Public acceptance of enforced speed adaptation in the urban area

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Abstract

This paper discusses a way to drastically cope with speeding in the urban area. Pilots with Intelligent Speed Adaptation (ISA) in Europe applied in passenger cars support the perspective of creating an urban environment with a guaranteed maximum speed level for car drivers. Therefore, the perspective for improvement of the traffic related quality of the urban environment is quite positive. However, the ISA concept runs the risk of failure considering the imminent lack of acceptance by the general public in general and car drivers in particular. ISA systems differ in how intervening or permissive they are varying from producing warning signals to systems that take mandatory control over the gas supply. Social acceptance of automatically enforced maximum speed levels was studied in a real life environment. This paper describes the results of a Dutch pilot with 120 test drivers and 3 reference groups of drivers. The study shows a prevailing positive attitude towards automatically enforced speed adaptation. Practise with ISA appears not to induce a lower level of acceptance. However, the basis for acceptance is frequently not embedded in the understanding of a speeding problem. This weakens the permanence of the support in society. The results of the compulsory ISA system will be compared to the results of experiences with ISA systems used in various European countries.
Keywords: acceptance, intelligent speed adaptation, ISA, AVG, speeding, traffic calming; car users, urban area.

1 Quality of life and speeding

The quality of the urban living environment is served, among others, by a policy capable reducing the usual negative impacts of the traffic system on citizens. A

diversity of traffic calming measures has been developed in the past few decades trying to cope with inevitable side effects of car mobility such as speeding and unsafety as a consequence of speeding. Physical measures like narrowing of the roads or road humps, enforcement strategies by the police, educational measures or fining are just as many strategies with varying degrees of success. Although such measures steer car mobility in the right direction, reserved driving speed is not guaranteed. Experience shows that those types of speed control are met with large-scale violations which illustrate the obstinacy of car drivers in this respect. Residents and vulnerable road users always run the risk of the danger of speeding cars.

The quality of life in the urban environment can benefit from efforts to improve traffic safety. In order to enhance traffic safety, the Dutch Ministry of Transport explored the possibility of having all car use bound to a the maximum speed level by way of an intelligent mechanism called Intelligent Speed Adaptation (ISA). Combining GPS with the maximum speed level on the spot the car is prevented from speeding by way of closing off the fuel supply. However, this policy to drastically cope with speeding could run the risk to fail just like some other measures such as road pricing or carpool strip failed completely due to lack of acceptance among the general public. This paper describes the public acceptance of ISA based on a real life trial and the evaluation study (Katteler, [1]; Duynstee et al. [2]. Both trial and evaluation study were lead by the Transport Research Centre of Rijkswaterstaat of the Dutch Ministry of Transport. Selected results can be compared to other trials in Europe that have been made in Europe meanwhile testing less compulsory systems.

2 Intelligent Speed Adaptation

2.1 Types of driver support systems

Intelligent Speed Adaptation is a direct way contributing significantly to traffic safety and an indirect way increasing the quality of public space. ISA is an exponent of the current tendency towards creating an automatic vehicle guidance (AVG) environment. Early AVG systems support the driver in one specific task such as distance keeping, lane keeping or speed behaviour. Future AVG systems will support the driver in a more integrated way. Although the complete implementation trajectory will require some decades, serious technical problem are not expected. Future general AGV developments were described by a.o. Marchau and van der Heijden [3]. They found that, generally, informing and warning devices are preferred to control systems. Carsten and Fawkes [4] described an ISA implementation scenario ending up in 2019 as a first possible date for a legal requirement for mandatory usage of ISA.

Advanced driver assistance systems can be categorized into systems that address the vehicles' speed on the one hand and into systems that address the position of the vehicle (Figure 1). Where various systems support the lateral dimension of the driving task, other systems are developed to influence the

longitudinal dimension of the driving task, such as Intelligent Cruise Control. The latter received substantial attention in studies (a.o Tornrös et al, [5]). A pilot focusing on the lateral support was evaluated last year (Katteler, [6]). All these systems can be implemented as either an advisory system or a mandatory system.

