be more mobile and, therefore, more likely to use a form of personal transportation. According to this view, it is unlikely that an early and adequate public transport network would influence this behaviour.

2. Research

This study analyses the effect of timing, with respect to the implementation of light rail based public transport in new housing areas, and how much use is made of it. For this study, three comparable new housing developments with differently timed light rail realisation were selected. These cases were compared with other new housing developments in the Netherlands. Furthermore, the cases were analysed on accessibility, self-selection and migration. With these factors, and public transport use in the areas, the effect of timing was analysed. Part of the research was to conduct a survey in the three case study areas.

The main research question of this research is: *To which extent does the time of implementation of light rail transport in new housing areas affect the local use of public transport?*

In the Netherlands, the large-scale new housing developments of the past decades are called Vinex locations (named after the Fourth Spatial Planning Document, *Vierde Nota Ruimtelijke Ordening Extra,*) (MVROM 1990). The Vinex locations are large-scale new-housing areas on appointed greenfield locations. Most of these locations were previously used as farmland. One of the goals connected to these Vinex locations was to reduce the

increase in passenger vehicle traffic. Some criteria for Vinex development locations are: locate the Vinex location within an urban district or assigned urban centre; in, on or near existing urban areas and with optimal accessibility by public transport and for walking and cycling. Furthermore, the neighbourhoods itself should also have quality public transport facilities and a quality network for walking and cycling (Snellen and Hilbers 2007).

Three Vinex locations in the municipality of The Hague were chosen for this case study; Wateringse Veld, Ypenburg and Leidschenveen (see Figure 1). As they are situated within the same municipality, the data sources are the same for all districts. In addition, the quality of their current public transport facilities are comparable, all three districts have access to a frequent light rail service. In Wateringse Veld, the development of new housing started in 1996, and a year later, in 1997, tram line 17 was established in the south of the district. In Ypenburg, construction was also started in 1996, but a tram line (15) did not become operational until 2002 – when 30 per cent of the houses had been built. In both districts, the light rail system connects them to The Hague central station. In the Vinex location of Leidschenveen, construction was started in 1997, and during the first decade, there was no light rail service connecting the area to the central station of The Hague. In 2007, a metro and tram station was built in the centre of the district, connecting it to the city of The Hague and, in a southern direction, to Zoetermeer and Rotterdam.

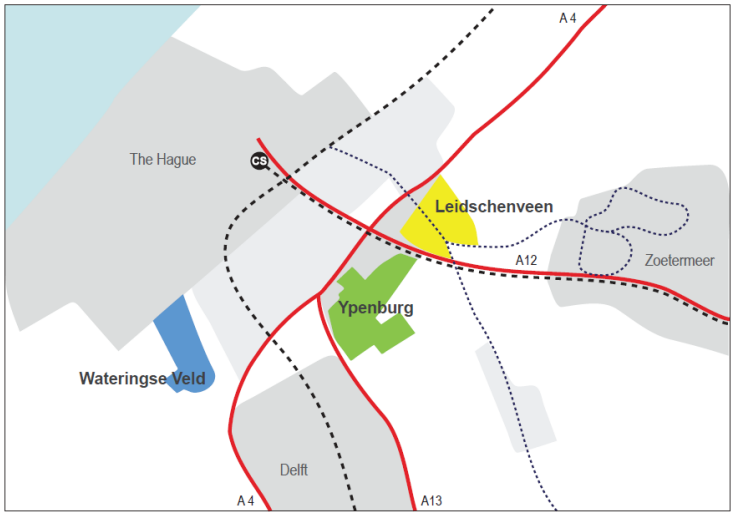

Figure 1: Case study area The Hague

3. Results

This section discusses the results from the analyses. First, the case study areas are compared with other Vinex locations in the Netherlands. In the second section, the case study areas are compared with each other. The third section discusses the accessibility of the areas. Self-selection is analysed in section four. In section five, the migration patterns are discussed. Section six discusses the use of public transport. Finally, in section seven the effect of timing is analysed.

3.1 Public transport in Vinex locations

To study the effect of the timing of public transport, many factors were analysed. First, the case study areas were compared with other Vinex locations in the Netherlands, see Figure 1. This showed that Vinex locations in the Netherlands were later and less well-connected to any form of quality public transport. Light rail systems are important to the case study districts in The Hague, but only cover 4 per cent of the Vinex land area. This is due to the fact that only the main cities have such a light rail systems.

