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Serie Research Memoranda

Speed Behaviour of Car Drivers:
A Statistical Analysis of Acceptance of Changes
in Speed Policies in the Netherlands

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Research Memorandum 1996-7

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Speed Behaviour of Car Drivers;
a statistical analysis of acceptance of changes
in speed policies in the Netherlands*

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Abstract

Lowering speed of car drivers will have positive impacts on environmental pollution and the number of road accidents. It is therefore a potentially interesting policy option for governments which want to reduce negative externalities of transport. In this paper the acceptance of such policies is analyzed by means of a survey questionnaire among car drivers and public transport users. First, an analysis is presented on the general speed behaviour, the behaviour on distinct road types, the acceptance of lower limits, and the acceptance and perception of electronic speed limiters. Next, a statistical analysis of subgroups is carried out. It is concluded that the speed of car drivers is in general not considered as a main problematic issue by drivers and non-drivers; therefore there is little scope for the acceptance of changes in speed policies. When speed policies are changed (lower limits) it seems most effective to emphasize safety aspects in order to increase support of the public. However, psychological factors of speed behaviour may play an important role in this respect.

1 Introduction

The rapid growth of road transport during the last decades has led to a number of problems in the field of emissions, noise and traffic safety which are hard to combat (see e.g., Verhoef, 1994). Many governments are applying a mixture of instruments to ameliorate these problems. In the first place, technological standards of vehicles are being changed to reduce emissions. In addition, financial instruments such as vehicle taxes and fuel taxes are used to reduce both the level of mobility and energy use per kilometre driven. Also spatial planning of residential and commercial areas is sometimes applied to reduce the demand for road transport (see e.g., Hart 1994; Nijkamp and Rienstra, 1996).

In the present paper we will discuss another possible way to reduce these externalities, i.e., the imposition of speed limits. It appears that many of the external effects depend rather strongly on the speeds of transport. For example, energy use and CO₂ emissions strongly increase with the speed of cars. Therefore, speed policies are potentially relevant.

The choice of a certain speed by drivers depends on a large number of factors, including personal features (age, gender, income), type of car, type of road, legal speed limits and external conditions (weather). The general problem we face is that the feasible speeds in terms of the engine capacity of the car, and the physical quality of the roads often allow speeds which are much higher than would be optimal from the perspective of the negative external effects of road transport.

In this paper we discuss a number of issues about speed behaviour of car drivers in the Netherlands, based on a survey among almost 1000 residents. In particular we will pay attention to the relationship between actual driving behaviour and the maximum possible speed of cars. In addition, we will investigate to what extent there is scope for effective speed policies of governments. The structure of the paper is as follows. In Section 2 we shortly discuss some of the relevant literature, Section 3 contains information on the survey on which this paper is based. Main descriptive results are given in Section 4. A more in depth statistical analysis of car choice (maximum possible speed), speed behaviour at various road types, acceptance of lower speed limits and acceptance of speed limiters is carried out in Section 5. Section 6 concludes.

2 Speed of Car Drivers; A Review of the Literature

The speed of car drivers has a wide range of impacts and is therefore an interesting research field (see also Sakshaug, 1993). High speeds have various impacts on the environment. When one starts driving faster than a certain speed (about 40 km/h) the use of energy per kilometre increases when the speed increases, as a result also emissions of harmful gases rise (e.g., CO₂, NO_x) (Klein, 1993). Therefore, reductions of the average speed of road traffic may help to achieve emission targets of such gases. Another feature of fast driving cars is that they cause more noise annoyance (ECMT, 1978). It may be concluded that speed

causes several costs, which are in general external costs (accidents and environmental costs), however. Therefore, these may be reasons for reducing speed limits or controlling them better.

From an analysis of databases of EU and EFTA countries it appears that driving at excessive speed is the main cause of serious and fatal accidents. As a result, a 30% reduction of injuries by transport may be achieved when speed reductions are implemented (Rothengatter, 1992).

However, speed contributes to accessibility of modes in a transport network. When the average speed of trips decreases, the travelling time increases, which causes time costs. Trips may even be cancelled when they take longer. Therefore, a trade-off exists between the costs and benefits of a reduction of speeds. In such a trade-off the monetary value of the external costs is important. Several scenarios may be constructed in this way (see e.g., Werkgroep '2duizend, 1996).

