Speed management systems and road safety in the Netherlands

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Summary

A general problem of enforcement of traffic laws in industrialized countries is the limited priority this problem gets in relation to criminal offenses. Furthermore the available police manpower often is not being employed efficiently. Therefore more and more automated warning and enforcement systems are being applied on the roads. These systems can be put into operation locally, on a stretch of road and in a network. Several experiments have been conducted in the Netherlands in this field with positive effects on speed behaviour and road safety. Automatic speed warning at the approach of an intersection in The Hague gave a reduction in mean speed of 5 km/h. The possible effect on accidents was calculated based on a scenario, a reduction of several tenths of percentages in accidents was the result. In the province of Friesland the speed limit at the approach of the intersection was reduced from 100 to 70 km/h and an automatic speed warning sign flashes when cars were driving faster than 70 km/h. In the beginning a police car was posted periodically at that intersection. The mean speed went down from around 80 km/h to 63 km/h, and the percentage of speeders remained at about the same level (lowered speed limit!).

On four provincial road stretches with a speed limit of 80 km/h an automatic speed warning and enforcement system resulted in a total average reduction of the mean speed from 78 to 73 km/h and the percentage of speeders went down from 40% to 10%. The total number of accidents was reduced with 35%.

Projects on enforcement of speed on a provincial road network have just started in the Netherlands. The main aspect is the exclusive use of inconspicuous radar and camera that to be moved after 2 hours of enforcement to another location. Feed back information is given to all passing vehicles downstream of the enforcement site showing 'Ýour speed has been checked. Police'. This campaign is combined by periodical information campaigns to increase the subjective risk of being caught. In a separate part of one province conventional enforcement technique stopping speeders along the road will be evaluated too.

Preface

Prof A.S. Hakkert from Technion Israel Institute of Technology and the SWOV have a good and fruitful working relationship.

During his last visit to the SWOV he conveyed his interest in automatic speed management systems that has been designed and evaluated by the SWOV, for possible application in Israel.

The SWOV, in the person of undersigned, project leader of the speed management experiments in the Netherlands, was invited by Prof. Hakkert to present a paper at the Symposium on 'Enforcement and Punishment in Traffic' to be held at Technion in Haifa on april 20th 1994. Working visits are also planned among others to road authorities and traffic police to exchange views and experiences.

This paper will deal with the following areas of interest: government policy on speed, speed limits and present speeds on rural roads, speed and accidents, philosophy and strategy on speed management, design of speed management at a locality, on a road stretch and on a road network, the hard- and software, types of police enforcement, effects of experiments on speed and accidents.

1. Introduction

There is a kind of contradiction in the approach of speed on the road: in Western society speed in general sense is regarded as a positive quality, also active, powerful, dynamic and strong. Time is money! Slow, passive, static, and softness are considered to be negative aspects in our culture. This can be found in advertisements of all kinds and specifically of car manufacturers praising their speedy, powerful, aggressive vehicles. Further the improvements in sound isolation, tires, braking systems, and road surfaces make fast, comfortable, smooth driving in silence possible.
In contradiction to this general attitude and developments, drivers on the road are expected to drive slowly and carefully!

It took an energy crisis to make policy makers and the motoring public speed conscious, although motivated by fuel economy and not road safety. Since 1973 speed limits were introduced in many industrialized countries. Until some ten to fifteen years ago the general opinion regarding the effect of measures that lower the speed of motor vehicles was 'a couple of kilometres per hour less, so what?', implying that such measures will hardly have any effect on road safety. Not so any more nowadays.

Government policy on road safety and speed

Speed today is an important subject for policy makers, road authorities, research institutes, police authorities and speed enforcement industries.
In the Netherlands a 'Multi-year road safety programme' was firstly introduced by the government for the period 1987-1991. The programme is adapted periodically. The overall objective is to reduce the number of traffic victims with 25% in the year 2000 related to the year 1985.

Speed of motor vehicles, specifically on 80 km/h two-lane rural roads and on 50 km/h main urban roads is one of the spear heads concerned. The reason being the high level of speed and the great number of victims on these road types. Other spear heads are drunk drivers, safety belt use, heavy vehicles, bicycles, and dangerous situations. The safety potential of speed management on these types of road is expected to be very high. The objective regarding speed is to reduce the average speed with 5 to 10 percent in the year 2000, respectively to have the percentage of speeders below ten percent.
It is expected that the result will be a reduction of 150 fatalities and 2000 injured persons at least.