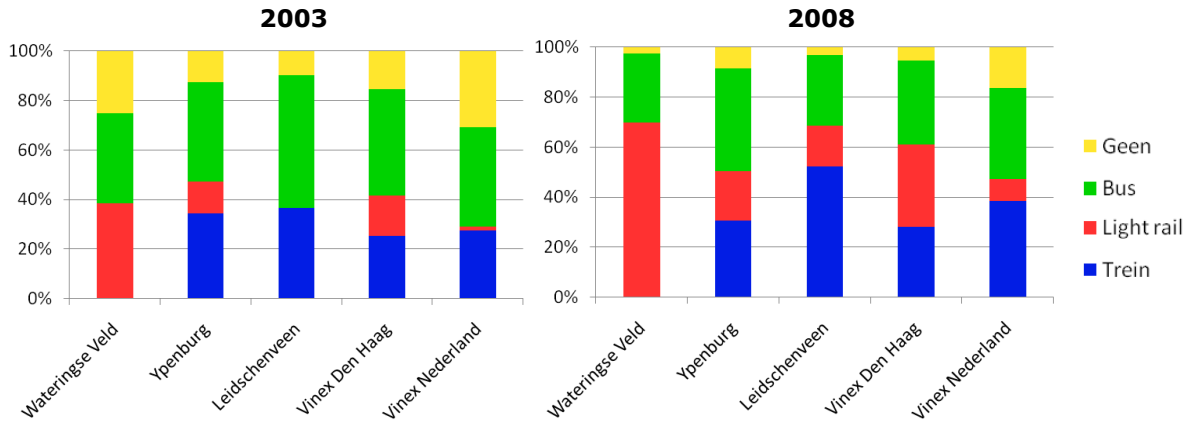

Figure 2: Service area public transport in Vinex locations (Public transport stops, PBL)

3.2 Study areas

Subsequently, the characteristics of the case study areas were compared. This analysis showed that Wateringse Veld has the largest share of adult residents with a driving licence, and the group of people that are the main user of a car is the largest in Wateringse Veld. However, Wateringse Veld also has the highest number of students and those that own a student public transport card. These characteristics are positively related to public transport use.

For other characteristics, such as demography and spatial planning, the districts are comparable. The main difference between Wateringse Veld and the other two case study areas is that 7 per cent of the population in Wateringse Veld is elderly, while for the other two areas this is between 3 and 4 per cent, which could have influenced mobility figures.

3.3 Accessibility

Even though the districts are located within the same municipality, there are many differences in accessibility. The amount of jobs, shops and schools within the service area show big differences.

Wateringse Veld has most jobs and facilities accessible to cyclists, while Leidschenveen was most accessible for cars. The public transport services of Wateringse Veld and Ypenburg are comparable, both leading in the direction of The Hague's central station. Leidschenveen has a much wider level of public transport, having connections to more locations outside the area, and a faster connection to The Hague's central station. With respect to schools, the differences are smaller, especially for public transport. One of the reasons for this could be that none of the schools were located within 300 metres of a light rail stop. Reviewing the main destinations of the residents, in 2006, it became clear

that in Leidschenveen public transport is most competitive (in 2010). The results for Ypenburg and Wateringse Veld were expected to be comparable.

3.4 Self-selection

Some people consider public transport an important aspect in their choice of moving to a certain area. A survey among 150 residents in the case study areas showed that the number of people who felt this way was only small; the respondents who did value this aspect appeared to live scattered over the three areas. Furthermore, there appeared to be a relation between the level of satisfaction about the public transport facilities in the neighbourhood and the use of public transport. The amount of people satisfied with the public transport, was the highest in Wateringse Veld, the area with the earliest connection; also this area had the largest amount of public transport users among its residents, according to the survey. However, the differences between the case study areas were only small and, therefore, not likely to have influenced the outcome of the survey to any great extent.

3.5 Migration

The migration patterns influenced the group of people that had no public transport facilities available to them during their first years in the district. These patterns were relatively slow in each of the three districts, compared to other areas in The Hague and the Netherlands, see Figure 3. Over the years, group with no public transport facilities in the beginning, will become increasingly smaller, therefore, the effect of early public transport will slowly fade out with the years.