Speed limits are transgressed by virtually all drivers: 80% of the EU-drivers transgresses speed limits on highways, on two-lane roads this share is still 50% (Rothengatter, 1992). An interesting observation in this respect is that there are systematic differences in speed behaviour of different subgroups, for example, per income, age, gender, etc. (Jorgensen and Polak, 1993); also the driving experience is an important variable for the speed behaviour.

There is a wide range of reasons why drivers transgress speed limits. In particular, speed appears to be an important psychological factor (e.g. fast driving gives a nice feeling), while also the behaviour of other car drivers may be an important incentive to drive faster. Another reason may be that cars have a high maximum speed, so that speed transgressions happen more or less unconsciously (Blaas et al., 1992).

In order to help drivers choose an appropriate speed, several types of policies are possible:

- * **Engine downsizing.** This would decrease the gap between feasible speeds and desired speeds. In terms of speed effects, engine downsizing is only effective at roads where high speeds are feasible. In urban areas such limits are not effective. However, since downsizing improves the fuel efficiency of cars, it has also impacts on roads where the speeds remain unaffected.
- * **Infrastructure adjustments.** The feasible speed and the maximum speed allowed on a road are often not in agreement with each other. In such a case, infrastructure adjustments can help to reduce speeds. Examples are the construction of road thresholds in urban areas, and the introduction of roundabouts at dangerous crossings.
- * **Surveillance.** Police supervision, complemented with a system of fines, is indispensable as long as roads and vehicles are not designed in such a way that speed behaviour of drivers is appropriate.
- * **Communication strategies.** These strategies are aiming at changing perceptions, attitudes and habits of drivers.
- * **Electronic speed limiters.** The use of mechanic speed limiters has been legally imposed in trucks in the EU recently. The present generation of speed limiters is inflexible: it only imposes one maximum speed, and it

cannot be **switched** off. In the foreseeable future one **may expect** the introduction of electronic speed limiters that are flexible in the sense that the speeds **can** be adjusted to the type of the road and to special **circumstances** (e.g., foggy weather). It is **clear** that the introduction of electronic speed limiters would make speed **policies** of governments **much** more effective. **However**, the social and political acceptance of this instrument may be problematic.

In the next sections, **will** we carry **out** an empirical study on the behaviour of **car** drivers, the acceptance of lower speed limits and the acceptance of speed limiters in order to analyse whether the above-discussed observations hold and to what extent **changes** in speed **policies** are **accepted** in society.

3 Introduction to the Survey

In Summer 1995 a survey on the speed of **car** traffic was carried **out** in the Netherlands. A questionnaire was handed **out** to **car** drivers at four **petrol** stations and to public transport users at one **train/metro** station. **After** the respondents had filled **out** the questionnaire these were returned by mail.

In the questionnaire questions are asked on the own speed behaviour on several road types, the **perception** of the speed of other **car** drivers and the opinion on electronic speed limiters. **Such** a limiter can be implemented in cars and **control** the maximum speed of the **car** at the speed limit which is **introduced** on the road segment in an electronic way (see **Section 4.3**).

In the survey a distinction is made between four types of roads, which are most common in the Netherlands:

- * highways **having** a speed limit of 120 km/h;
- * highways **having** a speed limit of 100 km/h;
- * roads outside the built environment **having** a speed limit of 80 km/h;
- * roads within the built environment mostly **having** a speed limit of 50 km/h.

In the Netherlands most highways have a speed limit of 120 km/h. On certain parts - in the densely populated west of the country, around big cities and at highway-crossings - the speed limit is mostly 100 km/h for safety reasons and for reducing congestion. In the underlying road network some **main** roads have a speed limit of 100 km/h, but most roads have a speed limit of 80 km/h. Within the built environment the speed limit is mostly 50 km/h, although in some **specific** cases it is **higher** or lower.