Speed limits in the Netherlands

The general speed limit on motorways for light vehicles is 120 km/h. For heavy vehicles the limit is 80 km/h. Motorways of lesser quality or intense traffic flow have a reduced speed limit of 100 km/h. The general speed limit on other rural roads is 80 km/h. The general speed limit of urban roads is 50 km/h. Residential areas have a limit of 30 km/h.

The rule is that general speed limits are not shown along the road side, not so for exception of these general limits: they are shown on road signs. So some confusion can arise regarding the prevailing speed limit on a specific road stretch. Once an American acquaintance of mine was touring with his wife through Holland in their Mercedes sports car with a speed of 180 km/h. The motorway police could stop them with some difficulty. 'Sir, do you know the speed limit in the Netherlands?' the driver was asked. 'Of course' he replied '120 km per hour per person'.

Actual speeds

Recent speed measurements on 2-lane rural roads show that 40-60% of the passenger cars are exceeding the speed limit of 80 km/h. For heavy vehicles the percentage is between 30 and 50%. The percentage for urban main roads is also high. So a lot has to be done to achieve the objective on speed.

Speed and accidents

Empirical studies in the U.S., Sweden and Finland have shown that the introduction respectively change of speed limit(s) on rural and urban road networks resulted in a reduction of the mean speed and a considerable reduction of the accident rate and more so of the injury rate. A relation between reduction of the standard deviation of the speed distribution and reduction in accident rate was also found.

Application of the formula that relates reduction in average speed to reduction in accident rate from the Scandinavian countries, result in a possible reduction of the accident rate between 20 and 50 percent (depending on the accident severity) when the percentage of speeders be reduced to maximally ten percent, potentially a large reduction in accident rate.

Speed and road function and design

The road network in urban and rural areas can be categorized according to function, design and use of the road. It is general policy to harmonize these three aspects. But in practice discrepancies can be found between e.g. function and design where a road in a residential area has the character of a through road, or between function and use when car traffic is making a short cut through a residential area. Structural speeding of cars might be caused by discrepancies between function, design and use of the road. To compensate these discrepancies often traffic signs are introduced, as a temporary measure, until structural measures of the road infrastructure is realized. Because of the high costs of infrastructural reconstructions it usually takes a multi year programme before this can be realised.

Speed management systems

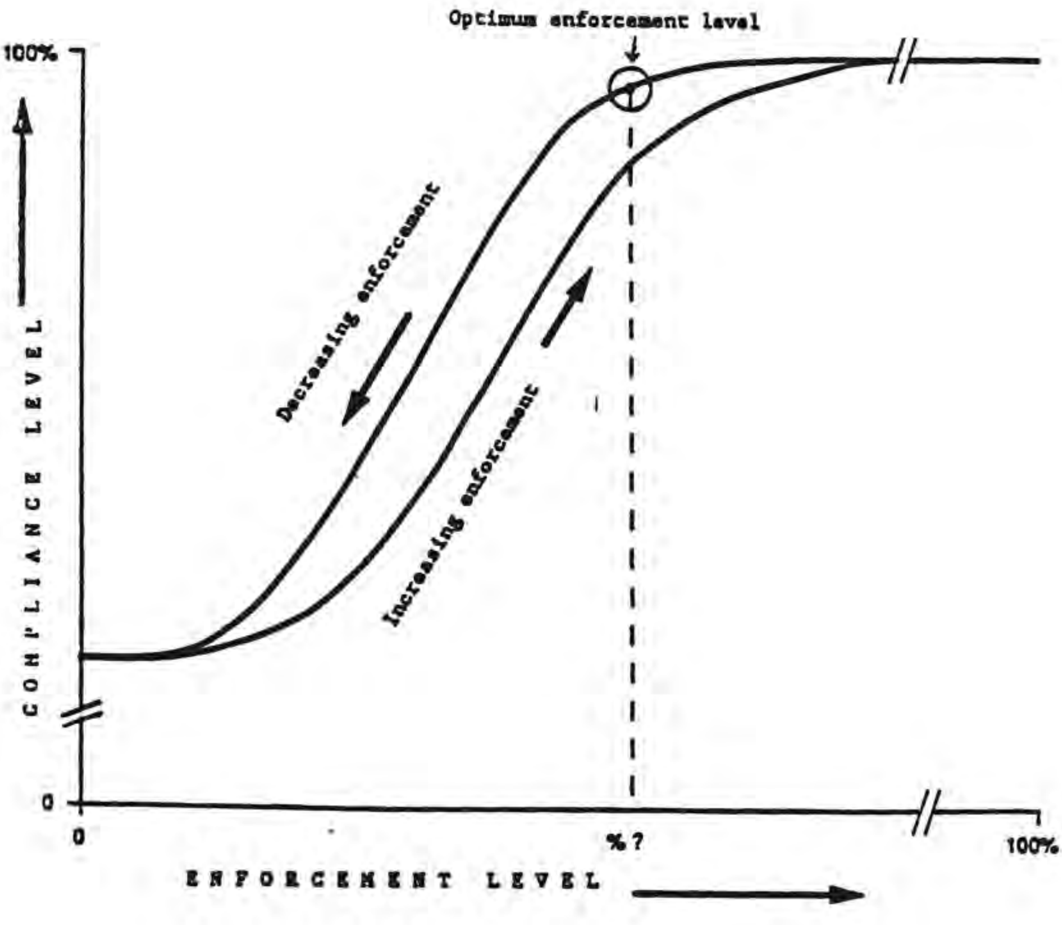
Traditional methods to control speed are: infrastructural reconstructions, warning systems, police enforcement and information campaigns.