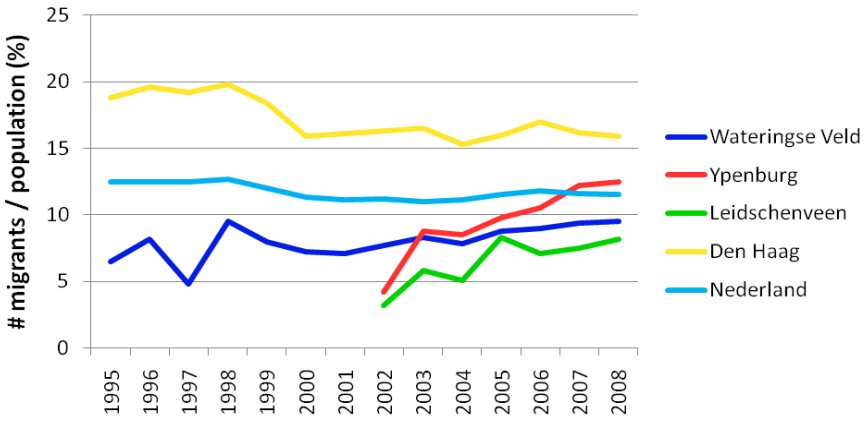

Figure 3: Migration mobility (District Monitor The Hague)

3.6 Use of public transport

The use of public transport was analysed according to different parameters. The results showed that Wateringse Veld had the highest modal split for tram or metro in 2006 (Figure 4). However, the counts from the light rail stations, counting the number of people getting on and off the tram or metro, show another result (Figure 5). From the day that the tram lines in both Leidschenveen and Ypenburg were realised, a higher number of people were counted getting on and off the light rail trams, than in Wateringse Veld. Also when the results are corrected for head time and for the number of non-residents travelling to and from these areas. These differences between case study areas can partly be explained by the number of trips per person, per day. Looking at the

frequency of public transport use (2010), Leidschenveen had the highest share of frequent users.

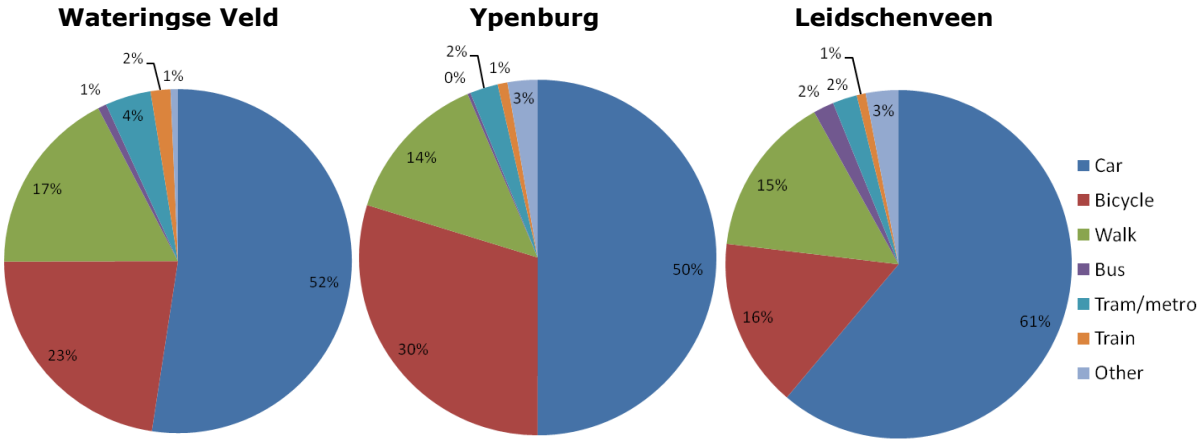

Figure 4: Modal split in trips in percentage (MON The Hague 2006)

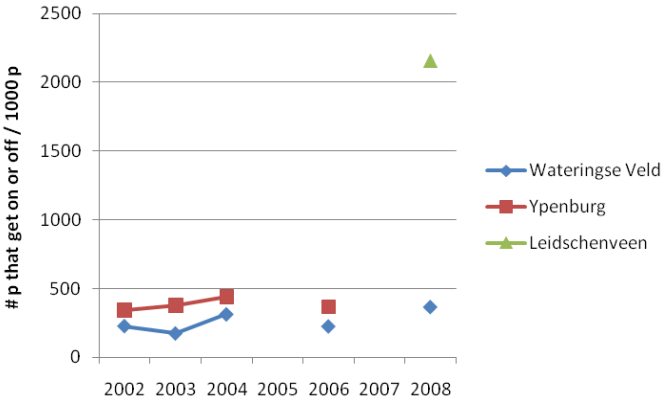

Figure 5: Get on and off for an average working day, not corrected (tram counts, Stadsgewest Haaglanden)