The response to the questionnaire was fairly high: 31.4%, leading to 927 observations; the share of the public transport users is about 25 % of **the** total research population. One should be aware that drivers **who** drive long distances a year **will** go to **petrol** stations more frequently., and hence they have a **higher** probability of being interviewed than drivers **who** only drive short distances. Therefore, a correction is carried **out** by weighing the drivers **who received** the questionnaire at a **petrol** station by the inverse of the yearly number of kilo-

metres they drive; this weighting is used in the analysis of Section 4. In the next section we will discuss the main results of the questionnaire, in Section 5 we will present some statistical results of a subgroup analysis of the respondents. For a more extensive discussion of the results, we refer to Rienstra and Rietveld (1996).

4 Main Results of the Survey

The results of the questionnaire may be split up in three sections: the general perception of speed, the opinion on speed limits for the above-mentioned road types and the opinion on the introduction of the electronic speed limiter. In this section we will discuss the opinion of the whole (weighted) research population, in the next section we will turn to a statistical analysis of subgroups.

4.1 The general perception of speed

In general it appears that speed is not considered as a big issue by the respondents. Speed appears not to be an important factor for buying a car; safety aspects and the costs (purchase costs, energy efficiency, maintenance) are much more important. The own speed behaviour is often considered as normal or average. In Figure 1, for example, the results are presented of the opinion on the question whether other car drivers drive faster, or whether other drivers are driving too fast. It appears that the respondents think that other drivers drive in general faster, but only in some cases the other drivers are considered as driving too fast. On the question, whether one feels unsafe because of the speed of car drivers, it appears that most respondents answer 'sometimes'; only a small minority indicates that this is 'often' the case.

Another interesting question concerns the reasons why one transgresses the speed limits or why one does not transgress these¹. The main reason to transgress the limit is - according to the respondents - that this happens in an unconscious way; the second main reason is to save time. The most important reason to keep the speed limit is for safety reasons; striking is that external effects like air pollution and noise annoyance are far less important.

In general it may be concluded that the speed of car traffic is not regarded as a big problematic issue by car drivers. The respondents are not largely annoyed by the speed behaviour of other drivers, while they also do not feel very unsafe. However, safety considerations are not unimportant: drivers report safety reasons as the most important reason why they stick to speed limits. Environmental aspects are considered as less important in this respect.

¹ The results mentioned here are not given in Table or Figure form to save space. Detailed results are available on request from the authors.

Figure 1 General perception of speed behaviour other drivers
Note n = 927

4.2 Speed behaviour on different road types

There appear to be interesting differences in opinions about the speed limits and the behaviour on the distinct road types. The largest share of the respondents indicates, that they 'often' transgress the speed limit on 120 km/h highways (see Figure 2). Another question is what transgressions are acceptable according to the respondents. It appears that small transgressions - 5 or 10 km/h - are largely acceptable, larger transgressions like 20 km/h are much less accepted, however, while very large transgressions (40 km/h, see Figure 2) are not acceptable according to most respondents. It is not striking therefore, that a large majority opposes the measure to reduce the speed limit on 120 km/h highways to 100 km/h; about 80% of the respondents is against such a measure.

The same conclusions can - even to some greater extent - be drawn for the 100 km/h highways. Here the transgressions are even larger and considered as more acceptable. From the answers given it appears however, that the respondents accept that the speed driven on these segments should be lower than at the 120 km/h highways.

In general, it can be concluded that it is largely accepted in society that the speed limits on highways are transgressed. According to most respondents therefore, the speed limits on the highways should be higher rather than lower.

Figure 2 Opinions on 120 km/h highways
Note n = 927

Next, an interesting question is whether these conclusions also hold for other road types. In Figure 3 some results are presented for roads within the built environment (mainly 50 km/h roads). It appears that the speed transgressions are **much** less than is the case on the highways. Most respondents answer that they ‘**almost never**’ or only ‘**sometimes**’ transgress the speed limits. The same **result** is found for the acceptance of transgressions: the largest share thinks that a transgression of 10 km/h is not or only sometimes acceptable, a large **majority** appears to **oppose** transgressions of 20 km/h or more. **However**, although the respondents appear to be **much** more inclined to **obey** the speed within the built environment, the largest group is still against lower limits (e.g., to 40 km/h); about the same share **indicates, however**, that this **may** (possibly) be useful.