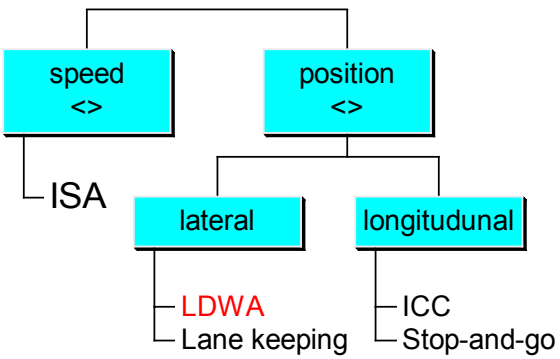

Figure 1: ISA as a type of Advanced Driver Assistance System.

2.2 The Intelligent Speed Adaptation trial in Tilburg-NL

Pilot schemes differ in degree in which the desired driving behaviour is enforced: varying from automatic enforcement without leaving any opportunity for the driver to exceed speed limits (mandatory systems) via voluntary systems to in-car warning systems leaving the driver the choice to exceed the speed limit (advisory systems). The former was tested in the Netherlands, the latter in the UK (Carsten & Fowkes [4]) and in Sweden (Vägverket [7]). Also in Belgium and Hungary (city of Debrecen) field trials were carried out. An experiment in Spain (city of Mataró) is going on. The Dutch trial was held in the city of Tilburg (150.0000 inhabitants) involving roads with speed limits of 30 km/h and 50/km/h and a few roads with a maximum speed of 80 km/h outside the built up area.

The on-board computer of the ISA Tilburg-system contained a virtual map of the test area with information about the desired speed limits. A differential Global Positioning System (dGPS) determines to two metres accurate in which speed zone of the map the car is situated. When an ISA-vehicle drives into a pre-programmed area, the speed limiting mechanism is activated on a predetermined speed. If the vehicle speed is exceeded, the fuel inlet is automatically restricted. The system used in Tilburg was a mandatory ISA-variant. It had an emergency button that enabled the driver to overrule the system.

The ISA system was standing by during 12 months in the Campenhoef area within Tilburg. Twenty passenger cars were equipped with an ISA system and were available to 20 persons randomly selected. Each test driver had the test car available for. Six successive groups of 20 test drivers were involved in the experiment having the test car available during a 6 week period each, leaving time for learning effects. In total, 120 test drivers participated in the test.

3 Study design

The study design included different groups of residents with a divergent degree of exposure tot ISA. Four groups of 120 persons each were included:

- Test drivers: car drivers experiencing ISA in the car they drive daily.
- A first reference group: inhabitants of the same residential area Campenhoef in which is driven by the test drivers; they interact on the roads with cars restricted in their speed but have a similar level of information on the ISA principle.
- A second reference group: inhabitants of the city of Tilburg addressed with ISA-information to a relatively low extent and with hardly any interaction with ISA cars on the road.
- A third reference group: inhabitants of other cities of the province of North Brabant, not specifically supplied with ISA-information and without any interaction with ISA cars on the road.

In fact, the design was experimental. Even the allocation of residents to the test group and the first reference group was in the hands of the research team. The risk of self-selection was avoided with this procedure.

A second relevant principle was to measure the acceptance of ISA at different moments in time: preceding the test, during the test and - among test drivers - after the test. The measurement preceding the test was not a real zero-measurement: Campenhoef residents had already been informed on the principles of ISA and the initiative to have the trial in their area. By consequence, their attitude at the start of the trial appeared to have been influenced by the mere fact of alerting to the ISA principle and ISA test. The well-known Hawthorne-effect can be assumed to have occurred. Analogue to the increased work productivity purely influenced by research attention at Hawthorne Works at Western Electric Chicago, the attitude towards ISA appeared to be substantially more positive compared to the attitude of citizens not informed. Therefore, the attitude values of those other citizens were given to the Campenhoef residents as initial values.

4 Problem awareness

It can easily be understood that the acceptance of any policy measure is stronger and lasting when going together with the sense of controlling a real problem. Whereas measures that combat phenomena that are not really felt by drivers as problematic will fail to evoke internalised behaviour, measures that link up with problems that are really felt will meet sympathy and gain enduring support. Therefore, the perspective of policy measures to influence social behaviour or traffic behaviour is better when solving a well-recognised problem.