3.7 The effect of timing

Finally, the effect of timing was analysed. The effect of the time of implementation of light rail facilities was determined using regression analyses. With these analyses the differences between the districts could be determined. Logistic regression is based on the logistic function, see formula 1 and 2. In the analyses the regression coefficients (β) are estimated.

$$f(z) = \frac{e^z}{e^z + 1} = \frac{1}{1 + e^{-z}} \qquad (1)$$

$f(z)$: *dependent variable*

With z:

$$z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_k x_k \qquad (2)$$

β_0 : *intercept*

$\beta_{1,\ldots,}\beta_k$: *regression coefficients*

$x_{1,\ldots,}x_k$: *independent variables*

Three models are estimated, based on two data sources. First the Dutch Mobility Research The Hague 2006 (*Mobiliteitsonderzoek Nederland*, referred to as MON) is used

to predict the use of light rail. Included in the modal are personal, household and transport characteristics. The second and third model are based on the survey conducted for this research. The second model included the same characteristics as the model based on the MON. The last model included also personal preferences of the respondents. Table 1 lists the included variables.

Type	MON The Hague 2006	Survey	
Dependent	Using tram	Frequent public transport user	
Independent	District	District	
	Sex	Sex	
	# persons in household	# persons in household	
	Education level	Education level	
	Social characteristics	Job	
	Age	Age	
		Type of house	
		Ownership house	
	# cars in household	# cars in household	
	# bicycles in household	# bicycles in household	
	Possession student PT card	Possession PT subscription	
	Adult with no driving licence	Trip frequency to The Hague	
	Adult not being main car user	Value transport modes	**(Model 3)**
		Value transport characteristics	**(Model 3)**

Table 1: Variables in logistic regression

The results from the logistic regression, Table 2, show that from 2006 there was significant difference between the districts. In Ypenburg and Leidschenveen the light rail use was lower than in Wateringse Veld. The tramline in Ypenburg at this moment was opened for four year. The results from the survey for 2010 show a different result. In these models the districts do not differ significantly. This can partly be explained by the different data source and output variable, but on the other hand illustrates that the effect of an early realisation of public transport is temporary. In the third model the personal preferences are significant in explaining the output variable, for the complete results see Appendix I: Results logistic regression.

		Wateringse Veld	**Ypenburg**	**Leidschenveen**
2006	β (S.E.)		-1,03 (0,14)	-1,19 (0,14)
	Significant	**0.000**	**0.000**	**0.000**
2010	β (S.E.)		-1,46 (0,80)	-0,57 (0,74)
	Significant	0.191	0.069	0.437
2010*	β (S.E.)		-2,06 (1,40)	-0,77 (1,51)
	Significant	0.325	0.141	0.610

* Model included personal preferences

Table 2: Results logit model

Therefore, it is concluded that, taking into account personal, household and transport characteristics, there was a significant difference in public transport use between the districts (2006). At this time there are comparable light rail services in Wateringse Veld and Ypenburg; in Leidschenveen there are no light rail facilities available. When having public transport facilities in all districts (which was the case in 2010), transport use in the districts did not differ significantly. Therefore, the time of implementation could have had an influence, but only temporary.

4. Conclusion and recommendations

Based on the analyses in which the three cases are compared, it is concluded that timing of public transport does have a small effect on its use, visible in the number of people that used the light rail services in the case study areas. Looking at the variables that explain the amount of light rail use in the case study areas, in 2006, the areas themselves play a significant role. Although another data source of April 2010 showed the districts to not be significantly different. Therefore, timing could have an influence on public transport use, albeit temporarily.

This section, furthermore, describes the limitations of the research and policy recommendations.

4.1 Limitations

The difference in quality between the public transport connections of Leidschenveen and the other two areas, made the conclusion harder to draw. Leidschenveen has connections to more destinations outside the area and also a smaller head time. Therefore, the results could not easily be compared.