The opinions on the 80 km/h roads are in general inbetween the opinions on the highways and the 50 km/h roads. The speed and speed limits are mostly considered to be ‘good’, but again a large majority is against lower limits (e.g., 70 km/h) on these segments.

From these results it **may** be concluded that especially on highways there is **much** opposition against the limits. Transgressions are therefore considered to be more acceptable and there is **much** opposition against a lower speed limit. The 80 km/h roads are an inbetween category, while within the built environment

Figure 3 Opinions on 50 km/h roads

Note n = 927

transgressions are much less accepted. In all cases, however, there appears to be no majority for lowering the speed limits.

Next, it will be analysed whether an entirely new option to maintain the speed limits - the electronic speed limiter - is acceptable for the research population.

4.3 The acceptance of electronic speed limiters

One of the most important new options for maintaining speed limits could be the electronic speed limiter on private cars. Recently, on trucks a mechanical speed limiter has been introduced in the European Union, which allows a maximum speed of 80 km/h (the legal maximum speed for this type of vehicle). A similar measure to introduce mechanic speed limiters in passenger cars setting the maximum speed at the legal maximum would be less useful, however. The main reason is that the legal maximum speed limit for passenger cars is much higher (in the Netherlands 120 km/h) and differs per country, so that the speed limiter would have no impact on most of the roads. Electronic speed limiters, however, would react to electronic signals (e.g., from satellites) and therefore adjust to the limit of the specific road type, thus allowing a much larger flexibility.

The speed limits at which the limiter are set may differ. The limits may be set at the current limits, they may be set lower (e.g., 10% lower limits), or the limits may be flexible (e.g., higher at night, lower when the weather conditions are bad). It is technically simple to introduce other services at the same time, an example may be the introduction of cruise control.

In Figure 4 the acceptance of speed limiters set at lower limits, current limits or flexible limits is presented.

Figure 4 Opinions on speed limiters

Note n = 927

As discussed above, there is a strong resistance against lowering speed limits. It is not striking therefore, that a large majority rejects the introduction of a speed limiter at lower speed limits. However, when the limits are set at the current limits, the acceptance increases considerably , although the number of opponents is still much larger than the number of advocates. Striking is that the number of advocates is larger than the number of opponents for a limiter set at varying limits, although there are much more ‘strong’ opponents than ‘strong’ advocates. Other measures which might make the introduction more acceptable would be ‘cruise-control’ or the introduction of higher speed limits.

In the survey the respondents have been exposed to some statements on the speed limiter to analyse the perception of the limiter. The most interesting findings are that, according to the majority of the respondents:

- * limiters **will** interfere with the personal freedom of drivers;
- * **car** driving **will** become more unsafe;
- * they **will** not lead to unnecessary **time** losses;
- * they **will** not help to **reduce** congestion;
- * limiters are easily subject to fraud;
- * more **police control** is preferable above the introduction of limiters.

From the responses to these statements it **may** be concluded that speed limiters are mainly thought to affect those features of **car** driving (personal freedom, unsafety), which are considered to be important for a positive valuation of **car** driving. This seems to be the most important reason of opposition against limiters. The actual impacts on **car** driving (travelling time, congestion) are **considered** to be low, **however**.

In **general**, it **may** be concluded that the acceptance of speed limiters is **rather** low. Only limiters at varying limits would have some support from the research population.

4.4 Conclusions

On highways speed limits are considered to be too low by the respondents, while on the other roads the speed and speed limits are mainly considered to be 'good'. As a **result**, **electronic** speed limiters do not **receive much** support of the respondents, the only exception is a **limiter** with varying limits. The differences in these responses seem to **relate** mainly to differences in safety on various road types; environmental **aspects** are not considered to be important.

Next, it is interesting to analyse to what extent there are differences in opinions on speeds among subgroups of the population. This will be the subject of the next **section**.