Part of the evaluation study accompanying the ISA trial identified the degree in which speeding in the urban area is felt as a real problem. This was done separately for three types of roads: streets in the built up area, urban traffic routes and secondary roads that usually have a maximum speed limit of 80 km/h. Also a study in Belgium took this notion on board in a nation-wide study about ISA

acceptance (De Mol et al, [8]). Two elements were distinguished in the Dutch study when identifying people's concern:

- to what extent do residents in the urban area experience speeding;
- as far as they experience so, is this speeding felt as inconvenient rather than problematic or does it really affect them as a problem.

Only those who both observe speeding and feel it as problematic got the 'problem awareness' score. Over 500 car using households in three urban areas were included in the study (Tilburg, Breda and Den Bosch). Figure 2 shows that the problem of speeding is experienced differently per type of road. Whereas speeding in residential streets is a real problem to a majority of people (62%): speeding on secondary roads keeps a minority of people (29%) concerned. This is remarkable given the fact that most accidents occur just on secondary roads. The ISA initiative in Tilburg applies to all three types of roads. The degree in which the social acceptance of enforced speed adaptation is embedded in this problem consciousness was part of the study.

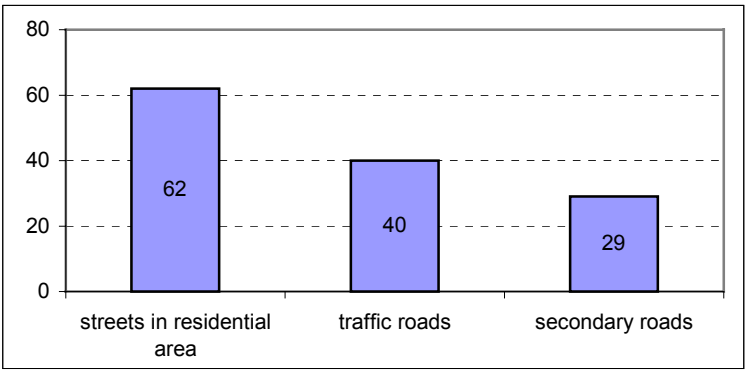

Figure 2: Percentage of people having problem with speeding, per type of road (N=550).

5 Acceptance of ISA by test drivers

Drivers' attitude towards ISA was measured as follows: 'What is your position concerning Intelligent Speed Adaptation as applied in the pilot?" (against – neutral – in favour of it). The question was raised at a series of 5 moments. This allowed observing the development of ISA acceptance over time (Figure 3). Within this time frame test drivers experienced thoroughly the principle of automatic speed adaptation. Effects on driving behaviour - e.g. is there the tendency to compensate for the lower speed outside the test area - go beyond the scope of this paper. The following observations can be made based on Figure 3.

a. The attention given ex ante to the ISA project raised the acceptance level even before the very start of the pilot period (the Hawthorne-effect).

b. The acceptance level decreased from over 80% to a level of about 60-65 percent after this initial increase.
c. The decrease already occurred in the period of waiting for participation (test drivers had to wait for their turn given the system of 6 groups of 20 drivers). Therefore, the decrease can be attributed to the fading away of the Hawthorne effect rather than by the ISA experience.
d. The acceptance level did not diminish after a period of two months after test participation. There is no evidence of decreasing enthusiasm when falling back in the usual pattern of driving in a not speed-limited passenger car.
e. Most importantly: experiencing an automatically enforced speed limitation did not influence the acceptance level in the negative direction. The acceptance level is at the end definitely not at a lower lever compared to the initial level.

The percentage of opponents (not shown in Figure 3) amounts to 10-15 percent of the test drivers after a period of intensive communication and practise. This is less than half of the initial resistance observed in the 'zero' situation. The number of ISA opponents that holds a strong negative view could be neglected.

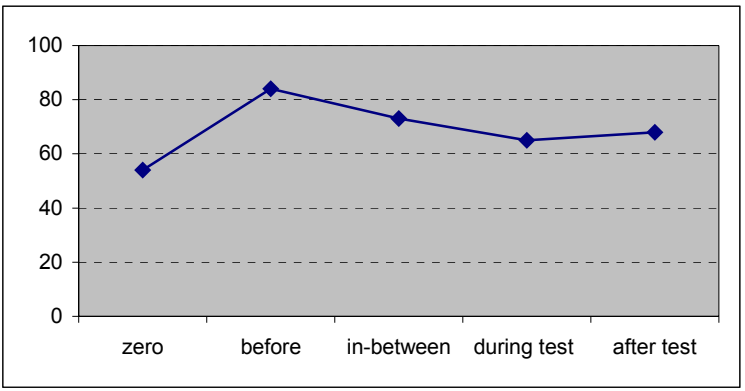

Figure 3: Development of acceptance of ISA in % of test drivers (N=120).