Another limitation were the quality levels of the public transport services in the case study areas. From the time of development of the three areas, all were serviced by quality bus services. Therefore, most of the early residents did have access to public transport if they so desired. This could make the possible effect of the realisation of light rail at a later stage smaller. From talking to survey respondents, it became clear that residents in Leidschenveen did feel the disadvantage of late realisation of their light rail service. According to some residents, they bought a second car during this period, which they would not have done if there had been good public transport.

The sample size of the primary data set for this research was only limited. The time and resources were limited and, therefore, no solid conclusions could be drawn, based on the survey alone. The survey would have provided more information on residents' preferences if conducted in larger sample or under a larger population.

4.2 Recommendations

When considering the realisation of public transport facilities in newly urbanised areas, it is important that the factors that influence the use of such public transport are taken into account. Furthermore, as resources are not unlimited in public transport projects, the importance of early implementation needs to be weighed against other aspects, such as connections, frequency and quality of these services. This research shows that there is no clear evidence that early realisation makes a large difference to the way public transport is used in a particular area. Therefore, policymakers need to take this into account when considering such early realisation. The frequent use of public transport in Leidschenveen indicates that other aspects of public transport facilities may play a more important role.

In the case study Vinex locations in The Hague were well-connected to frequent bus services before the light rail service was realised. A bus service is a good option to provide public transport for early residents, making the larger investments for light rail at a later stage, when the population of these new districts has become larger.

Acknowledgement

In this research data from the Municipality of The Hague (*Gemeente Den Haag*) and the Region Haaglanden (*Stadsgewest Haaglanden*) is used. The municipality provided the oversampling of the Dutch Mobility Research 2006 and the Region Haaglanden provided the tram counts. Without these data sources this research it was not possible to do this research. Therefore I would like to thank these organisations and Peter van de Vijver and Jan Termorshuizen personally.

References

MVROM (1990), 'Vierde Nota over de Ruimtelijke Ordening Extra: op weg naar 2015, deel 1: Ontwerp Planologische Kernbeslissing', (Den Haag: Ministry of Housing, Spatial Planning and the Environment).

MVROM (2006), 'Nota Ruimte: Ruimte voor Ontwikkeling. Deel 4, samenvatting', (Den Haag: Ministry of Housing, Spatial Planning and the Environment).

MVW (2004), 'Nota Mobiliteit', (Den Haag: Ministry of Transport and Public Works).

Snellen, D. and Hilbers, H. (2007), 'Mobility and congestion impacts of Dutch Vinex Policy', *Tijdschrift voor economische en sociale geografie,* 98 (3), 398-406.

Appendix I: Results logistic regression

					95% C.I. for e^{β}		
		B	**S.E.**	**Sig.**	**Lower**	**e^{β}**	**Upper**
Constant		.918	.347	**.008**		2.505	
# persons in hh		.032	.067	.637	.906	1.032	1.176
Age	<18	1.336	.329	**.000**	1.994	3.802	7.250
	18-35			**.000**			
	35-50	-.743	.154	**.000**	.352	.476	.644
	50-65	.215	.178	.227	.875	1.239	1.756
	>64	-1.177	.413	**.004**	.137	.308	.692
Sex	Female	.223	.102	**.029**	1.023	1.250	1.527
District	Wateringse Veld			**.000**			
	Ypenburg	-1.029	.141	**.000**	.271	.357	.471
	Leidschenveen	-1.192	.142	**.000**	.230	.303	.401
# cars in hh		-.936	.097	**.000**	.324	.392	.475
# bicycles in hh		-.508	.051	**.000**	.544	.602	.666
Possession student PT card		2.698	.406	**.000**	6.697	14.848	32.923
Adult	No driving licence	1.693	.231	**.000**	3.457	5.437	8.551
	Not main car user	.933	.152	**.000**	1.886	2.542	3.428
Social	Unemployed			**.000**			
	Part time	2.288	.292	**.000**	5.563	9.854	17.456
	Full time	3.068	.281	**.000**	12.394	21.507	37.322
	Student	1.139	.203	**.000**	2.100	3.124	4.648
Education (adult)	Low	-.720	.151	**.000**	.362	.487	.654
	High	-.486	.141	**.001**	.466	.615	.811

Note R^2 = .28 (Hosmer & Lemeshow). .32 (Cox & Snell). .43 (Nagelkerke).
Model χ^2 = 1038.721. p<.001

Table 3: Logit model 2006 (MON The Hague 2006)