Infrastructural measures, such as round-about, narrowing the road or introducing road humps or sharp bends. These measures also reduce speed when not necessary e.g. during the night. Infrastructural measures have a limited possibility for application on rural roads, as these roads often have an important connecting function. Further these roads are designed for the largest vehicle that is allowed on these roads, i.e. heavy vehicles. So a middle class passenger car can easily drive with high speed on such roads. Also the design speed limit is under the condition of a wet road surface, so under dry, sunny and low traffic conditions this speed can easily and often safely surpassed.

Speed warning systems can be static, such as fixed signs showing 'Lower your speed' or dynamic, such as switchable signs being triggered by speeders, showing for example the speed driven or 'You are speeding'. These signs often have limited effect, if not combined with enforcement.

The problem of criminality in industrialized countries prevents road offenses getting a high priority by the police. After the recent reorganisation of the Dutch police new tasks,

structures and procedures still have to find its ultimate form. Further the enforcement methods used often are susceptible for improvement regarding efficiency and effectivity.
A theoretical relation between level of enforcement and level of compliance to the speed limit is shown in the following Figure. At zero enforcement level a certain percentage of drivers comply to the speed limit, increase of this level has no noticeable effect at first, then the curve start to rise to end levelling off. If the enforcement level is decreased again, the curve will not follow the original curve, because of time lag. So a hysteresis curve will be the result.



COMPLIANCE VERSUS ENFORCEMENT LEVEL

Police enforcement can be done stationary or mobile, non-automatic and automatic, with stopping the speeder or just fining him some weeks after the detection of the offence. It is common use in the Netherlands that a very large part of the police endeavour on speed enforcement is done by stopping speeders at the spot. Guidelines formulated by the prosecution office stipulates that enforcement of traffic offenses should be done by stopping the offender in about 50% of the cases. This requires a very large input of manpower against few speeders being stopped. As an example the experience with speed enforcement on the Dutch motorway in 1992 is given. The length of motorway to be enforced is 2 x 2.200 km. In the following table the number of man hours for speed enforcement depending on the method used and the resulting number of trespassers being detected is given.

Enforcement method	Man-hours	Detected speeders
Radar+camera	4.300	210.000
Radar or surveillance with halting the speeder	81.700	90.000
TOTAL	86.000	300.000

Notwithstanding this large input of manpower the percentage of speeders on the Dutch motorways is still high. The Dutch government has concluded that endeavours for managing speed should be sought by increasing the efficiency of the methods used and not by employing more manpower. A concept of an efficient and possibly effective method for enforcing speed is given in the next chapter.
It is common knowledge that the effect of enforcement in time and space is usually very limited. The old speed behaviour is back within a few kilometres from the enforcement spot and within a short time after the enforcement campaign is ended. The level of police enforcement in many countries is at such a low level that even doubling the input of manpower may have no noticeable effect on speed behaviour.
Enforcement to be effective requires a regular and minimum input of police manpower. So in several countries this problem is partly solved by using automatic warning and enforcement techniques. Also an optimal design of enforcement on a road network having a long lasting effect is needed.