It can be provisionally concluded that practical experience with automatic speed enforcement seems to increase support for ISA and, definitely, that it does not decrease the support for ISA. This conclusion has to be validated against the information gained from the reference groups.

6 Acceptance compared with reference groups

Each of the three reference groups had a different degree of exposure to intelligent speed adaptation. The exposure varied from 'intensive' for those who are living in the test area (interaction with cars limited in their speeding) to 'nothing' for those who live in another urban area without information on ISA ('Tilburgers; Brabanders'). Figure 4 shows that the acceptance level at test start

was high (around 80%) both among test drivers and non-test drivers living in the test area ('Campenhoef"). This high acceptance level among people living in the test area appeared to be an artificial consequence of media attention in the test district given to the ISA concept and the forthcoming trial (Hawthorne effect).

The proportion of car users in the reference groups deprived of any specific ISA information was at the 50-55 level. This acceptance level was felt to be unexpectedly high. According to a measurement among stakeholders, a substantially lower acceptance level for mandatory ISA was expected. Half of the stakeholders did expect less than 35% of drivers accepting mandatory ISA. Van der Heijden and Molin [9] observed an acceptance level of 55% in an earlier ISA study, however, this finding was mainly related to advisory ISA. This shows that a common feature of different ISA studies is the existence of positive basic attitudes towards ISA.

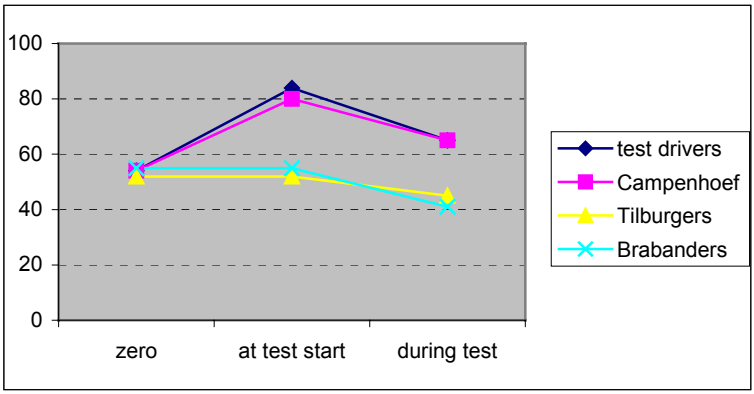

Figure 4: Development of ISA acceptance in test group and reference groups (N=120 each).

It can be observed that the development in attitude towards ISA is quite similar for test drivers and residents in the test area. This observation allows the conclusion that driving experience does not bring about a higher acceptance level than just an intensive communication process. A further observation is that acceptance slightly decreases after a while, irrespective of being under or outside test conditions. This suggests that a first acquaintance with the ISA principle usually evokes a positive view among a large amount of people, however, with some toning down after elapse of time.

Finally, a most relevant observation is that, at the end of the day, the level of acceptance among residents of the test area is at a considerably higher level than the acceptance level among others. The difference of 20 percent points is substantial. Therefore, the following major conclusions can be drawn:

- Acquaintance with the principle of automatically enforced speed adaptation goes with a higher level of acceptance.
- In-car practise with ISA does not lead to a higher acceptance level than hearing about it and getting well informed.

7 Stability of ISA acceptance

Figure 2 showed that a substantial proportion of the residents notice speeding while having a serious problem with it, be it that the data show a considerable difference between type of roads. Then, it was observed – see Figure 4 - that the ISA concept is supported by the majority of those who experienced ISA and by many (about half) of those who just learned about the principle. It is interesting to analyse to what extent this support for ISA is embedded in the feeling that the ISA measure serves to solve a real problem. In other words: to what extent can this support be considered more stable rather than superficial. The Dutch study revealed that the support for ISA is frequently associated with meeting a strong need but this is certainly not the overall picture. The stability of ISA acceptance clearly differs per type of road (see Figure 5).