					95% C.I. for e^{β}		
		B	**S.E.**	**Sig.**	**Lower**	**e^{β}**	**Upper**
Constant		2.736	2.303	.235		15.424	
# persons in hh		.298	.350	.395	.678	1.347	2.677
Age		-.031	.032	.338	.910	.970	1,033
Sex	Female	.156	.681	.819	.308	1.169	4,436
District	Wateringse Veld			.191			
	Ypenburg	-1.460	.802	.069	.048	.232	1,119
	Leidschenveen	-.572	.736	.437	.133	.564	2,385
Owner occupied home		-1.247	.825	.131	.057	.287	1.449
Type of house	Apartment			.072			
	Terrace	.480	.837	.566	.314	1.616	8,332
	Semi detached	3.141	1.782	.078	.704	23.127	759,895
	Detached	4.394	1.957	**.025**	1.750	80.977	3747,67
# cars in hh		-2.644	.669	**.000**	.019	.071	.264
# bicycles in hh		.045	.205	.828	.699	1.046	1.563
Possession PT card		2.405	.619	**.000**	3.295	11.075	37.229
Job	Full time			.308			
	Part time	.725	.726	.318	.498	2.065	8,571
	Unemployed	-.895	1.161	.441	.042	.409	3,974
Education	Low			.756			
	Mid	.646	.910	.478	.321	1.908	11,351
	High	.620	.912	.496	.311	1.859	11,110
Seldom to centre The Hague		-.701	.649	.279	.139	.496	1.768

Note R^2 = .44 (Hosmer & Lemeshow). .43 (Cox & Snell). .59 (Nagelkerke).

Model χ^2 = 72.039. p<.001

Table 4: Logit model 2010 (survey)

					95% C.I. for e^{β}		
		B	**S.E.**	**Sig.**	**Lower**	**e^{β}**	**Upper**
Constant		7.786	9.68	0.421		2406.8	
# persons in hh		0.141	0.658	0.83	0.318	1.152	4.18
Age		-0.265	0.102	**0.009**	0.628	0.767	0.936
Sex	Female	-1.089	1.647	0.509	0.013	0.337	8.496
District	Wateringse Veld			0.325			
	Ypenburg	-2.055	1.396	0.141	0.008	0.128	1.975
	Leidschenveen	-0.768	1.506	0.610	0.024	0.464	8.883
Owner occupied home		2.083	1.574	0.186	0.367	8.029	175.50
Type of house	Apartment			0.211			
	Terrace	1.146	1.456	0.431	0.181	3.145	54.616
	Semi detached	6.008	3.18	0.059	0.799	406.617	206917
	Detached	16.297	14.126	0.249	0	$1.2*10^{7}$	$1.3*10^{19}$
# cars in hh		-5.613	2.132	**0.008**	0	0.004	0.238
# bicycles in hh		0.809	0.511	0.113	0.825	2.246	6.115
Possession PT card		2.813	1.329	**0.034**	1.23	16.653	225.49
Job	Full time			0.313			
	Part time	0.615	1.591	0.699	0.082	1.85	41.86
	Unemployed	3.479	2.297	0.130	0.359	32.418	2924.34
Education	Low			0.229			
	Mid	-3.616	2.148	0.092	0	0.027	1.812
	High	-3.051	2.022	0.131	0.001	0.047	2.488
Seldom to centre The Hague		-2.082	1.384	0.132	0.008	0.125	1.877
Value (Importance)	Car	0.014	0.927	0.988	0.165	1.014	6.24
	Bicycle	-0.01	0.995	0.992	0.141	0.99	6.962
	Bus	2.858	1.182	**0.016**	1.719	17.419	176.53
	Tram	2.165	1.052	**0.040**	1.108	8.712	68.51
	Train	0.187	0.965	0.846	0.182	1.205	7.986
Value (moving into the area)	Near highway	-0.178	0.418	0.669	0.369	0.837	1.897
	Parking facilities	-0.731	0.578	0.205	0.155	0.481	1.493
	Bicycle lanes	-0.192	0.554	0.730	0.279	0.826	2.447
	Public transport facilities	1.488	0.689	**0.031**	1.147	4.427	17.09

Note R^2 = .72 (Hosmer & Lemeshow). .60 (Cox & Snell). .83 (Nagelkerke).

Model χ^2 = 117.515. p<.001

Table 5: Logit model 2010 including personal preferences (survey)