Information campaigns is a necessary part of the enforcement measure, to increase the subjective probability of being detected, to increase the knowledge regarding speed and accidents and hopefully to change the attitude of the driver.

Speed enforcement in space

Enforcement on speed can be distinguished spatially:

- At a specific dangerous location such as approach of an intersection, sharp bend, at road works. The objective is speed adaptation at that specific location. A warning to road users can be given at those locations.
- On a specific dangerous road stretch. The same as above applies here.
- On a road network. Here it is of importance that the location and time of enforcement be unpredictable for the road user.

Lowering the speed on a straight road part will also lower the speed at the approach of intersections on the road stretch.

This paper deals with three speed management systems in the Netherlands:

- Automatic speed warning system at a *locality*, urban and rural intersection.
- Automatic speed warning and enforcement system on a rural *road stretch*.
- Speed enforcement system on a provincial road *network*.

2. Problem analysis

Accident causation

Is it not a necessity to determine first the cause of an accident, and if speed being the cause then to eliminate this cause? This is a very tedious and difficult approach, as very often the necessary information for determining 'the cause' of an accident is lacking. We can circumvent this problem through a different approach: a road accident can be described as a process, a chain of consecutive links of causal events. Driving speed, not necessarily being the main causal factor, will in most cases be one of the links in this chain. An accident can be prevented by breaking the chain at any one or more of the links. So by influencing the driving speed through speed management an accident can be prevented.

Driving tasks

Speed selection is part of the driving task and the driving task can be structured hierarchically into:

* Trip preparation: selection of destination, mode of transport, arrival and starting time and route. This phase of the driving task has a big influence on driving speed en-route. A late departure or selection of a wrong route will result in time-pressure and to compensate this in speeding. Further a well prepared trip will alleviate navigational problems underway.
* Navigation en route: to identify location and direction of the vehicle on the road and the route to be followed. The quality of the route that is chosen has direct influence on speed selection. Real-time information regarding road conditions will help the driver in selecting the appropriate route.
* Manoeuvring the vehicle: the most important manoeuvres are following the track, intersection-approach, car-following, and overtaking. Speed selection is part of these manoeuvres. Law stipulates that at any time a driver has to be able to halt his vehicle within the distance in which the road is free and can be overlooked. A collision can be considered as a result of the fact that the driver could not stop his vehicle in time, that is the selected speed was not appropriate considering the prevailing conditions.

Accident types

An analysis of 1991 accident data in the Netherlands on roads having 80-km/h speed limit shows that the main accident types are:

Accident type	Number of accidents	Percentage
- Single vehicle accidents	1,382	20
- Collision between crossing vehicles at or near intersections/exits	864	13
- Collision between vehicles driving in opposing direction	736	11
- Collision between vehicles driving in the same direction	3,930	56
Total	6,912	100

Driving task and accident type

These accidents can (partly) be ascribed as being a result of failure in the execution of the following specific manoeuvre tasks, i.c. speed selection:

* Following the track <---> Single vehicle accidents in bends and straight road sections.
* Crossing <---> Side impact at intersections/exits.
* Car-following <---> Rear-end collisions on straight roads and at approach of intersections.
* Overtaking <---> Head-on collisions on straight roads and in bends.

Speed management at manoeuvre level

So a self-evident approach to counter these specific accidents is by speed management at each of the specific driving tasks. This approach is suitable for specific accidents occurring on specific locations. On roads where several types of accidents occur this approach will lead to speed management systems that interact with each other.

A much simpler approach then is to manage speed on the whole stretch of road, i.e. lower the high speeds (and raise the low speeds). The idea is that through lowering high speeds in general, the speed in executing the above mentioned specific tasks will also be lowered and through influencing speed selection the accident rate and the impact speed will be reduced resulting in a reduction of the injury rate and injury severity.

3. The speed management experiments

3.1. Introduction

The following hypotheses form the basis of the speed management experiments conducted in the Netherlands. Lowering speed of cars will result in:
- More time for perception, judgement and action; linear relation between speed and available time.
- Shorter braking distance.
- Reduction of accident risk.
- Lowering impact speed.
- Reduction in injury and fatality risk.
- Reduction in injury severity.