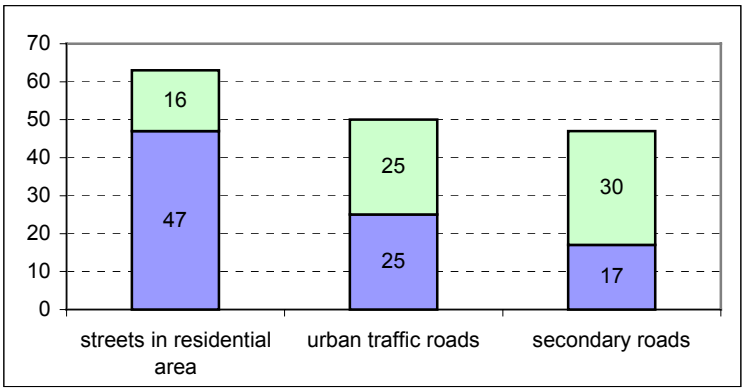

Figure 5: Percentage of people accepting ISA, by consciousness of speeding as a problem per type of road light colour: low degree of consciousness; dark colour: high degree

The support for ISA in residential areas goes together with a high degree of problem consciousness. The big majority among those who are in favour of ISA for that type of roads holds the view that a serious problem is addressed by this measure. However, as far as urban traffic roads are concerned, the support is as frequently opportune as robust (25%-25%). The majority of those who support ISA for secondary roads have a low degree of problem consciousness. Therefore, as far as resistance would arise against ISA, this could be expected for this type of roads outside the built up area. The degree of acceptance is highest for ISA in residential streets, also considering the association of meeting a strong need.

8 Acceptance experiences in other studies

According to attitudinal studies in the UK and in Belgium among people without any ISA experience, a majority of people are in favour of ISA, even the mandatory version. In the UK, 53% of driving license holders favoured fitment

of mandatory ISA (Carsten [10]), whereas 59% of the 2.500 respondents in Belgium supported the idea (De Mol et al [8]). Even 88% of these respondents claimed to accept a voluntary ISA system that gives signals when speeding.

Study results based on real experiences with test drivers are more informative. An acceptability scale was used in the EVSC/ISA project in the UK (Carsten & Fowkes [4]). This allowed drivers to express opinions about two ISA variants. Subjects rated the mandatory system as more useful after experiencing it as compared with their prior conception, and they also rated it less negative in terms of satisfaction, although they were still quite negative about it in this respect. However, the results of a simulator study and a real road study did not provide identical results. In general, the scores tended to improve with familiarity. More positive attitudes after using ISA were found.

An on-road experiment in Finland tested three types of ISA in a so-called within-subjects design (Paätalo et al [11]). The systems did not result in dramatic differences in acceptance. The following proportions of the 24 test drivers claimed that they could take the system to their own car: informing system 62%; recording system 64%; compulsory system: 48%. One of the field experiments in Sweden (Lidköping; 220 cars) compared the ISA information system with the active accelerator pedal that activates a resistance as soon as the driver attempts to exceed the speed limit. Significant differences in acceptance could not be found (Vägverket [12]). This study showed a high general acceptance level.

9 Concluding remarks

The study results are based both on the experiences of 120 test drivers who were exposed to the drastic traffic calming measure during a six week period and on 3 x 120 persons in reference groups. Although lack of support to a high extent was expected, the study results offer confidence that a substantial part of car drivers tend to accept the mandatory ISA strategy. This tendency is consistent to results of other ISA tests in Europe that showed a still higher acceptance level for voluntary systems. Data suggest a firm support for mandatory ISA provided that the strategy will be implemented on a general basis. The impact for vulnerable road users and practical advantages for the drivers are key factors for acceptance.

Automatic enforcement of the speed limit is a policy inspired from the point of view of traffic safety. The quality of urban environment would benefit substantially from this traffic calming strategy. However, national authorities still hesitate to support implementation. This reserve originates from political reasons, uncertainties about the type of ISA to implement and about the public acceptance. Considering the results of the ISA study described in this paper, lack of public support will not frustrate ISA policy provided that ISA is generally applied.

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