5 Statistical Analysis of Speed Behaviour

As **also** observed by Jorgensen and Polak (1993) personal features **may** have a large influence on the speed behaviour of **car** drivers. Therefore, we **will** analyse in this **section** which features influence the opinions on speed and which features really affect the speed behaviour of individuals. The features **distin-**guished are: age, education level, area of residence (in the densely populated West or Randstad in the Netherlands or elsewhere), **gender**, **income**, the yearly number of kilometres driven and whether one does (not) own a **car** or whether one uses a company **car**. In the estimates on the behaviour and opinion **also** the question whether someone else in the household had a serious accident has been taken into account.

Because most variables are subdivided in **categories** several dummies have been used. The only exceptions are the yearly amount of kilometres driven and the maximum speed of the **car**. In the estimations only those observations which

include answers on **all** questions used are taken into consideration.

First, we **will discuss** now the conceptual model used for our analysis. Then the distinct relations in this model **will** be analysed in a statistical way.

5.1 A conceptual model

A conceptual model on the **perception** of speed and speed behaviour is presented in Figure 5.

Figure 5 A conceptual model on speed behaviour and on opinions on speed

The first relation is between personal features of the respondent and the maximum speed of the **car** (s)he is driving. It is expected that here some influence **will** be found, because for example people earning a **higher income can afford cars** with a **higher** maximum speed or younger people **may** prefer faster cars.

The next relation is between personal features and the acceptance of lower speed limits. Again it is expected that several subgroups have a different view on speed, as a **result** the opinions on lowering speed limits **may** differ. **However**, also the maximum speed of the **car** one is driving **may** impact the opinion on lowering limits. **Also** because of the above-discussed differences in opinion on different road types, these opinions are expected to differ for the distinct road types.

The same relation as for the opinions about the acceptability of lower speed limits **may** hold for speed behaviour, so whether and to what extent the respondents transgress the speed limits on the several road types.

Finally , personal features **may also** influence the acceptance of the **elec-tronic speed limiter**. The same is expected for the maximum speed one is driving, while **also** the transgression behaviour **may** influence the opinion on speed limiters. In the next **section** we **will** estimate these relations, and analyse which features are important for the opinions and behaviour of respondents.

5.2 An analysis of maximum possible speed of cars

The first relation to be estimated is between the maximum speed of the car driven as the dependent variable and several personal features as the explanatory variables; the results are presented in Table 1. Because the maximum possible speed of cars is known as a continuous variable a linear regression is used to estimate this relation. The average maximum speed of the observed cars is about 174 kilometres per hour. In this section we try to explain its variance by means of personal features of the drivers.

Table 1 Results with the maximum possible speed of cars as dependent variable

	Coefficient	T-value
Age 26-35 years	5.40	1.9'
Age 36-45 years	5.78	2.0'
Age > 45 years	3.88	1.3
Education secondary school	4.14	1.3
Education medium vocational	1.29	0.4
Education higher voc./univ.	-2.87	-0.9
Residence area: Randstad	-0.16	-0.1
Gender: women	-5.72	-2.6'
Ln (yearly driven kilometres)	0.93	0.9
Income < fl.500	15.00	3.1'
Income f2.501 - 4.000	8.24	3.0'
Income > f4.000	14.90	5.4'
No-car owner	2.39	0.5
Owner of company car	5.90	3.4'
Constant	148.39	13.4'
R ²	0.16	

Notes 1) 'significant at the 5% level
2) n = 593
3) reference values for the independent variables are: age: < 26 years; education: less than secondary school; location: outside Randstad; gender: male; income: fl.501 - f2.500 per month; car ownership: own car.

Age appears to have a significant impact on the speed of the car which is driven. The youngest category drives mostly slower cars, while especially the middle-categories drive in fast cars (drivers in the age between 26 and 35 years old drive cars with a maximum speed that is 5.4 km/h higher than the younger drivers). The educational level appears not to have a significant impact on the maximum speed of the car used, the same holds for the area of residence and the yearly number of kilometres driven.

Women appear to drive in significantly slower cars (5.7 km/h). Also between income groups significant differences exist. It is striking that drivers in both the low and higher income groups use cars with maximum speeds of about

15 km/h higher than drivers in the income group between fl.501 and f2.500. A possible explanation is that low income earners are keen on buying fast - second or third hand - cars. Finally , the owners of a company car drive in faster cars (about 6 km/h), which may be the consequence of the fact that the company pays for the car and their company finds it important that their car has a de luxe image.