High objective and subjective detection rate through efficient and effective speed management (warning and enforcement) will result in:
- Increase in attention level of drivers.
- More drivers complying to the rules.
- Speed behaviour that conforms to the rules.
- Disproportionate large reduction in the accident rate.

(Automatic) speed signs

Further it can be learned from literature that static speed signs have little or no (long term) effect on speed behaviour. Dynamic speed signs have the potential of increasing the level of attentiveness of the driver and of lowering driving speed. The objective of automatic speed warning is to give the warning selectively to speeders only. The level of effectiveness of this system is depending on the topicality, the relevance and the credibility of the information. Also of influence is the level of specificity of behaviour instruction given. A better response may be expected when the information is given on specific risky locations, periods or conditions. Information regarding the reason for the dynamic speed sign will increase the effect.

(Automatic) enforcement
(Automatic) enforcement will enhance the effect on speed behaviour considerably. Automatic enforcement implies that police manpower is only needed for processing the photos made of speeders. A possible disadvantage might be that the court is drowned by a large number of speeders not willing to settle the fine. Trespassers exceeding the speed limit with more than 30 km/h also have to appear in court. The most effective speed management system is the combination of:
- Information campaign conveying the message to all *potential* road users.
- Fixed signs giving the information to all *passing* road users.
- Dynamic signs warning all *trespassing* road users.
- (Automatic) enforcement 'catching' all *persisting* trespassers.

3.2. A local speed warning system in The Hague and in Friesland

Urban intersection
Yellow flashers are commonly used in the Netherlands to warn road users of several kinds of danger, e.g. approach of an open bridge, an intersection or a sharp bend. As yellow flashers are not specific enough and have little effect, a specific warning sign regarding speed is chosen.
Three types of speed signs at the approach of an intersection where a school complex is generating crossing school children periodically were evaluated consecutively:
- Fixed '50 km/h' sign.
- Glass fibre sign showing '50' continuously during school hours.
- Glass fibre sign flashing '50' when an approaching vehicle is speeding.

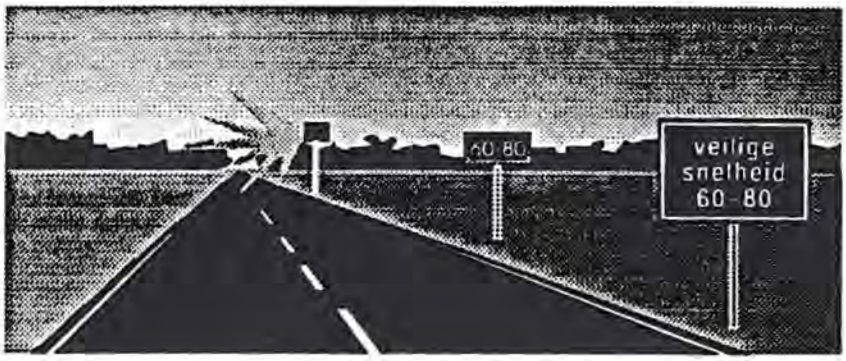
Just before the start of the experiment an information campaign was conducted. Speed was measured before the installation of the signs and about three weeks after the start of the operation of the system. The strongest effect was found with the flashing sign: the average speed was lowered by 5 km/h. A theoretical calculation is made on the effect in the number of accidents. The result is a reduction of 24% in accidents. Detailed information on this experiment is given in Oei & Papendrecht (1989; see the addendum).

Rural intersection
In the province of Friesland in the past several accidents have occurred every year at an intersection between a main 2 lane rural priority road having a speed limit of 100 km/h and a road with a low traffic function. The measures consisted of an information campaign followed by:
- Lowered speed limit at the approach of the intersection of 70 km/h.
- Fixed sign advising to lower the speed.
- Flashing sign warning of speeding.

Speed was reduced in both directions since the start of the operation in summer 1991 of the measures untill recently: the 85 percentile speed was reduced from 96 km/h to around 70 km/h. The number of accidents was small, but was reduced from a yearly average of seven to two accidents.

3.3. Four provincial road stretches

The four experiments were conducted on two-lane rural roads with a speed limit of 80 km/h. Two types of speed measurements were conducted with the following objectives:
A. Reduce high and low speeds of motor vehicles on two roads closed for slow vehicle types.