In conclusion, age, income, gender and the type of car ownership appear to have a significant impact on the speed of the car which is normally used.

5.3 An analysis of the acceptance of lower speed limits

The majority of drivers thinks that a reduction of speed limits is not useful (ranging from 83 % on 100 km/h highways to 48% on 50 km/h roads). In this section we try to explain differences among drivers. The relation to be estimated is between the personal features of the respondent and the acceptance of lower speed limits. Next to the features in the previous estimation, also the question whether a serious accident occurred of another person in the respondent's household has been taken into account. For this estimation we used a probit-analysis, in which the answers 'useful' and 'maybe useful' received the value '1' , while the answers 'not useful' received the value '0'. The results of this estimation for the four distinguished road types - in which also the maximum speed of the car is taken into consideration - are presented in Table 2.

It appears that a significant result is obtained for a smaller number of variables compared with the previous estimation. It is found that on highways drivers in fast cars are less willing to accept lower speed limits. On the other road types no significant result is found for the maximum speed of the car. This makes sense since it is only on highways that actual speeds may come near to the maximum speed of the car. The annual number of kilometres driven has a negative impact on the acceptance of lower speed limits on all road types, except within the built environment; a similar result is found for the people in the highest income category. People in high income groups have a significantly lower propensity to accept speed reductions than other people, which is not an unexpected result since their value of time is higher (HCG, 1990).

The other variables and features appear - except once the area of residence - to have no significant impact on the opinion on lower speed limits, although the signs are as expected in most cases.

Table 2 Probit-analysis with the acceptance of lower limits as dependent variable

	120km --> 100 km		120/100 km --> 90 km		80 km --> 70 km		50 km --> 40 km	
	Coeff	T	Coeff	T	Coeff	T	Coeff	T
Maximum speed	-0.01	-2.1'	-0.01	-2.1'	0.00	0.1	-0.00	-1.6
Age 26-35 years	-0.05	-0.2	-0.05	-0.2	0.19	0.9	0.42	2.1'
Age 36-45 years	0.42	1.5	0.44	1.5	0.39	1.7	0.67	3.3'
Age > 45 years	0.39	1.3	0.32	1.1	0.17	0.7	0.53	2.5'
Educ. secondary	-0.21	-0.7	0.03	0.1	-0.04	-0.2	-0.15	-0.7
Educ. medium voc.	-0.56	-1.7	-0.26	-0.7	-0.07	-0.3	-0.16	-0.7
Educ. high. voc./un.	0.11	0.4	0.25	0.8	0.05	0.3	-0.07	-0.4
Loc. : Randstad	-0.08	-0.5	-0.06	-0.4	-0.23	-2.0'	-0.19	-1.8
Gender: women	-0.09	-0.4	0.34	1.7	0.20	1.2	0.02	0.1
Ln (numb. of kilom.)	-0.30	-3.3'	-0.18	-2.0'	-0.18	-2.3'	-0.08	-1.1
Accident other	0.24	1.2	0.26	1.2	-0.12	-0.7	0.11	0.7
Income < f2.500	-0.52	-1.1	-0.47	-1.0	0.07	0.2	0.04	0.1
Income f2.501-4.000	-0.09	-0.4	-0.20	-0.8	-0.16	-0.8	-0.15	-0.8
Income > f4.000	-0.53	-2.0'	-0.54	-2.0'	-0.39	-1.8	-0.22	-1.1
Non-car owner	0.03	0.2	-0.49	-1.2	-0.09	-0.3	0.41	1.2
Company car	-0.90	-2.0'	0.01	0.1	-0.02	-0.1	0.01	0.1
Constant	3.59	3.0'	2.21	1.7	1.24	1.3	1.47	1.6
Chi square	559.9		531.3		570.0		582.4	

- otes
- 1) significant at the 5% level
 - 2) n = 561 - 583
 - 3) reference values for the independent variables are: age: < 26 years; education: less than secondary school; location: outside Randstad; gender: male; income: fl.501 - f2.500 per month; car ownership: own car.

5.4 An analysis of speed limit transgressions

As discussed in Section 4.2 36% of the respondents admit that they ‘often’ or ‘always’ ignore speed limits on highways (120 km/h). The results of a probit analysis on speed behaviour per road type are presented in Table 3. In this analysis the answers ‘never’ , ‘almost never’ and ‘sometimes’ received the value ‘0’, while the answers ‘often’ and ‘always’ received the value ‘1’.

The estimation results are rather similar to those on the acceptance of lower speed limits. The maximum possible speed appears to influence speed behaviour only at highways, which is no surprise given the result in Section 5.3. The number of kilometres driven impacts on the roads outside the built environment, which also are the roads on which most kilometres are driven. Also the people in the highest income category seem to transgress significantly more on these roads, while also the category between f2.501 and f4.000 shows almost

Table 3 Probit-analysis with transgression behaviour as dependent variable

	120 km		100 km		80 km		50 km	
	Coeff	T	Coeff	T	Coeff	T	Coeff	T
Maximum speed	0.01	3.0 ¹	0.01	2.8 ¹	0.00	1.4	0.00	1.2
Age 26-35 years	-0.52	-2.4 ¹	-0.38	-1.8	-0.00	-0.0	-0.51	-2.5 ¹
Age 36-45 years	-0.99	-4.4 ¹	-0.81	-3.6 ¹	-0.49	-2.3 ¹	-0.84	-3.9 ¹
Age > 45 years	-1.33	-5.6 ¹	-1.36	-5.8 ¹	-0.63	-2.8 ¹	-1.12	-4.6 ¹
Educ. secondary	0.44	1.8	0.12	0.5	-0.13	-0.5	0.17	0.7
Educ. medium voc.	0.38	1.6	0.13	0.5	0.02	0.1	0.29	1.2
Educ. high. voc./un.	0.33	1.4	0.16	0.7	-0.10	-0.5	0.03	0.1
Location: Randstad	0.07	0.6	0.16	1.4	-0.11	-1.0	0.15	1.2
Gender: women	0.05	0.3	-0.04	-0.2	-0.10	-0.6	0.14	0.8
Ln (numb. of kilom.)	0.33	3.9 ¹	0.19	2.5 ¹	0.16	2.0 ¹	0.04	0.4
Accident other	-0.18	-1.2	-0.18	-1.1	0.06	0.4	0.27	1.7
Income < f1.500	0.32	0.9	0.29	0.8	0.34	0.9	-0.25	-0.6
Income f2.501-4.000	0.41	1.8	0.36	1.7	0.50	2.3 ¹	0.17	0.8
Income > f4.000	0.63	2.9 ¹	0.63	2.9 ¹	0.45	2.0 ¹	0.17	0.8
No-car owner	0.51	1.5	-0.02	-0.1	0.14	-0.9	-0.19	-0.5
Company car owner	0.25	1.9	0.24	1.8	-0.12	0.4	0.05	0.3
Constant	-5.22	-5.1 ¹	-3.38	-3.4 ¹	-2.81	-2.8 ¹	-1.58	-1.5
Chi square	566.8		568.5		565.5		552.7	

Notes 1) significant at the 95% level
2) n = 560 - 574
3) reference values for the independent variables are: age: < 26 years; education: less than secondary school; location: outside Randstad; gender: male; income: fl.501 - f2.500 per month; car ownership: own car.

positive significant results. Age appears to be the only significant variable for roads within the built environment; the youngest category transgresses much more than the other categories; this holds also for all other road types. The education level, the way of car ownership, the gender and the area of residence do not have a significant impact on the transgression behaviour of the respondents .

5.5 An analysis of the acceptance of speed limiters

The last relation in the conceptual model concerns the acceptance of electronic speed limiters and personal features. In Section 4 we found that 34% of the drivers are (strong) advocates of speed limiters at the current limits. In addition to personal features, also the maximum speed of the car and the transgression behaviour are taken into account. The last is taken as a variable with values ranging from '0' to '4', according to number of times one said to trans-

gress the limit on the distinct road types. A score of ‘4’ means that the limit is transgressed at **all** four road types, a score of ‘0’ means that the respondent does not transgress speed limits at **any** road type. Again we used the **probit** analysis to estimate this relation; in this estimation the advocates and strong advocates received the value ‘1’, the opponents and strong opponents received the value ‘0’. The results of this estimation are presented in Table 4.