B. Reduce high speeds on two roads also open for tractors.

The experiment consisted of the following steps:

Information campaign: Just before the start of phase I and II (see following) information was given in regional daily papers regarding respectively in phase I the danger of unadapted speed, the aim of the systems applied and the desired speed behaviour and in phase II the high detection risk for speeders.

Automatic warning signs in phase I (30/11/90 - 14/3/91):
A. Fixed signs showing 'Safe speed 60-80 km/h' (repeated at important intersections) and an automatic switchable sign '60-80' lighting up when vehicles driving slower than 60 or faster than 80 km/h.
B. Installation of fixed signs showing 'Max. speed 80 km/h' at the beginning of the road stretch (repeated at important intersections) and an automatic switchable sign 'You are driving too fast' lighting up when vehicles driving faster than 80 km/h. A sign showing the speed driven when exceeding the limit was considered, but because of the possibility that drivers will use this sign to check the accuracy of their speedometer, this idea was abandoned.

Automatic enforcement in phase II (15/3/91 - 30/6/91):
Installation of 3 to 4 posts along the four road stretches in which a radar, camera and flash can be mounted. The system is operated at speeds above 90 km/h (after consultation with the police and public prosecutor). The radar+camera system was operational during early morning until midnight. Vandalism necessitated the stopping of the operation during several weeks on two road stretches.

A cost-benefit calculation was made beforehand:

Costs of the system per annum	
(interest, writing off, damage by vandals)	: US$ 40,000
Average benefit per saved injured victim	: US$ 14,000
Average benefit per saved damage only accident	: US$ 4,500

The break-even point is reached at a savings of 3 injured victims or 9 material damage only vehicles per annum. Costs of police manpower are not included in the calculation.

Evaluation
The evaluation research was conducted by order of the Dutch Ministry of Transport and Waterways and consists of an evaluation of:
- Speed in the phases 0, I and II.
- Accidents during the phases 0 and I+II.
- Automatic enforcement.

Speed evaluation
Speed was measured by radar in the phases 0 (before period), I and II at several locations. About four weeks after instalment of the systems speed was measured in phase I and II. Traffic on each road stretch is measured in each direction separately at the middle of the road stretch, i.e. away from the direct influence of the speed signs and the radar posts. If a speed reduction is found at this location then it is plausible that at locations near the warning signs and radar posts the effect on speed may even be greater.

A consistent reduction of the following characteristics of the speed distribution was found on almost all locations of the experiment roads. Aggregation of the data of the four roads show - compared to phase 0 - a *reduction* of:
- Average speed: 3 km/h in phase I and 5 km/h in phase 2.
- 85 percentile speed: 3 km/h in phase I and 8 km/h in phase II.
- Standard deviation: 1 km/h in phase I and 2 km/h in phase II.
- Percentage of speeders: from 38.2% to 28% in phase I and from 38.2% to 11.4% in phse II.

- Percentage of cars driving slower than 60 km/h was small, though it showed an *increase*: from 2.0% to 4.4% in phase II.

On the four *control roads* no consistent decrease in speed could be found: average and 85 percentile speed fluctuates in the phases 0, I and II, partly increasing, decreasing or unchanged. Also the percentage of trespassers fluctuates and is greater than 40%.

Aggregated results of the speed measurements of the four roads in phase 0, I and II:

Table 1. Aggregated speed on the four roads

Speed. distr. charact.	Experiment roads Phase 0	I	II	*Control roads* Phase 0	I	II
N	19478	11872	13417	5580	5172	5378
Average	78,2	75,2	72,9	78,7	80,2	78,9
15-%	70,2	68,7	66,4	68,8	71,4	71,9
85-%	86,7	83,8	78,9	88,3	90,4	88,6
Stand. dev.	10,0	9,2	8,0	11,7	10,9	11,7
% < 60 km/h	2,8	3,0	4,4	3,9	2,3	3,6
% > 80 km/h	38,2	28,0	11,4	40,9	50,2	44,4

Accident evaluation
As the total experimental period being only seven months, accidents in phases I and II were totalized and this number was compared with the number of accidents in the same period of three past years. As the number of accidents with injuries is quite small we shall consider the total number of accidents, i.e. lethal, injury and damage only accidents.

Table 2. Number of accidents in phase 0 and [I+II] on the four experiment roads and the control roads

	Experiment roads						*Control roads*	
	Injury		Mat.Damage		Total		*Total*	
Phase	0	(I+II)	0	(I+II)	0	(I+II)	*0*	*(I+II)*
	22	14	128	67	150	81	*284*	*237*

The total number of accidents (lethal, injury and damage only) on the experimental roads has been reduced from 150 to 81, a reduction of about 46%. The total number of accidents on the four control roads was reduced from 284 to 237, i.e. a reduction of 17%. Taking into account this last reduction in the effect of the system on accidents yields a **35% decrease.**

A cost-benifit calculation showed that the benifits were almost three times the costs (the costs of police were not reckoned).

Evaluation of the automatic enforcement system

The fear that the automatic enforcement system will overload the police and the court with work did not materialize. The number of photos made was much lower than expected by police and justice authorities, so continuation of the radar and camera system was allowed, although at the end of the experiment period at 50% level, because of lack of manpower during the holidays.
This can be explained by the high detection risk, objectively and subjectively, a result of the information campaign in the regional papers and the camera posts along the road. Vandalism though is quite a problem, resulting in discontinuation of the operation of the radar + camera system on all four roads for a couple of weeks. This vandalism consisted of breaking the enforced glass protecting the camera, shooting at the double cased posts, spraying the glass with paint, burning the post with in gasoline soaked cotton and forcibly opening the door of the post and removing the camera in one case. Through analysis of the photos in two cases the culprits could be arrested.

3.3. Enforcement on a road network.

Speeders can be distinguished in structural and incidental speeders. Structural speeders will be detected at any location on a road stretch. So when a road network consists of a certain number of road stretches, it will be sufficient to enforce each road stretch once in a certain period. The location of the enforcement site has to be changed every time for reasons of unpredictability for the road user.

A speed enforcement project on rural roads with a speed limit of 80 km/h in the province of Friesland was recently started with press conference. A selection was made of roads that have a great potentiality in accident reduction when the percentage of speeders be reduced to 10%, as government policy has stipulated for the year 2000. The number of road stretches is 38. The total length of the selected roads is about 250 km. Enforcement will be done for 100% by radar+camera from an unmarked car stationed on the road side, so no cars will be stopped. Down stream from the enforcement site a feed back will be given to all passing road users through the fixed sign showing 'Your speed has been checked. Police'. This will enhance the subjective probability of detection. The police agreed to enforce speed for a total of 2.500 hours during the project, i.e. 24 weeks. The project consists of two phases, the enforcement level of the second phase depends on the effect on speed in the first phase. This speed project will probably also be conducted in two other provinces. The enforcement level will differ in each province. An important objective of the three projects is to determine the optimal enforcement level on the above given curve. The enforcement will be conducted during working days from 7-19 hours, every location will be enforced during 1,5 to 2 hours, then the radar car will move to a next road. Every road stretch of the network will be enforced during 1,5 hours every 10 days. It is regarded important to know the acceptability of this kind of intensive enforcement for car drivers and the contended effect on behaviour. They will get a form to be filled in at home. Also the police will fill in a form their experience with this project, so improvements can be made in the future.

4. Conclusions

The Dutch government has formulated objectives for the year 2000 as regards average speed on 2-lane rural roads and main urban roads. The present level of speeds are far from mentioned objectives. The traditional way to manage speed have not resulted in a satisfying speed behaviour, on the contrary. The possibilities of speed management through infrastructural measures on two lane rural roads are limited, further police surveillance and control often have a temporary effect.

It is a necessity to find new ways in coping with the speed problem through employing more efficient methods. Automatising the warning and enforcement of speeders offers a promising solution.

Experiments with automatic speed warning and enforcement systems at the approach of an intersection and on road stretches have resulted in a significant drop in speed and accidents. Still some problems exist, such as vandals breaking the radar and camera housing along the road, the conspicuity of the radar poles, the manual reading of the photos, and the judicial processing of the cases. Developments in digital reading of number plates show promising results. This could further increase the efficiency of the whole system.

Experiments on speed enforcement on a road network using exclusively radar+camera have recently started in the Netherlands and are to be evaluated on speed behaviour and accidents. It is of great interest to find the optimum level of enforcement, i.e. to determine the minimum level of police employment with the maximum effect on reduction of speeders.

In the long run solutions should be found in harmonising function, design and use of the roads, in such a way that the roads will not entice road users to speed.

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