Table 4 *Probit-analysis with acceptance of speed limiters as dependent variable*

	Coefficient	T-value
Maximum speed	0.00	0.4
Transgression behaviour	-0.26	-5.3'
Age 26-35 years	0.08	0.4
Age 36-45 years	-0.02	-0.1
Age > 45 years	-0.06	-0.3
Education secondary	-0.45	-1.8
Education medium vocational	-0.24	-1.0
Educ. higher voc. /univ.	-0.51	-2.2'
Location: Randstad	0.01	0.1
Gender: women	0.51	2.9'
Ln (yearly driven kilometres)	-0.00	-0.0
Accident other	-0.05	-0.3
Income < f2.500	0.47	1.2
Income f2.500 - 4.000	0.23	0.6
Income > f4.000	0.07	0.2
Non-car owner	0.25	0.7
Company car owner	-0.06	-0.4
Constant	0.07	0.1
Chi square		490.3

Notes 1) significant at a 95% level
2) n = 492
3) reference values for the independent variables are: age: < 26 years; education: less than secondary school; location: outside Randstad; gender: male; income: fl.501 - f2.500 per month; car ownership: own car.

The transgression behaviour has a clearly significant impact on the **acceptance** of speed limiters: people **who** frequently transgress speed limits tend to accept speed limiters to a less extent. Striking is that people with the highest education level tend to be stronger against speed limiters, compared with the lowest category . **Women** are significantly more in favour of speed limiters. The rest of the variables do not have a significant impact on the acceptance of speed limiters.

5.6 Conclusion

It appears that there are some interesting differences in the opinions on speed between the distinct categories of respondents. Especially the young categories, higher incomes, men and 'owners' of company cars think speed is important and they transgress the limits to a greater extent. As a result, they are often stronger opponents of lowering speed limits.

In general however, it appears that also in the above mentioned subcategories there is little acceptance of lowering speed limits, especially outside the built environment. The same holds true for the analysis of most other opinions. So, although the respondents in this subcategory have more moderate opinions on speed behaviour and changes in speed policies, the majorities still reject large changes in policies.

6 Possibilities for and Acceptance of Changing Speed Policies

Drivers report that on highways speed limits are transgressed frequently, while within the built environment the transgressions are somewhat less. When determining the appropriate speed the relation between speed and safety seems to be the main concern for most drivers. However, the association of speed with psychological factors (personal freedom, car driving is nicer when one is driving fast, etc.) is also important, while the relation with environmental externalities (emissions of gases, noise) is clearly considered to be less important. Therefore the acceptance of changes in speed policies is low in general, and especially for highways, where safety is already high.

From an environmental protection viewpoint, however, lower speed limits would be more attractive on highways than other road types. Also cost-benefit evaluations indicate that the net benefits of speed reductions would be higher on highways (Rietveld et al., 1996). This leads to an interesting tension: it is on the road types where lower speeds would be most needed (highways) that they are least accepted by the public.

In the statistical analysis it appears that especially younger people drive faster and consider speed to be more important, while the acceptance of lower limits is low. The same holds in several cases for men, higher income categories, respondents who drive many kilometres per year and in some cases the drivers in company cars. Also the maximum speed of cars driven has influence on the speed driven and the acceptance of lower limits on the highways.

The introduction of electronic speed limiters may be accepted by the public when at the same time varying speed limits are introduced. However, in most cases limiters are not acceptable according to most respondents. Again psychological factors seem to cause most resistance ('car driving becomes boring'), while the actual impacts (on travelling time, yearly amount of kilometres driven) are expected to be small. Again the respondents stress the relation with safety aspects. Striking is that the differences in opinion between subgroups are rather small, only women are more in favour of limiters than men.

In conclusion, when governments desire to change speed policies (e.g., by lowering limits), especially the impacts on safety (e.g., road accidents) should be emphasized and attention should be given to the psychological factors of driving. However, it will be hard to get such policies accepted in the society.

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